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(54) PORTION PACKAGE, BEVERAGE PREPARATION SYSTEM COMPRISING VARIOUS TYPES OF PORTION PACKAGES

(57) The present invention refers to a portion package (1) for preparation of edible products, presenting two construction elements (3, 4) respectively adapted for the entry and exit of a pressurized fluid flow and at least one envelope layer (31, 41) provided with a plurality of zones of weakened material (51, 61) with a pattern of distribution including groups thereof that leads to improved characteristics of interaction of the pressurized fluid flow with said portion package (1), more effective in terms of quality of the beverage obtained and without the need for means for perforation of the package envelope.

The present invention further refers to a system (20) for preparation of beverages including at least one beverage preparation machine (10) comprising at least one extraction device (8), and at least two types of portion packages (1'a, 1'b) of similar dimension and configuration, but adapted for different types of beverages or for a beverage with different characteristics.

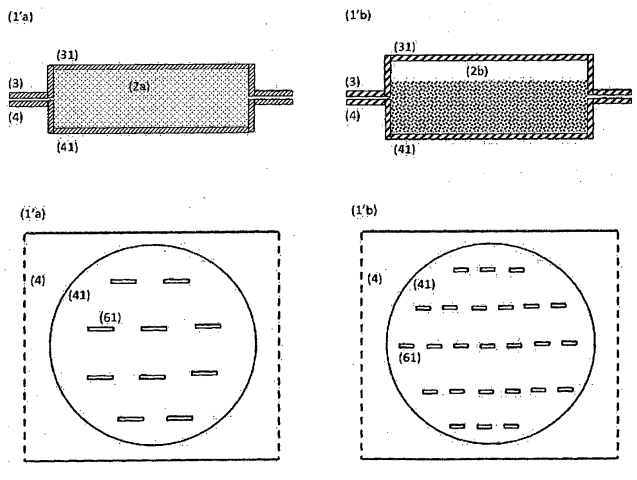

Fig.6

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Description

Field of the invention

[0001] The present invention refers to the field of the portion packages substantially air tights and comprising one dose of at least one edible substance and adapted for the preparation of an edible product.

[0002] The present invention further refers to the field of the systems for preparation of beverages, notably of aromatic beverages such as for example espresso coffee, tea and similar, based upon the extraction of respectively precursor substances contained in the portion packages by means of a pressurized fluid flow.

Background of the invention

[0003] The field of the present invention includes many solutions, in particular relating to packages containing a single portion of an edible product in an interior volume and adapted to be processed in a respective device so as to prepare an edible product, such as for example in the case of certain beverage preparation machine, notably espresso coffee machines.

[0004] The configuration of the flow passageways on the exit of said portion packages as zones of weakened material presents several advantages and is known from prior art. In fact, documents EP 0521510 B1 and EP 0806373 B1 are examples of substantially regular distributions of such zones of weakened material, without grouping thereof that result noticeable in terms of the spatial distancing apart and, especially, in terms of the resulting flow behavior. Document EP 1555218 B1 discloses a construction solution for the parts that break on the exit side characterized in that said parts are obtained by means of grooves formed in said zones of weakened material.

[0005] The document WO 2012/100976 A1 discloses a capsule adapted for preparation of beverages by means of centrifugation. The document further discloses a plurality of zones of weakened material of dot-like format and arranged along groups of three along a perimeter zone thereof, whereby this disposition is allegedly advantageous for the exit of the beverage through said perimeter zone.

[0006] In flow systems of relatively reduced dimensions and relatively high energy intensities, as the present case, it is known that small dimensional and form variations may lead to big differences in the interaction of the pressurized flow with a respective entry and/or exit construction element of the portion package and, therefore, in the resulting downstream flow. There is therefore the need to additionally optimize this type of solution, notably so as to optimize the surface distribution of zones of weakened material, in particular in view of increasing the flow turbulence and, thereby the production and consistency of crème in a resulting edible product.

General description of the invention

[0007] The objective of the present invention is to provide a portion package adapted for preparing an edible product, notably aromatic beverages including espresso coffee, tea and similar by means of extraction by a pressurized fluid flow, that provides better interaction conditions of the pressurized fluid flow with the construction envelope thereof, in particular providing adjacent zones of weakened material with certain characteristic dimensions tending to generate behavioral synergies among each other, so as to produce a flow with pulsing flux characteristic during at least part of the period of passage of the pressurized flow through a respective entry envelope zone and/or exit envelope zone of said portion package.

[0008] This objective is attained according to claim 1.

[0009] In particular, the aforementioned objective is attained by means of zones of weakened material provided with certain forms and dimensions, and spatially arranged in at least two groups spaced apart and provided in certain distributions and dimensions, so as to develop an oscillatory behavior of the pulsing flow type over at least most part of the surface of the construction element of the portion package that is disposed on the exit side of the flow. This type of mechanic behavior of the envelope is advantageous in terms of the resulting beverage quality.

