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CA 3095365 A1 2019/10/24

(21) 3 095 365

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2019/04/18
(87) Date publication PCT/PCT Publication Date: 2019/10/24
(85) Entrée phase nationale/National Entry: 2020/09/28
(86) N° demande PCT/PCT Application No.: EP 2019/060145
(87) N° publication PCT/PCT Publication No.: 2019/202103
(30) Priorité/Priority: 2018/04/20 (EP18168588.4)

(51) Cl.Int./Int.Cl. *B65D 85/804* (2006.01)

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(54) Titre : CAPSULE PORTION
(54) Title: PORTION CAPSULE

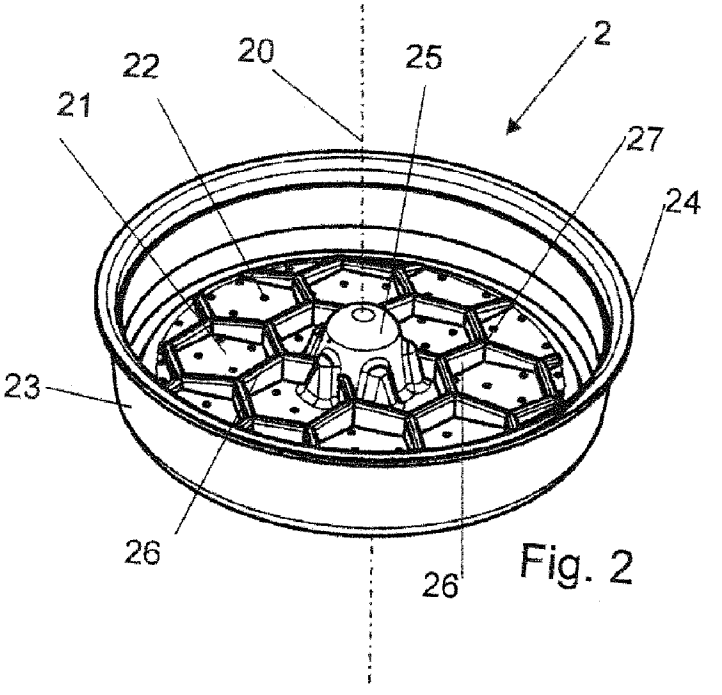

Fig. 2

(57) Abrégé/Abstract:
A filter element (2) for a single-serve capsule can be inserted into a base element, which is cup-shaped for example and which defines an outer capsule wall together with a capsule lid, which is fastened to the base element after the filter element has been inserted. The filter element (2) is designed in such a way that the filter element divides the capsule interior between an extractable-material region and a collecting region, which is formed between the filter element and the outer capsule wall. The filter element forms a filter plate (21) and a two-dimensional structure of struts (26), which extend along the filter plate and hit one another at an angle, the struts having a cross-section that diminishes radially outward.

ABSTRACT

A filter element (2) for a portion capsule (1) is insertable into a base element which is designed for example in a beaker-like manner and which together with a capsule cover (12) which is fastened to the base element after inserting the filter element defines an outer capsule wall. The filter element (12) is designed such that it divides the capsule interior between an extraction material region and a collecting region which is formed between the filter element and the outer capsule wall. The filter element forms a filter plate (21) and a two-dimensional frame of struts (26) which run along the filter plate and meet one another at an angle, wherein the struts have a cross section which reduces radially outwards.

Date Reçue/Date Received 2020-09-28

PORTION CAPSULE

The invention relates to the field of systems for preparing drinks by way of a fluid which is introduced into a drinks capsule. In particular, it relates to a portion capsule which contains a soluble foodstuff substance, from which a drink or a drink constituent can be prepared by way of injecting water.

