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(54) **OPTICALLY READABLE CAPSULE FOR THE PREPARATION OF A BEVERAGE AND THE
RELATIVE RECOGNITION SYSTEM**

(57) A system for recognising capsules for the preparation of beverages and the relative capsule for said system that is designed to be a simple and reliable

system for recognising a capsule that has a recognition component for the automatic machines that use said system.

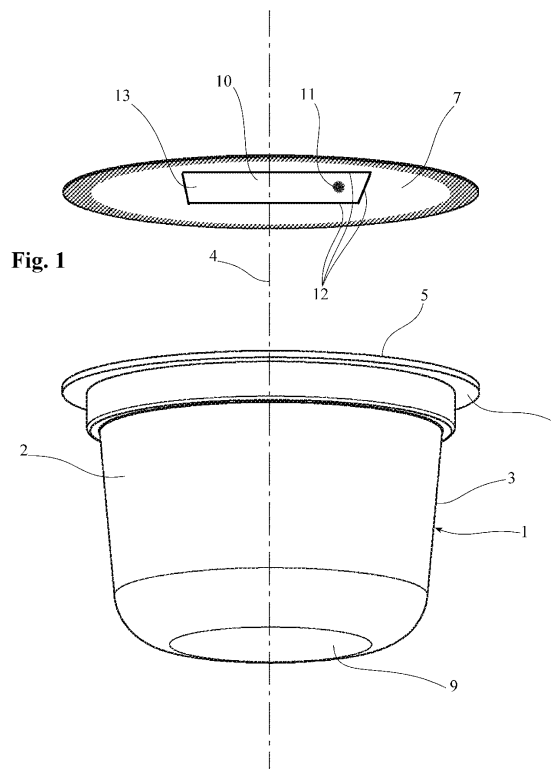


Fig. 1

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Description

[0001] The subject of the present invention refers to a system for recognising capsules for the preparation of beverages and a capsule specifically designed to be used with said system.

State of the Art

[0002] Single-use capsules for the preparation of beverages are well-known. Said single-use capsules are suitable for use in automatic machines for the preparation of beverages; they usually have a truncated cone-shaped body, inside which there is substance, usually in the form of a powder, that is meant to be infused or another soluble powder to be dissolved by the fluid that the machine injects into the capsule after perforating a cover that seals the aforementioned truncated cone-shaped body.

[0003] In the field of automatic machines that use disposable capsules, it is well known that different methods have been developed for the recognition of these capsules. Sometimes to recognise the characteristics of the capsules and their contents, but more often to identify the origin of the capsules, distinguishing the original capsules from those of competitors in order to prevent the use of the latter in the original automatic machines.

[0004] Known recognition systems are based on various technologies, generally inexpensive and for the most part capable of detecting markers on the outside of the capsule, very often on the cover, but also inside the capsule. Well-known recognition systems consist of the optical recognition of codes or substances applied to a part of the capsule, either on the outside or inside of it. All optical markers, hitherto used for the identification of a single-dose capsule, however, are of an unchanging type and have the defect of not being reliable when it comes to recognition, especially if there are foreign objects that could cover the marker or dirty the marker itself.

[0005] To try to avoid, or limit, the aforementioned drawback, some manufacturers have adopted a system for recognising the originality of a capsule which consists in having inserted into the capsule a permeable support that has a recognition substance; where said permeable support is permeated by the infusion fluid during the infusion process.

[0006] However, the aforementioned system, of employing a permeable support with a recognition substance inside the capsule, introduces the risk that said recognition substance is released from the permeable support, and transported by the infusion into the beverage.

[0007] This system also risks not correctly recognising an original capsule due to the presence of infusion powder between the permeable support and the closure film.

[0008] Other manufacturers have used a different system for recognising a generic capsule that involves using a multilayer closure film, which is attached to the flanged

edge of the conical-shaped body along the circumferential edge. The inner layer of the closure film is impermeable and only becomes detached from the closure film in a central portion by the perforator during the liquid injection process, allowing for the identification of the recognition substance in said film.

[0009] Also in this system, the infusion fluid is forced to pass through the layer that contains the recognition substance, and also said system might be at risk of failing to deliver the fluid if the internal layer with the recognition substance is not properly perforated. In fact, due to the overheating of the automatic machine, the perforator reaches a temperature such that, instead of piercing the inner layer, it deforms it thermally, leaving the hydraulic seal unchanged and preventing the infusion from passing through the single-use capsule. While the machine cold, the perforator might be able to perforate both sealing layers of the capsule body, without any displacement or detachment of the inner layer of the multilayer sealing film from the outer sealing film.