[0010] In particular, according to a first inventive aspect, the zones of weakened material of each group are provided along at least two at least approximately parallel extensions, so that it thus results a corresponding extension of flow passageways presenting a pulsing behavior. According to the present invention, is preferred when there is provided a plurality of surface extensions corresponding to a plurality of groups of zones of weakened material, and when said zones of weakened material are distributed over at least most part of the surface of the concerned construction element.

[0011] Moreover, it is preferred when said zones of weakened material are provided by a displacement of material from a respective exterior envelope layer, with accumulation of displaced material along at least most part of the extension of the edges of a respective cavity, in salient manner relative to the surrounding surface of a respective exterior envelope layer. It is thus provided a resistance reinforcement acting contrarily to the upstream flow pressure and enabling a more reliable rupture of the zones of weakened material.

[0012] Within the scope of the present invention, said construction elements can be configured in an individualized format, corresponding to individual recipients, or be configured in a strip-like format, corresponding to a plurality of successive recipients provided on a common:support.

[0013] Another objective of the present invention is to provide a system for preparation of beverages comprising at least two types of portion packages presenting similar dimension and configuration but adapted for prepar-

ing different beverages, or a beverage with different characteristics.

[0014] This objective is attained according to claim 13.

Description of the figures

[0015] The present invention shall now be explained in greater detail based upon preferred embodiments and the attached Figures.

[0016] The Figures show, in simplified schematic representations:

Figure 1: side cut view (top) and plant view (bottom) of embodiments of portion packages (1, 1') of substantially rigid construction (on the left) and substantially flexible construction (on the right);

Figure 2: plant views of the flow entry zone (top) and of the flow exit zone (bottom) of two embodiments of portion packages (1, 1') according to the invention;

Figure 3: detail plant views of two embodiments of the distribution of zones of weakened material (51, 61) in portion packages (1) according to the invention;

Figure 4: detail side cut views along a longitudinal direction of the zones of weakened material (51, 61) of an embodiment of portion package (1) according to the invention;

Figure 5: detail side cut views along a cross direction of the zones of weakened material (51, 61) of an embodiment of portion package (1) according to the invention;

Figure 6: side cut view (top) and plant view (bottom) of portion packages (1, 1') of substantially flexible construction of a system for preparation of beverages according to the invention;

Figure 7: views of a system (20) for preparation of beverages according to the invention, including side view (on the left) and front view (on the right) of a beverage preparation machine (10);

Figure 8: side views of distinct steps in a process for preparing beverages based upon a portion package (1) according to the invention.

Detailed description of preferred embodiments of the invention

[0017] **Figure 1** represents the general construction of embodiment of a portion package (1) according to the present invention, including in the form of a capsule (1) of substantially rigid construction (on the left) and in the form of a pod (1') of substantially flexible construction, eventually provided as a continuous strip (only indicated by the dashed end lines).

[0018] In each case, the portion package (1, 1') provides an interior volume for a dose (2) of at least one edible substance, including a substance precursor of an aromatic beverage such as for example in the form of roasted and grid coffee grains. As it can be observed, the portion package (1, 1') presents a first and second construction elements (3, 4) adapted so as to provide envelope surfaces for the entry and exit, respectively, of the pressurized fluid flow to be used so as to prepare an edible product from said dose (2). Said construction elements (3, 4) comprise at least a respective exterior envelope layer (31, 41) advantageously provided with a relatively reduced thickness, such as for example in the form of a folio or similar.

[0019] **Figure 2** shows two preferred embodiments of the configuration of the zones of weakened material (51, 61) provided in thee exterior envelope layer (31, 41) of portion packages (1, 1') according to the invention. The zones of weakened material (51, 61) are provided in groups spatially distanced apart, whereby according to an inventive aspect, the zones of weakened material (51a, 51b) in each groups are provided along at least two direction that in this case develop in parallel.

[0020] In a first embodiment represented on the left side, there are four groups, each comprising two zones of weakened material (51a, 51b, 52a, 52b) that develop along at least approximately radial directions in the exterior envelope layer (31) on the flow entry side, and ten groups of two zones of weakened material (61a, 61b, 62a, 62b) developing along parallel directions in the exterior envelope layer (41) on the flow exit side.

[0021] In the case of the second embodiment represented on the right side, there can be observed five groups of pairs of zones of weakened material (51a, 51b, 52a, 52b) in a similar disposition to the previous one, but in this case extending along most part of the diameter of the portion package (1'). As it can be observed, the exterior envelope layer (41) on the flow exit side also presents a similar number and configuration of the zones of weakened material (61, 61b), but including a pattern variation.