Amongst the systems for preparing drinks, so-called coffee capsule systems (they also exist in variants for preparing tea) are known, concerning which generally hot water mostly under pressure is introduced into a capsule, in order to prepare a coffee drink or tea drink by way of extraction. The capsule is often pierced at the one side (injection side) for the introduction of the hot water. Different possibilities are known for leading out the brewed drink, generally at the other side of the capsule (the extraction side). On the one hand there are systems, concerning which a piercing by way of suitable perforation spikes is also envisaged at the extraction side. On the other hand, systems are known, concerning which an extraction-side delimitation of the capsule under the internal pressure is pierced or torn during the brewing process, for which a capsule-external (present in the brewing chamber of the respective coffee machine) or capsule-internal means can be present. Finally, there are also capsules which are already opened, concerning which therefore no capsule wall / membrane needs to be pierced or torn, in order to lead out the drink.

Amongst other things, in order to prevent coffee powder (or tea leaves) from undesirably getting into the brewed drink, capsules concerning which a filter element is arranged in the inside of the capsule have become known, said filter element separating an extraction material region from a collecting region and being fluid-permeable in a suitable manner, for example by way of it comprising a plurality of filter openings.

Examples of portion capsules with such filter elements are to be found for example in EP 1 344 722 as well as in WO 2010/085824. The latter publication shows the filter element with struts which extend radially from an outer frame towards the middle and herein become thinner towards the middle. These are to reinforce the filter element. Such a reinforcement can be displaced, in particular with regard to the preparation of brewed drinks under pressure, as is the case for example with espresso and other coffee with a so-called "crema". With such brewing, the inner pressure of the capsule for the most part bears on the filter element which can therefore be subjected to a mechanical deformation.

Date Reçue/Date Received 2020-09-28

It is the object of the present invention to provide a filter element for a portion capsule as well as a respective portion capsule. The filter element is to be mechanically stable as well as inexpensive and simple in manufacture.

According to an aspect of the invention, a filter element for a portion capsule is provided. This can be inserted into a base element which is designed for example in a beaker-like manner and which together with a capsule cover which is fastened to the base element after the insertion of the filter element defines an outer capsule wall. The filter element is designed such that it divides the capsule interior between an extraction material region and a collecting region which is formed between the filter element and the outer capsule wall. The filter element forms a filter plate and a two-dimensional frame of struts which run along the filter plate and meet one another at an angle.

This approach according to the invention is based on the recognition that a two-dimension frame generally entails more stability than a system of struts which merely run radially from the outside to the inside. The reason for this can be the fact that under real conditions, the capsule inner pressure is not strictly constant with regard to time or location, and for this reason bending oscillations of the filter plate can also arise. A two-dimensional frame can accommodate such in a comparatively better manner. The invention however is not dependent on a certain explanation of this finding.

The struts can have a cross section which reduces radially outwards (i.e. have a reducing cross- sectional area).

Such a reduction of the cross section of the struts can be a reduction of the extension perpendicular to the plane of the filter plane. The reduction of the cross section can be continuous towards the outside. However, one also does not rule out the cross section for example also being regionally constant as a function of the radial position; but on average the cross section further to the outside with regard to a centre of the filter plate will be smaller than further to the inside. It is also possible for the frame of the struts to completely run out to the outside, i.e. for the struts to not completely reach the outer edge of the filter element.

This preferred embodiment with an outwardly reducing cross section is based on the insight that given a subjection to pressure in the capsule interior, the deformation is greatest in a central region of the filter element. Furthermore, generally less material is necessary for geometric reasons if the struts at the inside have a larger cross section than at the outside, in comparison to the opposite approach.

In a group of embodiments, the filter element comprises a central element. This can form for example a projection to the capsule interior (towards the extraction material region); such a projection can be essentially conical. The frame of the struts then preferably runs up to the central element, i.e. the innermost struts are connected to the central element, in order to stabilise this. The central element can define for example a free space for an extraction-side piercing spike.

A central element, up to which the frame of the strut runs, in particular can be designed as a bulging to the side, on which the struts are arranged (thus for example towards the capsule interior). By way of the central element in this embodiment being formed by a bulging, a cavity-like extension results towards the other side (thus for example towards the collecting region). Such a bulge-like or dome-like design of the central element is particularly favourable with regard to the ratio between the mechanical stability on the one hand and the material consumption on the other hand.