[0010] This failure to displace or detach the inner layer with a recognition substance prevents the recognition of the capsule and, as a result, it prevents the dispensing of the infusion.

Objects of the invention

[0011] The object of the present invention is to provide a more reliable recognition system for a single-use capsule.

[0012] A further object of the present invention is to provide a recognition system that is not affected by one or more of the aforementioned drawbacks.

[0013] A further object of the present invention is to provide a capsule with a recognition system that can be identified in a robust manner to accommodate all the variables of an automatic machine, with respect to the verification times of the capsule recognition component, with respect to insertion into the machine or when the sealing film is perforated by the perforator.

[0014] An important object of the present invention is to provide a capsule with a recognition system that is categorically recognised by said recognition system of an automatic machine.

[0015] An important object of the present invention is to provide a capsule for the preparation of a beverage in a beverage preparation machine that can be recognised optically, and that offers a simplified and reliable recognition method.

[0016] The object of the present invention is to provide a recognition system whose recognition device, with which the capsule is equipped, is not static or is not only static.

Explanation of the invention

[0017] All the aforementioned purposes and others that will be more clearly explained in the subsequent

discussion are achieved by a capsule using optical recognition for the preparation of a beverage through the infusion or dissolution of a food substance using an infusion fluid that is introduced into the capsule by a beverage-making machine,

[0018] where said capsule is suitable for being inserted into an infusion unit of an automatic beverage-making machine, and where said infusion unit, by means of an injector, injects an infusion liquid into said capsule to obtain a beverage from the infusion or dissolution of the food substance contained in said capsule; said capsule comprises:

a truncated cone-shaped body suitable for containing a powdered or soluble food substance for making the beverage,

a cover that seals the opening of said body consisting of a perforable film that is meant to be perforated by a perforator of the automatic machine for the entry of an injector of the infusion liquid infusion unit;

a recognition component connected to said cover; characterised by the fact that said recognition component consists of a flexible laminate component; where said component is a flexible laminate:

- positioned parallel to the sealing film;
- smaller than the opening of the cover;
- attached to the cover at one or more points inside its perimeter edge;
 - where said one or more attachment points are positioned only on one side of said flexible laminate component with respect to its longitudinal extension,
 - where said one or more points are some distance from the centre of the cover;
- positioned with the protruding end part, opposite to that connecting with the cover, positioned below the central part of the cover so as to allow said protruding end part, free from the connection with the cover, to be able to be moved by the perforator, keeping it intact, during the perforation of the sealing film and remaining elastically flexed;
- and staying next to the perforator, exposed in the central part of the capsule, below the part of the cover that has been perforated by the perforator.

Advantageous characteristics of the invention

[0019] Advantageously, said recognition component flexes elastically under the pressure of the infusion flow and does not obstruct or limit the flow.

[0020] Advantageously, said recognition component is of a similar thickness to the thickness to the sealing film, facilitating its seal connection.

[0021] Advantageously, said recognition component is

composed of a material identical to the sealing film, making it easier to seal and preventing the material from melting at the peripheral edges.

[0022] Advantageously, said recognition component only presents the surface facing the verification device or the terminal of the verification device, covered with a recognition substance.

[0023] Advantageously, said recognition component is impermeable, facilitating the flow of the infused liquid injected by the injector, which allows it to flow more easily within the body of the capsule without encountering any resistance.

[0024] Advantageously said recognition component is lightly contacted by the flow, rather than being directly passed through, thereby avoiding transferring the recognition substance into the beverage.

[0025] Advantageously, said recognition component is moved by the perforator, keeping the surface exposed to the verification device free from any foreign bodies.

[0026] Advantageously, said recognition component is moved by the infusion flow, keeping the surface exposed to the verification device of the automatic machine free from any foreign bodies and effectively avoiding false negatives in recognising the capsule.

[0027] Advantageously, said recognition component consists of an electrostatic material that makes the recognition component adhere to the sealing film, thereby facilitating the operations for constructing the capsule.

[0028] Advantageously, said recognition component constitutes a component for breaking the infusion flow by interrupting the linear fluid threads to generate a swirling flow to increase the contacted surface area of the edible material with the infusion flow.