[0022] As it can be observed, the zones of weakened material (51, 61) can be arranged in a substantially linear (top drawings) or matrix pattern (bottom drawings). The zones of weakened material (51, 61) can be configured developing locally, so as to provide a substantially dot-like flow passage area, for example with a substantially circular cross section (top drawing), or a substantially linear-like flow passage area (bottom drawings).

[0023] The basic principle of the present invention is that this type of disposition of the zones of weakened material (51, 61) in groups of at least two thereof and

developing along proximal directions, provides flow passage areas with a substantially similar behavior and sensitive to small flow pressure oscillations, leading to a pulsed-like behavior after a respective rupture under the action of the upstream pressurized flow, with successive opening and closing of said passage areas, including with cyclical periodicity. Based upon the experiments that have been carried out, this pulsing behavior of the respective exterior envelope layer (31, 41) has proven favorable, specially on the exit side of the portion package (1), notably in terms of increased flow turbulence and, therefore, enhanced crème generation of the resulting beverage. This effect is mostly obtained when said groups of zones of weakened material (51, 51b) extend over at least most part of the surface of a respective envelope layer (31, 41).

[0024] Moreover, as illustrated in Figure. 2, the pattern of distribution, form and dimension of said zones of weakened material (51, 61) and respective groups (51a, 51b and 52a, 52b; 61a, 61b and 62a, 62b) of relative spatial proximity, can be different in each of the exterior envelope layers (31, 41), so as to thus better adjust to the expectable prevailing conditions of the pressurized fluid flow in said zone.

[0025] **Figure 3** presents, in partial detail views, two embodiments of the configuration and relative distribution of zones of weakened material (51, 61) in form of two circular dots (top) and two parallel line segments (bottom), as well as respective groups in a portion package (1, 1') according to the invention.

[0026] As aforementioned, these groups are provided in a respective exterior envelope layer (31, 41) so that they develop an oscillatory behavior when submitted to an upstream pressure, thereby generating a pulsing like flux with successive opening and closing and turbulence generation.

[0027] As it can be observed, there are provided four zones of weakened material (51a, 51b, 51c, 51d) on the left side, and of groups of two zones of weakened material (61a, 61b) on the right side, in both cases developing along rectangular matrix-like patterns.

[0028] In this sense, it has been demonstrated as particularly advantageous, considering the type of construction material of the portion packages (1, 1') and range of pressures usually used in the preparation of beverages by extraction, when said groups of zones of weakened material (51a, 51b; 61a, 61b) are provided with certain characteristic dimensions, considered as relevant in view of the prevailing energy intensity and pressure field of the pressurized flow, as well as of construction characteristics of the exterior envelope layers (31, 41) and respective construction elements (3, 4).

[0029] It is thus advantageous when the zones of weakened material (51a, 51b; 61a, 61b) are provided at a minimal adjacency distance (a) between each other, preferentially comprised in a range between 0,5 and 10 mm, preferentially in the range between 2 and 5 mm.

[0030] Moreover, it is advantageous when the zones of weakened material (51, 61) present a characteristic dimension (b) of the respective flow passage area comprised in the range between 0,5 and 20 mm, preferentially in the range between 5 and 10 mm.

[0031] Both these dimensions contribute to ensure a rupture of the totality, instead of only part of the zones of weakened material (51, 61), as well as to a substantially pulsing behavior of the respective exterior envelope layer (31, 41), as a function of the prevailing local pressure, including of instant pressure or flow direction variations.

[0032] Moreover, it has been demonstrated as advantageous when each of said groups of zones of weakened material (51a, 51b; 61a, 61b) presents a spacing distance (c) relative to an adjacent group, comprised in the range between 1 mm and 30 mm. this minimum spacing distance between adjacent groups is also very important so as to provide said pulsing flux behavior to the exterior envelope layer (31, 41) and thereby reinforce the energy dissipation intensity of the fluid flow through it. As it can be observed, said spacing distance (c) can be different along different directions, such as for example in the embodiment represented on the right where the spacing distances (c) along orthogonal directions are substantially different.

[0033] In the case of a preferred embodiment, there are used zones of weakened material (51) in a dot-like form with circular section with a characteristic dimension (b) of 2 mm, with an adjacency distance (a) of 5 mm and a spacing distance (c) of 10 mm.

[0034] **Figures 4** and **5** present the construction detail in cut of two embodiments of portion package (1) according to the present invention, in particular of the zones of weakened material (61) provided as line segments, whereby Figure 4 presents a side view along a greater extension of the zones of weakened material (61), and Figure 5 presents a front view of these zones of weakened material (61), provided in an exterior envelope layer (41) of a construction element (4) adapted for the flow exit, and that, eventually, presents likewise an interior envelope layer (7) disposed adjacently. This interior envelope layer (7) is preferentially provided as a filter element, as these are known by the expert in the field.