The frame of struts in particular on a path from the inside to the outside, formed by the struts, can form several branchings so that struts which are arranged at least in a central region are each stabilised to the sides at both ends.

The struts which form the frame therefore, apart from in the middle where for example they meet the central element, can yet be branched at (in each case) one further location - they are therefore different to the struts which run in a radiant manner from the middle to the edge and are additionally stabilised by the branchings.

In particular, the frame of the struts can form a honeycomb structure. Given such a structure, the ratio of the material which is to be applied to the created stability is particularly favourable.

The filter plate can be provided with filter openings in a manner known per se, these being regularly or irregularly distributed over the filter plate and permitting the fluid to be led through. The size of the filter openings can be such that a passage of extraction material is prevented. One also does not rule out the filter openings being spanned by a for example fabric-like filter material, in order to prevent the passage of extraction material through the filter openings.

In particular, the struts can be arranged on the side of the filter element to the capsule interior, i.e. towards the extraction material region. At the rear side, the filter element can

comprise a plurality of spacers which help to prevent the filter plate being pressed against the outer capsule wall given a high pressure of the capsule interior.

The filter element can be designed in a beaker-like manner in the manner known per se, by way of it comprising a peripheral side wall which connects onto the filter plate at the outer side, and specifically in particular at the extraction material side, so that a filter beaker volume forms part of the extraction material region. A peripheral side wall can form a peripheral flange which projects radially outwards and which can serve for the fastening of the filter element in a capsule base element (for example capsule beaker).

In an alternative embodiment, the filter element as a whole can be roughly disc-like, without a peripheral side wall. Such a filter element is suitable for example for being fastened to a shoulder of the capsule base element (for example capsule beaker), for example by way of welding or another material-fit connection. Alternatively, such a disc-like filter element can also be positively - for example by way of clicking into a peripheral groove of the capsule base element - and/or non-positively received in the capsule.

The invention also relates to a portion capsule with such a filter element. The filter elements are arranged within an outer capsule wall of the portion capsule. Such can be formed for example by a beaker-like base element and a cover which is fastened thereto. The base element generally defines a capsule base and a capsule side wall. The filter element is located between the extraction material region which is filled with an extraction material, in particular coffee power, and the capsule base or between the extraction material region and the capsule cover. The filter element can be fastened to the base element or possibly to the cover, or it can also be merely inserted into the base element and be stabilised relative to the base element for example by the extraction material. A possible fastening of the filter element to the base element or cover can be with a positive, non-positive and/or material fit. Fastenings of filter elements in a capsule beaker are known per se and the present invention is independent of the manner in which the filter element is fastened.

Embodiment examples of the invention are described hereinafter by way of figures. There are shown in:

Fig. 1 a schematic sectioned representation of a portion capsule with the filter element;

Fig. 2 a view of a filter element from the extraction side;

Fig. 3 a view of the filter element represented reduced in size from the opposite side (collecting region side);

Fig. 4 a view of the filter element of Fig. 2 and 3 from above;

Fig. 5 a representation of a filter element sectioned along the plane V-V in Fig. 4;

Fig. 6 a representation of the filter element sectioned along the plane VI-VI in Fig. 4; and

Fig. 7 a view of an alternative filter element from the extraction material side.

Different scales have been used in the Figures 2, 3, 7 as well as 4-6 respectively. In the figures, the same reference numerals denote equal or analogous elements.

The capsule 1 according to **Figure 1** comprises a base element in the form of a beaker 11 (with axis 20) and a cover 12 which is fastened thereon along a peripheral flange 13, these together forming an outer capsule wall and defining a capsule interior. The beaker 11 as is known per se forms a capsule base 14 which here is slightly arched and a peripheral side wall 15.

The beaker and cover are manufactured of plastic in a manner known per se; however the invention can also be applied to capsules of other materials, for example aluminium. The fastening of the cover to the beaker has likewise being carried out in a known manner, for example by way of ultrasound welding or possibly also bonding.