[0029] Advantageously, said recognition component diverts the incoming flow by changing the direction with a component perpendicular to the main axis of the capsule and increasing the infusion yield.

[0030] Advantageously, said recognition component that vibrates under the action of the incoming flow, introducing air into the infusion flow, breaking up the flow and preventing direct channels from forming between the inlet and outlet of the capsule and enhancing the yield of the powder in the capsule, facilitating the dissolution of the compound.

[0031] Advantageously, the recognition component is smaller than the sealing film, and is not included along the perimeter edge joining the flanged part of the capsule body to the sealing film, thereby allowing the usual sealing settings between the cover and the body to be maintained for capsules that do not have the recognition component, since the sealing thicknesses and amounts have been kept unchanged.

[0032] The critical aspect of the sealing of any recognition component on its perimeter edge was also verified, since it could compromise the integrity of the sealing film.

[0033] It has also been verified that any sealing of the sealing film with the perimeter edge of the recognition component, after the deformation of the recognition com-

ponent itself by the perforator and the subsequent vibrations due to the flow that contacts said component, results in the triggering of cracks and the ongoing cuts of the perforator in the sealing film, causing parts of the sealing film to detach, and where these detached parts can remain inside the machine even after the used capsule has been removed from the automatic machine.

[0034] Another object of the invention is also the system for recognising capsules to be used for the preparation of beverages, which consists of the following stages:

- insertion of a capsule of the invention into the automatic machine by placing said capsule in an opening positioned between the infuser and the dispensing cup;

- bringing said infuser to the dispensing cup with the capsule of the invention placed in between, reaching and creating a hydraulic seal along the circumferential flange of said capsule;
- perforation of the sealing film of said capsule by means of a perforator;
- moving the protruding part of the flexible recognition component towards the inside of the capsule body;
- emission of an incident beam or verification signal by an emitting source of the machine towards said protruding part of the recognition component;
- acquisition of the beam reflected or emitted by the protruding part of the recognition component;
- evaluation of the beam or signal acquired by a controller in the machine;
- dispensing of the infusion liquid subsequent to a positive assessment of the acquired beam or signal, or failure of the infusion liquid to be dispensed following a negative assessment of the acquired beam or signal.

[0035] These and other objects are all achieved by the recognition system and the capsule that are the object of the invention according to the appended claims.

Brief description of the drawings

[0036] The technical characteristics of the invention, according to the aforesaid objects, can clearly be seen in the content of the claims below, and its advantages will become more readily apparent in the detailed description that follows, made with reference to the accompanying drawings, which illustrate a preferred embodiment that is purely exemplary and not limiting, in which:

Fig. 1 shows in a perspective view and an expanded view a capsule for preparing a beverage that can be recognised optically according to the present invention.

Fig. 2 shows a top plan view of the sealing film of the capsule of

Fig. 1 equipped with a recognition component.

Fig. 3 shows in section the step of inserting the capsule into an automatic capsule recognition ma-

chine with the infuser and the dispensing cup spaced apart from each other.

Fig. 4 shows in section the step of recognising the capsule inside an automatic machine after the perforation of the sealing film with the shifting of the recognition component by the perforator.

Detailed description of an example of a preferred embodiment

[0037] The capsule 1, the object of the present invention, comprises a truncated cone-shaped body 2 that is hollow on the inside so that it can contain the food substance that will be infused.

[0038] Said capsule 1 has a longitudinal main axis 4 and the side wall of the body 3 shares the same longitudinal axis as said longitudinal axis 4.

[0039] The larger base 5 of said body 2 generally has an outwardly-facing protruding flange 6.

[0040] A sealing film 7 is bonded to said flange 6 as a cover.

[0041] Said sealing film 7 is intended to be perforated by a perforator 8 of an automatic machine for the entry of an injector that injects the infusion liquid for obtaining the beverage.

[0042] The beverage exits through an opening, which is carried out by the automatic machine, on the smaller base 9.

[0043] Said sealing film 7 comprises, in the part facing the inside of the body cavity 2, a truncated cone-shaped recognition component 10. Said recognition component 10 joined to the sealing film 7 is constructed as a laminar element connected to a joint 11, preferably glued or welded, to the sealing film 7 in such a way as to be attached to it.