[0035] As it can be observed, the zones of weakened material (61) are preferentially provided by means of material removal, that is to say, localized reduction of thickness (e) of the respective exterior envelope layer (41). In particular, these zones of weakened material (61) are provided with such a reduction of thickness (e) that, when submitted to a given mechanic pressure, notably one bigger than the atmospheric pressure, in particular a hydraulic pressure exerted by the upstream flow, there is a rupture of material there along, thereby providing a corresponding flow passage through the respective envelope zone of the portion package (1).

[0036] As represented in the details P01 and P02, the zone of weakened material (61) is preferentially produced by means of displacement of removed material to the respective edge zones so that it results a material

protrusion along these edge zones. This construction characteristic of the zones of weakened material (61) contributes to reinforcing the respective elastic opposition resistance, that is to say, the force of opposition to the pressure being applied upstream, and whereby improve the rupture under pressure behavior.

[0037] Moreover, as represented in detail P02, the zone of weakened material (61) advantageously presents a section of substantially trapezoid format at least along a cross direction thereof, with the section narrowing along the flow direction, which likewise contributes to improving the rupture under pressure behavior.

[0038] **Figure 6** shows two portion packages (1'a, 1'b) of a system (20) for preparation of beverages according to the present invention. Said system further includes at least one beverage preparation machine (10) (vide **Figure 7**) comprising at least one extraction device (11) adapted for extraction of the doses (2a, 2b) contained in said portion packages (1'a, 1'b), for example grind and roasted coffee, or tea leaves.

[0039] As it can be seen in Figure 6, the two portion packages (1'a, 1'b present different zones of weakened material (61) in the exterior envelope layers (41) of respective construction elements (4) on the flow exit side, notably presenting different dimensions and distribution density. Alternatively, the portion packages (1'a, 1'b) may also present different zones of weakened material (51) in the exterior envelop layer (31) on the flow entry side.

[0040] According to a preferred embodiment, said beverage preparation system (20) therefore comprises at least two portion packages (1'a, 1'b), of similar or different construction and dimension (as represented), but including at least one different design parameter of said zones of weakened material (51, 61), including respective distribution pattern, form and dimension. The different configuration of the zones of weakened material (51, 61) aims at better adjusting the type of flow interaction with the type of precursor substance and respective beverage. In fact, different types of beverage may require different values of flow injection pressure, so that it will be advantageous to correspondingly configure a respective exterior envelope layer (31). The same reasoning can be likewise applied to the flow exit side, and to particular characteristics of beverage that one intends to obtain from a beverage discharge (11) from a beverage preparation machine (10).

[0041] According to a preferred embodiment, said at least two portion packages (1'a, 1'b) present zones of weakened material (51, 61) provided in materials with different specific mass or elastic deformation proprieties, so that they tend to break under different pressures or to recover an initial closed position whenever they are not submitted to a given minimum pressure value.

[0042] The present invention thus provides a beverage preparation system (20) that uses substantially similar portion packages (1, 1') with advantages in terms of respective production, eventually only differentiating in terms of the zones of weakened material (51, 61) provided at least on the flow exit side, with advantages in terms of the obtained beverage quality.

[0043] According to a preferred embodiment, in the case of roasted and grind coffee for the preparation of espresso coffee, the doses (2) are provided compacted in substantially stable volumetric form and present a volume with a form ratio between width and height comprised between 0,5:1 and 4:1.

[0044] According to a preferred embodiment, the exterior envelope layers (31, 41) are provided in a material, preferentially of folio-type in a synthetic and/or bio-synthetic material, preferentially different and preferentially with a bigger rigidity in the case of the envelope layer (31) on the flow entry side.

[0045] **Figure 8** shows two steps of a process for preparation of beverages according to the present invention. In a fist step, a portion package (1, 1') according to the invention is supplied to an extraction device (11) provided in a beverage preparation machine (10), or apparatus with similar functionality, presenting two actuation parts (12, 13) adapted to interact in proximity with a construction element (3, 4) adapted for entry and exit of the pressurized flow, respectively. In a following step, the actuation parts (12, 13) interact in proximity with said portion package (1, 1'), so as to inject a pressurized flow through the construction element (3) on the flow entry side, and to collect the resulting beverage from the construction element (4) on the flow exit side. In particular, the supply of the pressurized flow is provided at a minimal pressure, bigger than the atmospheric pressure, sufficient to actuate the rupture of the zones of weakened material (51) thereby providing at least one flow passageway through the construction element (3) on the flow entry side, and the beverage discharge results from the rupture of the zones of weakened material (61) provided on the construction element (4) on the flow exit side.