A filter element 2 which is inserted into the beaker is present in the capsule interior, the characteristics of which will be described in more detail hereinafter. In the represented embodiment example, the beaker is fastened to a shoulder 16 which is formed by the peripheral side wall 15, for example by way of welding, i.e. by way of material-fit connection. Other fastening methods, amongst others positive fit and non-positive fit connections would likewise be possible.

The filter element separates an extraction material region 5 which will be filled with extraction material, from a collecting region 6. In the presented embodiment example, the filter element 2 is arranged in the proximity of the capsule base 14, and the collecting region 6 is located on the side of the capsule base. The injection of the water into the capsule for the brewing process is then also generally effected from the cover side. The reverse arrangement

would also be conceivable, concerning which the water is injected from the base and the filter element is arranged at the cover side.

Figure 1 schematically and in a dashed manner also represents an optional distributing element 3 which is likewise inserted into the capsule and which delimits the extraction material region 5 to the injection side and between itself and the capsule cover 12 (or in the reverse arrangement between itself and the capsule base) defines a distributing region 7.

The filter element 2 as well as possibly the distributing element 3 is/are permeable to fluid in a suitable manner, and specifically such that the extraction material cannot pass through.

The manner of functioning of such filter elements as well as of distributing elements is described for example in EP 1 792 850, to which publication reference is made in regard of this.

An embodiment of the filter element is represented in **Figures 2-6**. The filter element 2 forms a filter plate 21 with a plurality of filter openings 22 which run through it and which in the represented embodiment example are designed widening slightly in the direction away from the extraction material region (towards the collecting region side), in order to prevent blockages by way of small grains of coffee. A plurality of spacers 29 is present at the collecting region side, and these supplementarily to the subsequently described reinforcing frame prevent the filter plate 21 from being pressed again the capsule base 14 given a high capsule interior pressure and thus can prevent a flow in radial directions in the collecting region.

In the represented embodiment example, the filter element as a whole is designed in a beaker-like manner, with a peripheral side wall 23 which connects onto the filter plate 21 at the outer side and which together with the filter plate defines a filter beaker volume which is part of the extraction material region. A peripheral edge 24 which projects outwards in a flange-like manner and which in the represented embodiment example serves for the fastening of the filter element 2 in the capsule beaker 11 is formed on the peripheral side wall 23 at the outer side.

A central element 25 which has the shape of an inwardly i.e. towards the extraction material region, projecting projection is formed in the centre of the filter plate 21. This projection which forms the central element 25 is essentially conical with a plurality of projections.

At the extraction material side of the filter plate 21, the filter element comprises a frame of struts 26 which form a hexagonal structure, i.e. a honeycomb structure. The nature of such a structure is that the individual struts 26 are equally long and meet at branchings 27 so that three

struts are adjacent to each branching 27. Such a honeycomb structure forms a particularly stable two-dimensional frame.

A further characteristic of honeycomb structures and other stable two-dimensional frame structures is that a plurality of branchings is always present on an arbitrary path along the struts from the very radial outside to the very radial inside, i.e. in the frame there are no struts which reach from the very outside to the very inside without them also being supported in lateral directions by a plurality of branchings 27. The same applies to an arbitrary path in the peripheral direction, i.e. no path of struts around the complete periphery, on which path the struts do not branch at several locations, is to be found in the frame.

The frame connects onto the central element at the radially inner side (direction details such as "radially" or "in the circumferential direction" or also "centrally" in this text, inasmuch as not explicitly stated otherwise, always relates to the axis 20 of the capsule).

The strength of the struts (i.e. the cross-sectional area perpendicular to the respective running direction of the struts) reduces radially outwards. This is realised by way of the extension of the struts in the dimension perpendicular to the filter plate being gradually reduced radially outwards, whereas the width, i.e. the extension perpendicular to the running direction of the respective strut and parallel to the filter plate is constant. The strength of the struts in the represented embodiment tends to zero radially at the very outside, which can be seen particularly well in Figure 5 and 6. However, it would also be possible for the strength of the struts not to be completely zero at the very radial outside and for the struts to reach up to the peripheral side wall 23.