[0044] Said joint 11 of the recognition component 10 to the sealing film 7 is only lateral with respect to a longitudinal extension of the recognition component and inside the perimeter profile 12 and set apart from said perimeter profile 12. In fact, it has been noted how critical a connection between the recognition component and the sealing film carried out on the perimeter profile is, following the deformation of said recognition component and the vibrations of the flow of the incoming liquid that comes into contact with said recognition component, leading to the breakage and detachment of parts of the thin layer and/or said recognition component.

[0045] Said recognition component extends, with respect to the connecting point, into the central part of the sealing film, going beyond the centre of the capsule.

[0046] Said overhanging protrusion 13 of the recognition component 10, with respect to the attachment point 11 with the sealing film 7, stays attached and bonded to the sealing film 7 also by means of electrostatic adhesion.

[0047] This overhanging protrusion 13 of the recognition component 10, following the breaking of the sealing film 7 by the perforator 8 of the automatic machine, is moved away from the sealing film 7 by the perforator 8

towards the inside of the cavity of the body 2 of the capsule 1.

[0048] This removal of the overhanging protrusion 13 takes place without affecting the structure and integrity of the recognition component 10, thanks to the considerable flexibility of the overhanging part 13 of the recognition component 10. The part that has been moved away, since it is more extended in comparison to the central breaking point of the sealing film 7, remains below and rests against the perforator 8.

[0049] Connected with said perforator 8 is the transmission terminal 14 and the receiving terminal 15 of the beam or the recognition signal of the capsule 1 by the automatic machine.

[0050] Said part of the recognition device 10, or even just the surface facing the perforator 8, near the perforator, which carries said terminals, transmission 14 and reception 15, remains close to the terminals, even when the recognition device 10 is moved by the perforator 8, for any depth reached by the perforator 8 within the cavity of the capsule 1.

[0051] Keeping the recognition device 10 close to said terminals 14, 15, ensures the reliability of the recognition of the capsule 1, avoiding any false negatives.

[0052] The flexibility of the configuration of the flexible laminar of the recognition device 10 also allows it to not obstruct or limit the incoming flow, which is sometimes used in a forceful manner to clean the recognition device 10 of any residues, and to be able to return to its position near the terminals 14, 15 as soon as the flow decreases and/or stops.

[0053] Said capsule 1 is designed to be used inside an automatic machine equipped with an infusion unit 16 for the production of a beverage, in which a predetermined amount of liquid is injected into the capsule 1 by an injector, which is part of the infusion unit 16, after the sealing film 7 is broken by a perforator 8.

[0054] The liquid that is injected into the capsule 1 infuses the material contained within the capsule or dissolves the material contained within the capsule, to be collected, through a hole in the smaller base 9, by a dispensing cup 17, and channeled out of the machine through an outlet conduit 18.

[0055] The infusion unit 16 and the dispensing cup 17 are mutually movable. Having moved away from each other, they allow the loading of a capsule 1 and, subsequently having moved closer together, they hold the capsule 1 and create a fluid-tight seal during the infusion, to then finally, once the infusion phase is over, move away from each other again, letting the single-use capsule 1 to exit the infusion chamber.

[0056] Prior to the infusion of the liquid injected by the injectors, the machine carries out the verification of the capsule 1.

[0057] Connected to the perforator 8 are the terminals for the transmission 14 and reception 15 of the capsule recognition beam or signal, typically a light beam in the visible or near ultraviolet or near infrared range.

[0058] Said terminals are connected to a source 19 and a receiver 20 inside the machine. Said source 19 and said receiver 20 communicate with a controller 21; said controller 21, after a positive check of the beam received from the receiver 20, authorises the continuation of the dispensing phases.

[0059] A successful verification is attained only if the incident beam or signal transmitted by the source 19, which is reflected or emitted by the recognition device 10 of the capsule 1 is then received by the receiver 20 through the receiving terminal 15, and then validated by the controller 21.

[0060] In fact, the recognition device 10 can consist of a material that simply reflects the incident beam, and in this case the frequency of the transmitted incident beam is identical to the frequency of the reflected beam, but it can also partially convert the incident beam that has a predetermined frequency, for example if it consists of a fluorescent or phosphorescent material, even partially, into another frequency. For example, the incident beam can be an ultraviolet beam and the beam reflected by the recognition device made of fluorescent or phosphorescent material, can be, in whole or in part, in the visible range.

[0061] In a more complex variant, the recognition device 10, can, when activated by an electromagnetic signal, transmit a return signal with various information about the capsule 1; and this return signal, received by the receiving terminal 15 and transmitted by the receiver 20 to the machine controller 21, allows the continuation of the infusion operations, with a possible optimised setting of the machine for the characteristics of the capsule. Said optimised setting may comprise, among other things, the temperature, pressure, duration, quantity etc. of the infusion liquid.