Claims

1. **Portion package (1)** adapted for preparing an edible product and configured so as to provide an interior volume for a dose (2) of at least on edible substance, and presenting two construction elements (3, 4) providing surfaces adapted for entry and exit passage respectively of a pressurized fluid flow,
   whereby at least one of said construction elements (3, 4) comprises at least one outside envelope layer (31, 41) presenting a plurality of zones of weakened (51, 61) adapted so that they can be broken by an upstream flow pressure higher than atmospheric pressure and thereby provide flow passageways through the-respective construction element (3, 4), and whereby said zones of weakened material (51) are provided in at least two groups.apart from each other and presenting at least two adjacent zones of weakened material (51a, 51b) so that the distance between said adjacent zones of weakened

material (51a, 51b) is smaller than the distance between any thereof and the zones of weakened material (52a, 52b) from another group,
characterized
in that the zones of weakened material (51a, 51b) in each group are provided along at least two at least approximately parallel extensions.

2. Portion package (1) according to claim 1, **characterized in that** said groups of zones of weakened material (51a, 51b) extend along at least most part of the surface of a respective envelope layer (31, 41).

3. Portion package (1) according to claim 1 or 2, **characterized in that** said groups of zones of weakened material (51a, 51b) are provided in a distribution pattern of orthogonal matrix or circular radial type.

4. Portion package (1) according to any one of claims 1 to 3, **characterized in that** said zones of weakened material (51, 61) develop in a locally confined area presenting a dot-like form, or extend along a straight direction presenting a line segment form.

5. Portion package (1) according to any one of claims 1 to 4, **characterized in that** said adjacent zones of weakened material (51a, 51b) of each group present an adjacency distance (a) between each other comprised between 0,5 mm and 20 mm, preferentially between 1 mm and 10 mm.

6. Portion package (1) according to any one of previous claims 1 to 5, **characterized in that** said zones of weakened material (51, 61) are provided with a characteristic dimension (b) comprised between 0,5 mm and 30 mm, preferentially between 2 mm and 10 mm.

7. Portion package (1) according to any one of previous claims 1 to 6, **characterized in that** said adjacent zones of weakened material (51a, 51b) of each group are provided at a minimum spacing dimension (c) from the zones of weakened material (52a, 52b) of an adjacent group that is bigger than said adjacency distance (a) and bigger than said characteristic dimension (b), whereby said minimum spacing dimension (c) is comprised between 1 mm and 30 mm, preferentially between 5 mm and 15 mm.

8. Portion package (1) according to any one of previous claims 1 to 8, **characterized in that** said zones of weakened material (51a, 51b) of at least one group develop in a variable pattern in a respective outside envelope layer (31, 41).

9. Portion package (1) according to any one of previous claims 1 to 9, **characterized in that** said zones of weakened material (51, 61) of at least one group present a variable form in a respective outside envelope layer (31, 41).

10. Portion package (1) according to any one of previous claims 1 to 9, **characterized in that** said zones of weakened material (51, 61) are provided by removal of material and/or displacement of material, preferentially with material accumulation in a salient manner relative to the surrounding outside surface, along at least most part of the extension of the edges of the cavity defining said zones of weakened material (51, 61).

11. Portion package (1) according to any one of previous claims 1 to 10, **characterized in that** said zones of weakened material (51, 61) are provided with a trapezoid-like cross-section, preferentially with narrowing of section along the flow direction.

12. Portion package (1) according to any one of previous claims 1 to 11, **characterized in that** at least one of said construction elements (3, 4) further presents an interior envelope layer (7) disposed inside and adjacent to said outside envelope layer (31, 41), de so that said interior envelope layers (7) exert a surface backpressure upon said outside envelope layers (31, 41).

13. **System** (20) for preparing beverages based upon a portion package (1) as referred in previous claims 1 to 12, **characterized in that** it includes:

- at least one beverage preparation machine (10) including at least one extraction device (11) adapted for injecting a pressurized fluid flow in a portion package (1) and collecting the resulting beverage flow therefrom, e
- at least two portion packages (1'a, 1'b) provided with different groups of zones of weakened material (51; 61) at least on a respective outside envelope layer (41) adapted for exit of the pressurized fluid flow, so as to prepare respectively different beverages or a beverage with different characteristics on said extraction device (11).

14. System (20) according to claim 13, **characterized in that** said at least portion packages (1'a, 1'b) present zones of weakened material (61) on said outside envelope layer (41) adapted for exit of the pressurized fluid flow, provided with at least one different design parameter including respective form, characteristic dimension, distribution pattern and distribution density of groups of said zones of weakened material.

15. System (20) according to claim 13 or 14, **characterized in that** said at least two portion packages (1'a, 1'b) present zones of weakened material (51, 61) with different specific mass and/or different elastic

deformation properties.