Figure 7 shows an alternative embodiment of the filter element 2 which differs from that of Figure 2 -6 in particular in that it comprises no peripheral side wall and is therefore not designed in a beaker-like manner, but as a whole is disc-shaped. The edge region 28 of the filter element at the radial outer side connects onto the filter plate 21 with the frame. It can comprise a peripheral rib at the outer side (i.e. the side towards the collecting region, in Fig. 7 the lower side and therefore not visible), said rib serving as an energy director in an ultrasound welding method. The filter element can thus be welded onto a shoulder which is formed by the capsule base element which for example is designed in a somewhat more pronounced manner than the shoulder 16 which is schematically represented in Fig. 1.

The central element, the frame of the struts 26 as well as the filter plate 21 as a whole in the embodiment of Fig. 7 is functionally equal to the aforedescribed embodiment.

Further embodiments are possible, amongst other things also with other capsule shapes.

It would also be possible to provide the frame of struts at the outer side, i.e. at the side of the filter plate 21 towards the collecting region.

Example: Numerical simulations were carried out with a filter element according to Figures 2-6. The filter element being subjected to a temperature of 100°C at a pressure of 12 bar on the inner side was simulated. For comparison, the same simulation was carried out on a filter element which does not comprise the frame of struts, but which is otherwise designed in an identical manner. It was found that given both comparable filter plates, the deformation is greatest in a central region, in particular at the location of the central element and in its direct environment. The maximal deformation with the filter element according to the invention however is reduced by a factor of approx 3 in comparison to the filter element which is not designed according to the invention

CLAIMS

1. A filter element (2) for a portion capsule (1) with a base element (11) and with a capsule cover (12), which together define an outer capsule wall, said filter element (2) being, for the purpose of separating a collecting region (6) from an extraction material region (5) in a capsule interior, insertable into the base element (11), wherein the filter element (2) comprises a fluid-permeable filter plate (21) and a plurality of struts (26) which run along the filter plate (21), **characterised in that** the struts (26) form a two-dimensional frame of struts (26) which meet one another at an angle.

2. The filter element according to claim 1, wherein the struts have a cross section which reduces towards radially outwards with respect to the filter plate (21).

3. The filter element according to claim 2, wherein the cross section of the struts (26) reduces radially to the outer side by way of the extension perpendicular to the filter plate (21) reducing whilst the width of the struts (26) is constant.

4. The filter element according to one of the preceding claims, comprising a central element (25), wherein the frame of the struts runs up to the central element and is connected thereto.

5. The filter element according to claim 4, wherein the central element (25) is formed by a projection of the filter element towards the extraction material region.

6. The filter element according to one of the preceding claims, wherein the frame forms a honeycomb structure

7. The filter element according to one of the preceding claims, wherein the frame is present on an extraction material region side of the filter plate (21).

8. The filter element according to claim 7, wherein a plurality of spacers (29) is arranged on a collecting region side of the filter plate (21), which collection region side lies opposite the extraction material region side.

9. The filter element according to one of the preceding claims, which as a whole is designed in a beaker-like manner and comprises a side wall (23) which connects onto the filter plate (21) at the outer side.

10. A portion capsule (1), comprising a beaker-like base element (11) and a cover (12) which along a peripheral edge is connected to this, wherein a filter element according to one of the preceding claims is inserted into the base element (1) and separates an extraction material region (5) which is filled with extraction material, from a collecting region (6).

11. The portion capsule according to claim 10, wherein the filter element (2) is positively, materially and/or non-positively fastened to the base element (11).

12. The portion capsule according to claim 10 or 11, comprising a distributing element (3) which is inserted in the base element (11) and which delimits the extraction material region (5) to an injection side and thus defines a distributing region (7).

13. The portion capsule according to one of the claims 10-12, wherein the base element (11) defines a capsule base (14) and a side wall (15), and wherein the filter element (2) is arranged between the capsule base (14) and the extraction material region (5).