Claims

1. Optically readable capsule for the preparation of a beverage following the infusion or dissolution of a food substance by an infusion liquid introduced into the capsule (1) by a beverage production machine, where said capsule (1) can be inserted into an infusion unit (16) of an automatic beverage making machine, and where said infusion unit (16), by means of an injector, injects an infusion liquid into said capsule (1) to obtain a beverage from the infusion or dissolution of the food substance contained within said capsule;
said capsule comprises:

- a truncated cone-shaped body (2) adapted to contain a powdered or soluble food substance for making the beverage,
- a cover (7) that closes the opening of said body, consisting of a perforable film to be perforated by a perforator (8) of the automatic machine for the

entry of an injector of the infusion unit (16) of the infusion liquid;
 - a recognition component (10) connected to said cover (7);

characterised by the fact that said recognition component (10) consists of a flexible laminate component; where said component is a flexible laminate:

- positioned parallel to the sealing film of the cover (7);
 - smaller than the opening of the cover (7);
 - attached to the cover (7) at one or more attachment points (11) inside its perimeter edge (12);

a. where said one or more joining points (11) are positioned only on one side of said flexible laminate recognition component (10) with respect to its longitudinal extension,

b. where said one or more attachment points (11) are at a distance from the centre of the cover (7);

- positioned with the end part (13) that protrudes, opposite to that of said one or more points of attachment (11) to the cover (7), positioned below the central part of the cover (7) so as to allow said end part (13) that protrudes and that is free from the attachment with the cover (7) to be able to be moved by the perforator (8), remaining intact, during the perforation of the sealing film of the cover (7) and remaining flexed in an elastic manner;

and where said end (13) rests against the perforator (8), exposed in the central part of the capsule (1), underneath the part of the cover (7) perforated by the perforator (8).

2. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) at the part where it protrudes (13) is flexible and flexes in an elastic manner when pushed by the infusion flow, and does not obstruct or limit its flow.
3. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) is of comparable thickness to the closure film of the cover (7).
4. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) is composed of a material identical to that of the sealing film of the cover (7).

5. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) has only the surface facing the verification device or the terminal of the verification device, covered with a recognition substance.

6. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) is impermeable, facilitating the flow of the infused liquid injected by the injector of the infusion unit (16).

7. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) is impermeable and continuous, where it is in contact with but not penetrated by the flow.

8. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) in the part that protrudes (13) is flexible and elastic and is moved by the perforator, making the exposed surface towards the verification device clean from any foreign bodies.

9. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) in the part that protrudes (13) is flexible and mobile and is moved by the infusion flow, making the exposed surface towards the verification device of the automatic machine clean from any foreign bodies.

10. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) consists of an electrostatic material that allows said recognition component (10) to be attached to the sealing film of the cover (7).

11. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) has a geometric configuration underneath the infusion flow that constitutes an component for breaking the infusion flow by breaking the linear liquid threads and generating a swirling flow to increase the surface affected by the edible material in contact with the infusion flow.

12. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) has a geometric configuration that changes the direction of the input flow with a component perpendicular to the main axis of the capsule (1).

13. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that said recognition component (10) at the part that protrudes (13) is flexible and elastic in a vibrating manner under the action of the incoming flow, where said vibrating protruding part is an inserter of an air component in the infusion flow, segmenting the rupture of the flow and preventing the direct channels between the inlet and the outlet of the capsule and enhancing the yield of the powder, facilitating the dissolution of the compound.
14. Optically readable capsule for the preparation of a beverage according to claim 1, **characterised by** the fact that the recognition component (10) has a smaller extension than the extension of the sealing film of the cover (7), where its perimeter profile 12 is at a distance from the perimeter edge of the joint between the flange (6) of the body (2) of the capsule (1) with the sealing film of the cover (7).
15. Capsule recognition system for the preparation of beverages consisting of the following steps:
- the insertion of a capsule (1) referred to in one or more of the preceding claims into an automatic machine equipped with an infuser (16) and a dispensing unit (17), the placement of said capsule (1) in an opening between the infuser (16) and the dispensing unit (17);
 - the approach of said infuser (16) to the dispensing unit (17) with said capsule (1) included and placed in between, reaching and creating a hydraulic seal along the circumferential flange (6) of the body (2) of said capsule (1);
 - the perforation of the sealing film of the cover (7) of said capsule (1) by means of a perforator (8) connected to the infuser (16);
 - the movement of the protruding part (13) of the flexible recognition component (10) towards the inside of the body (2) of the capsule (1);
 - the emission of an incident optical beam or verification signal by a source (19) emitting the machine towards said protruding part (13) of the recognition component (10);
 - the acquisition by a receiver (20) of the beam reflected or emitted by the protruding part (13) of the recognition component (10);
 - the evaluation by a controller (21) of the beam or signal acquired by said receiver (20);
 - the dispensing of the infusion liquid following a positive assessment of the acquired beam or signal, or failure to dispense the infusion liquid following a negative evaluation by the controller (21) of the beam or signal acquired by said receiver (20).