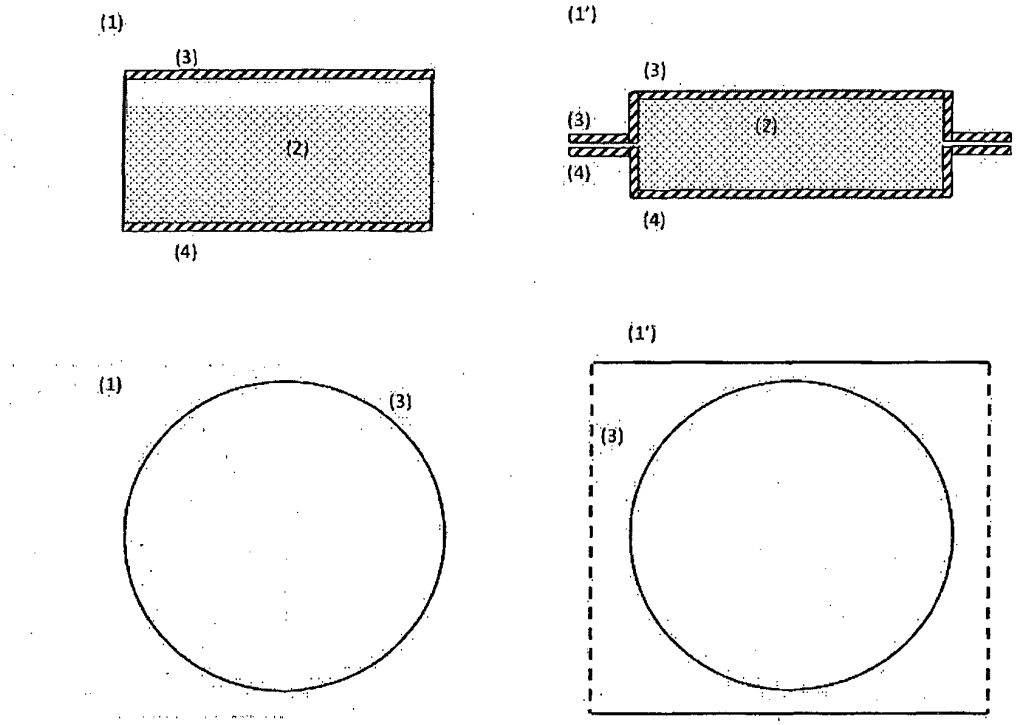
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Fig.1

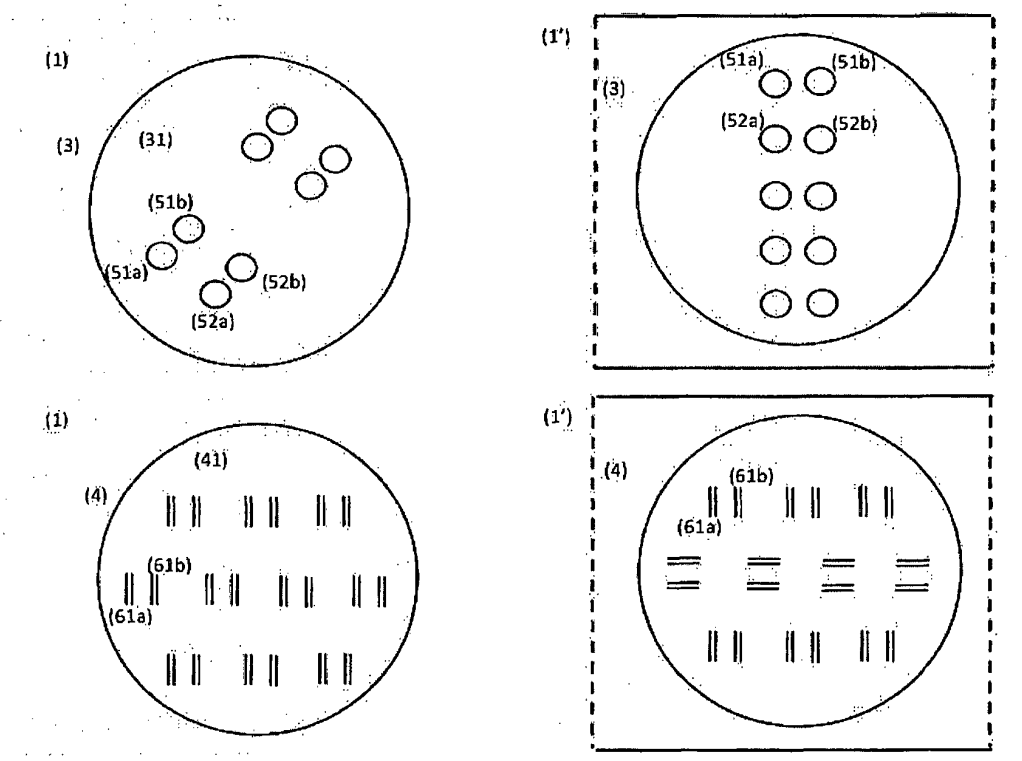
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Fig.2