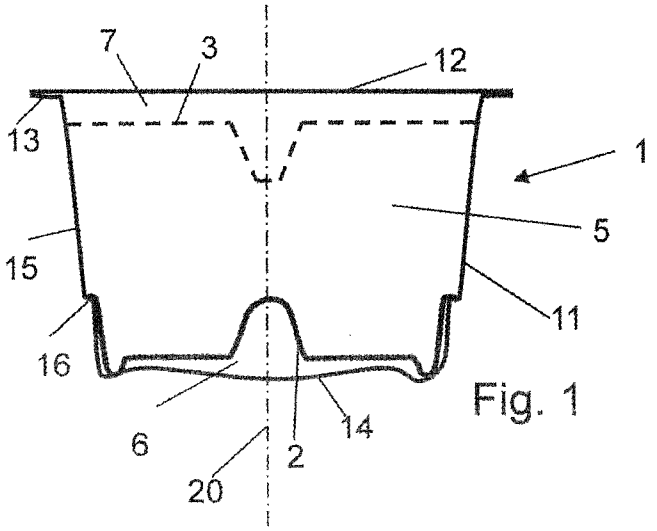

Fig. 1

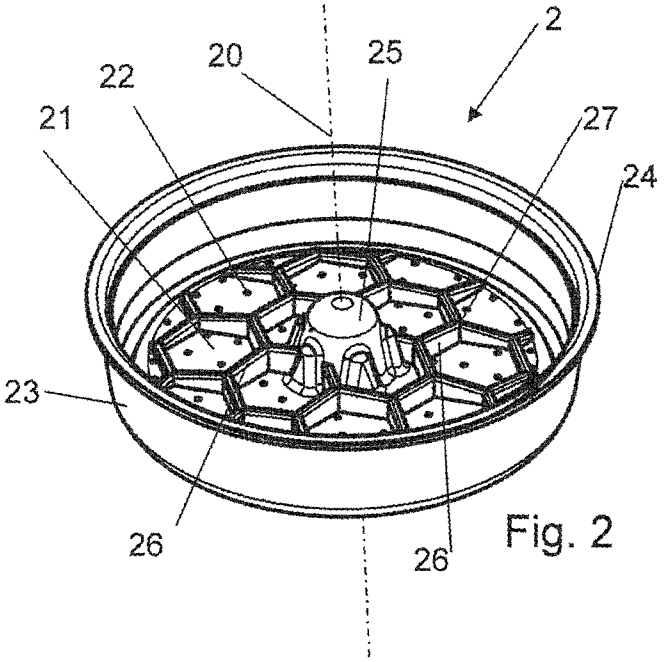

Fig. 2

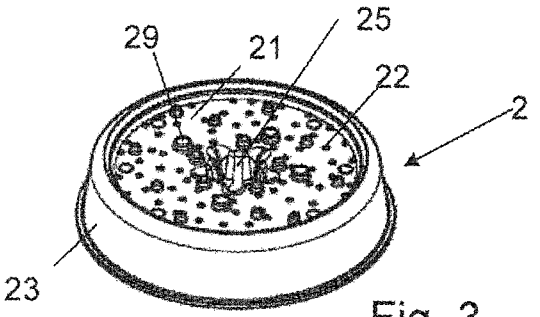