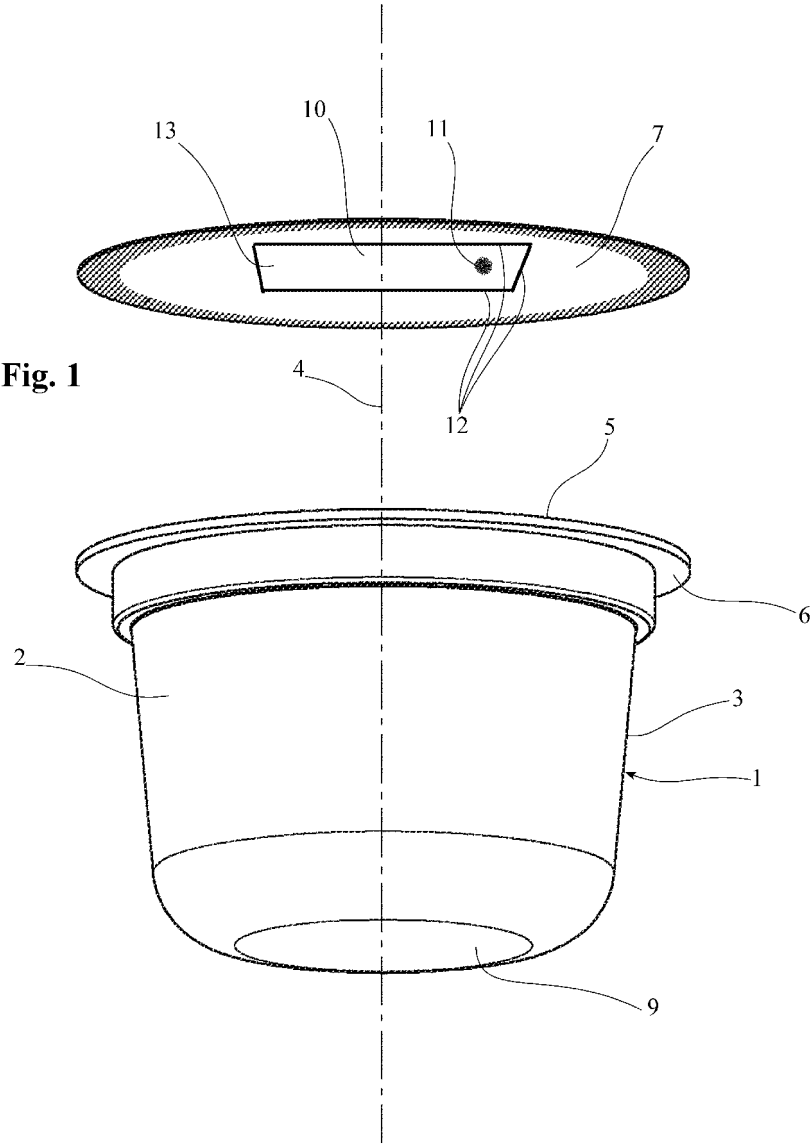
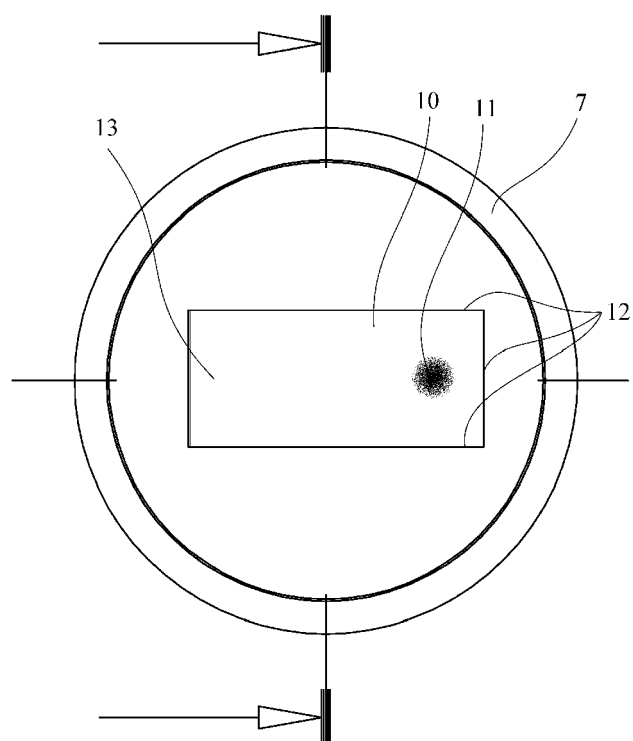
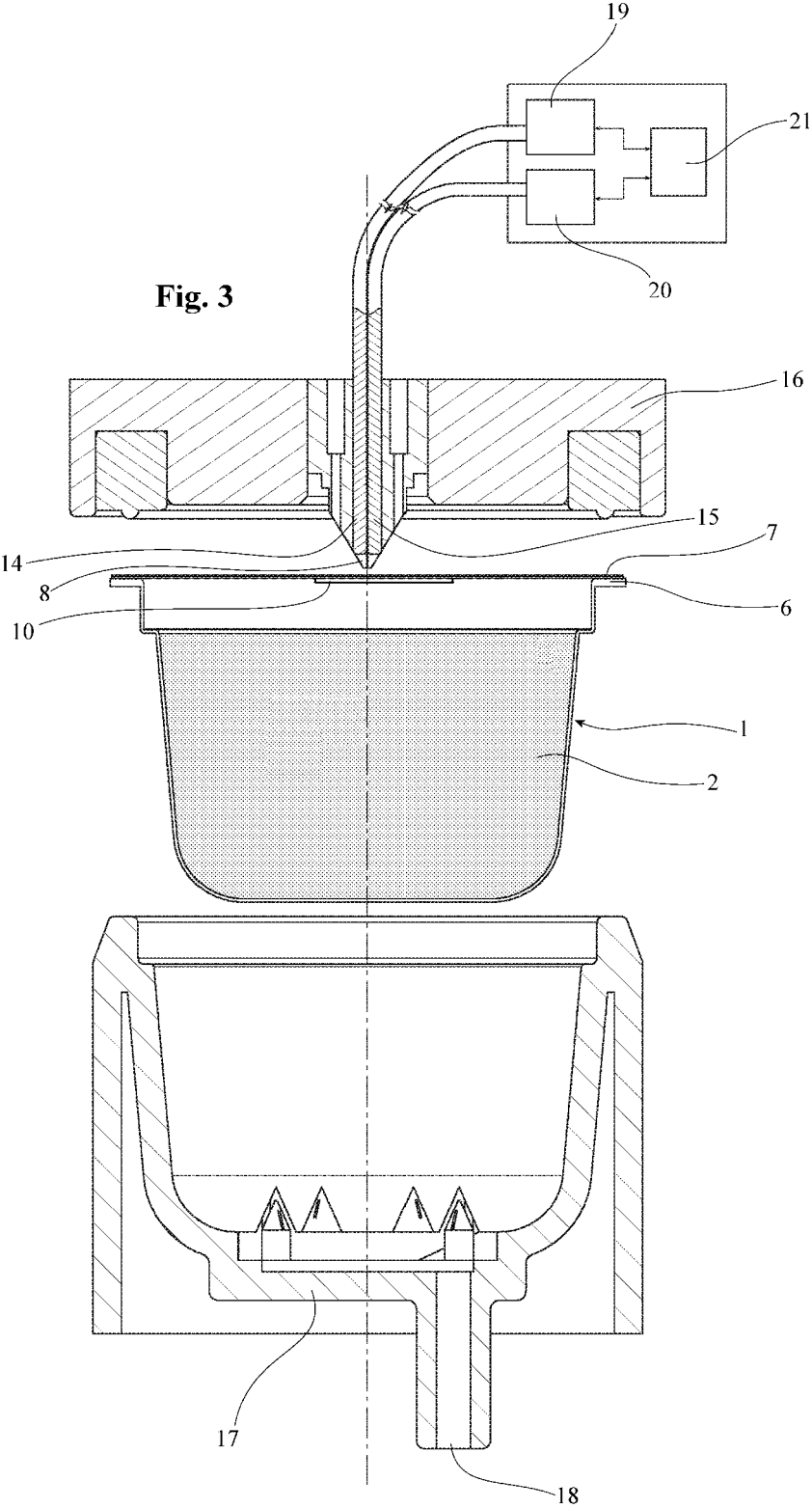
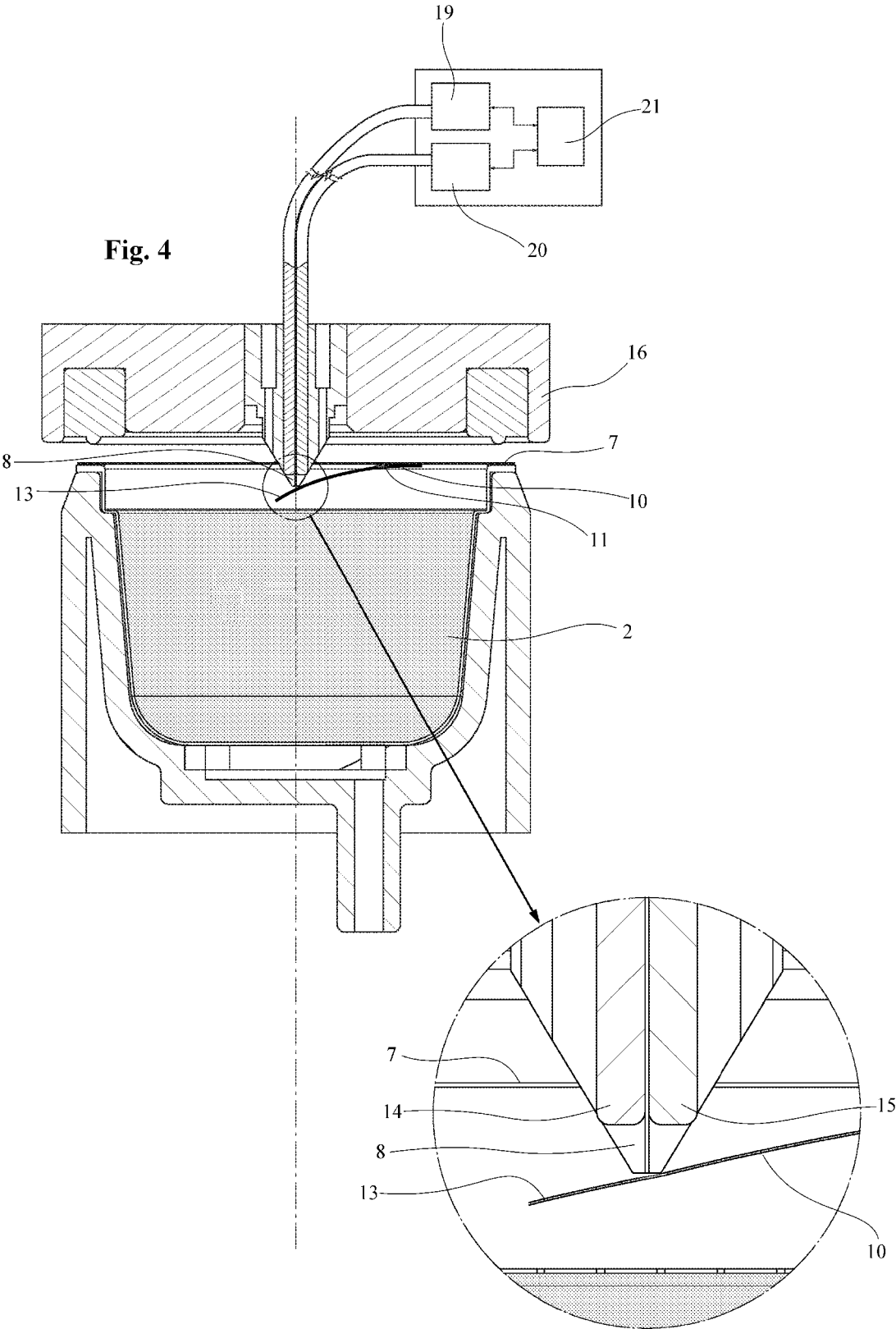


Fig. 2









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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
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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			
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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