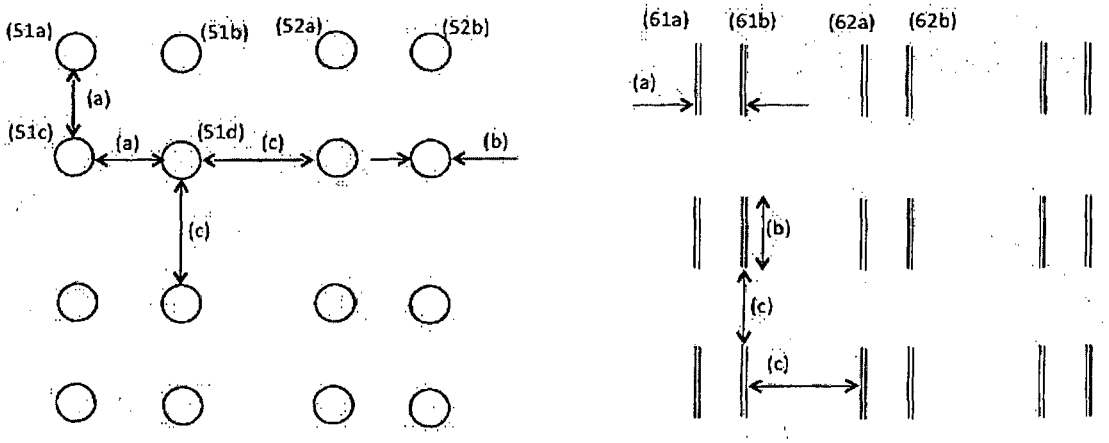
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Fig.3

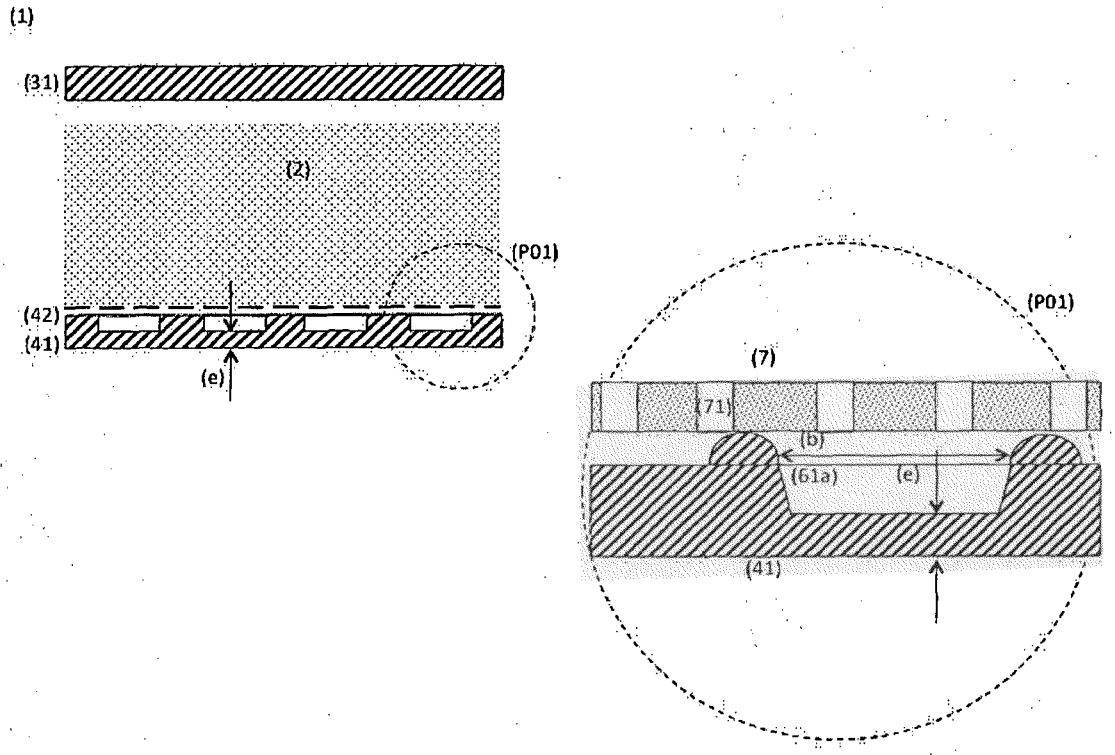
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Fig.4