Fig. 3

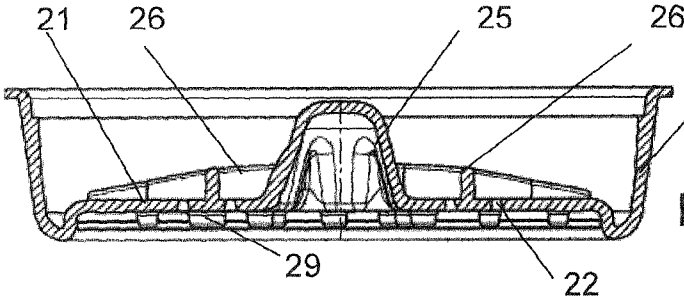

Fig. 5

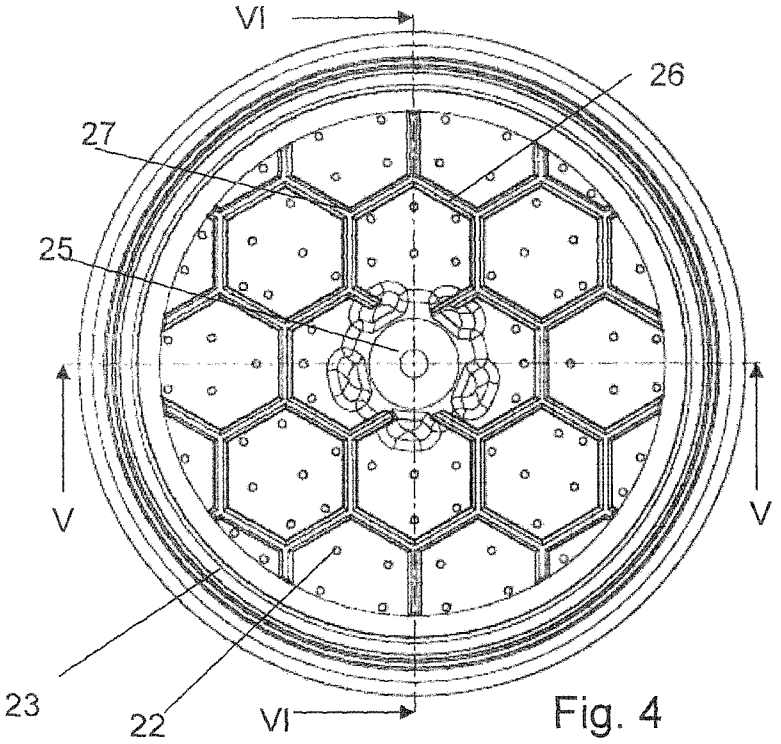

Fig. 4

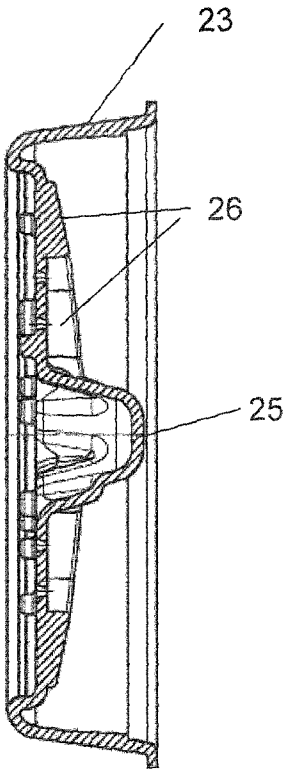

Fig. 6

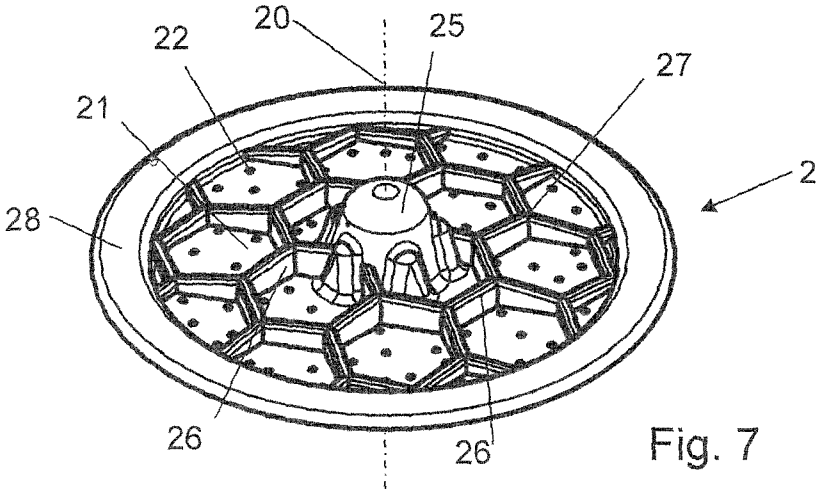

Fig. 7

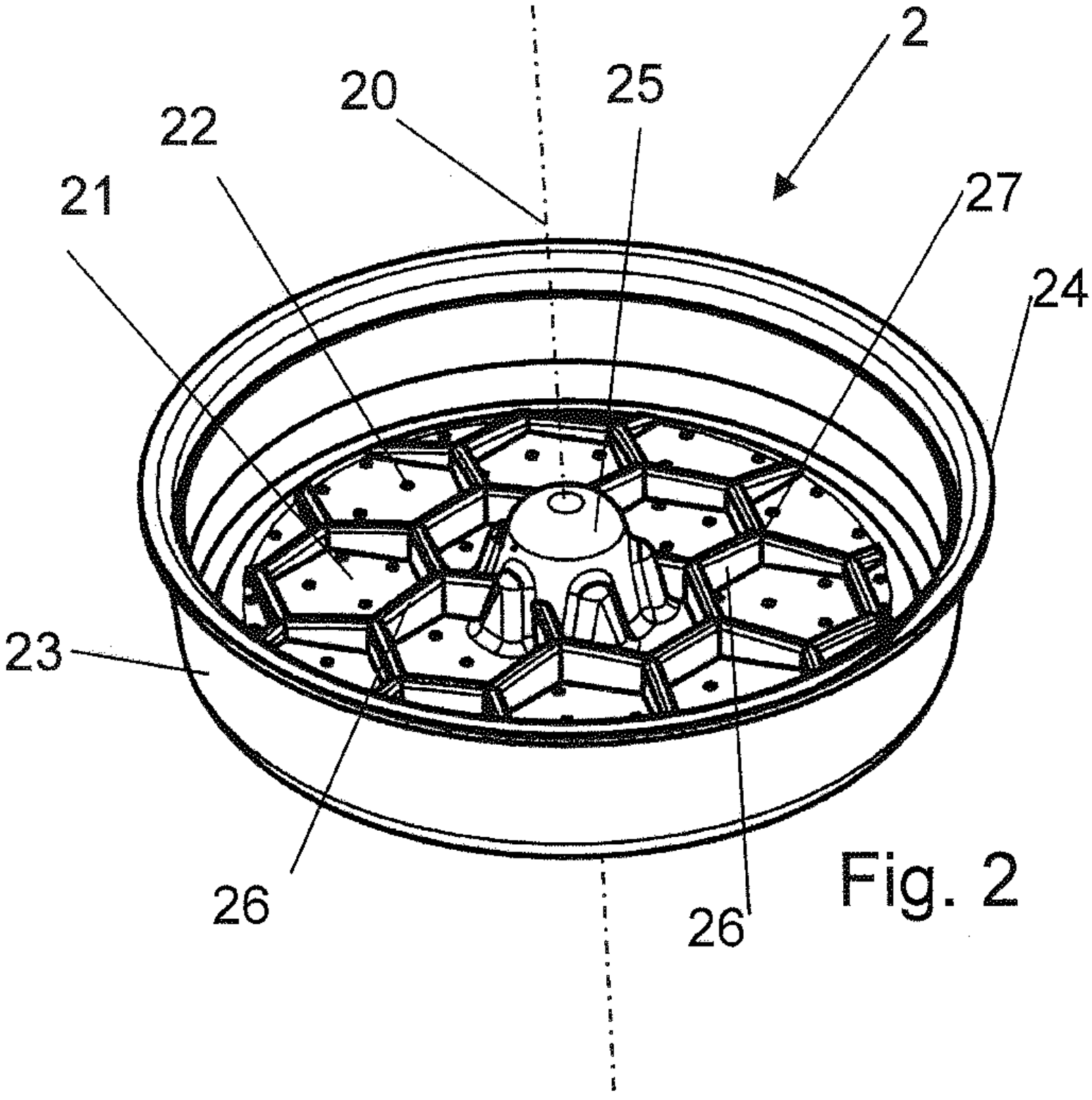

Fig. 2