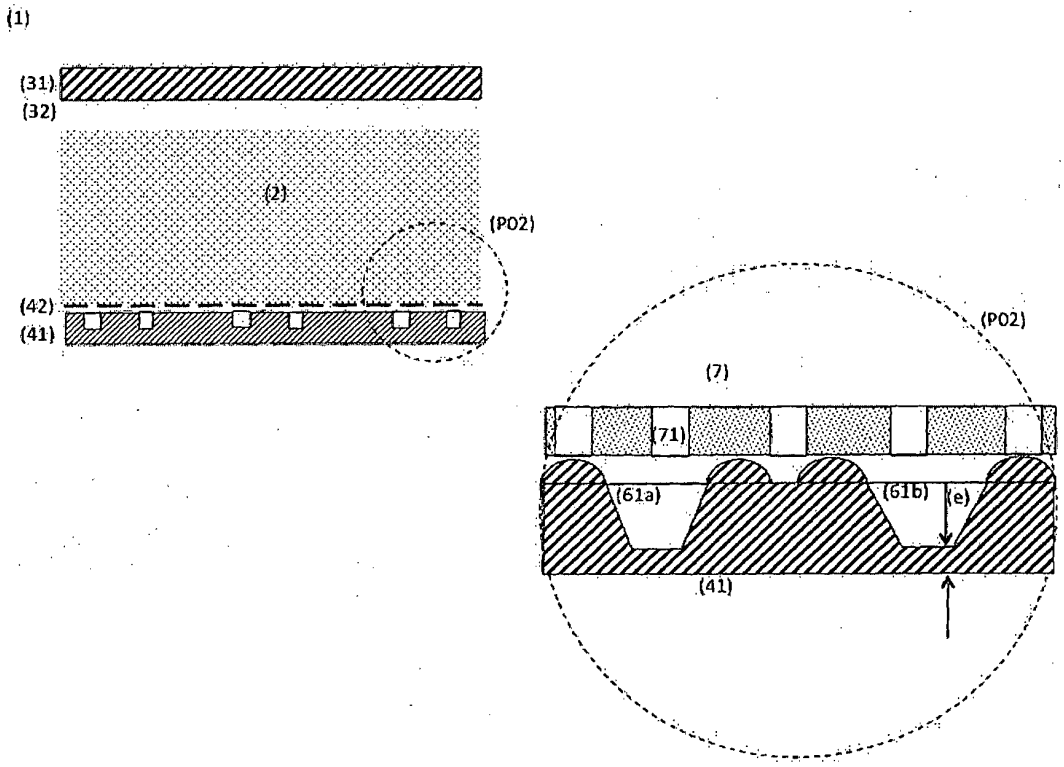
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Fig.5

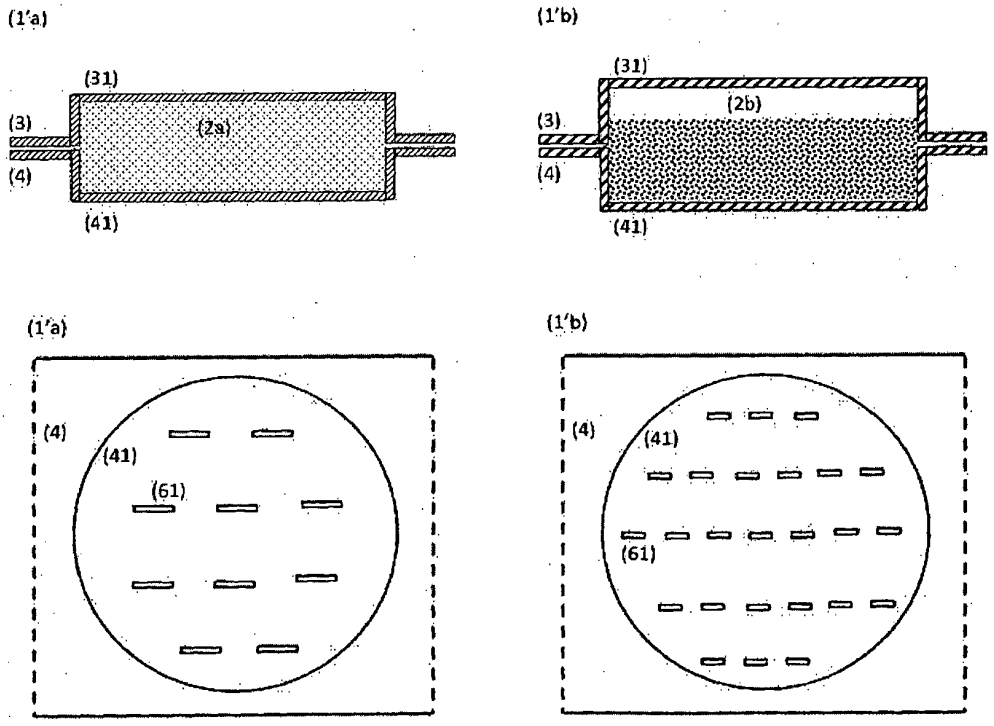
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Fig.6

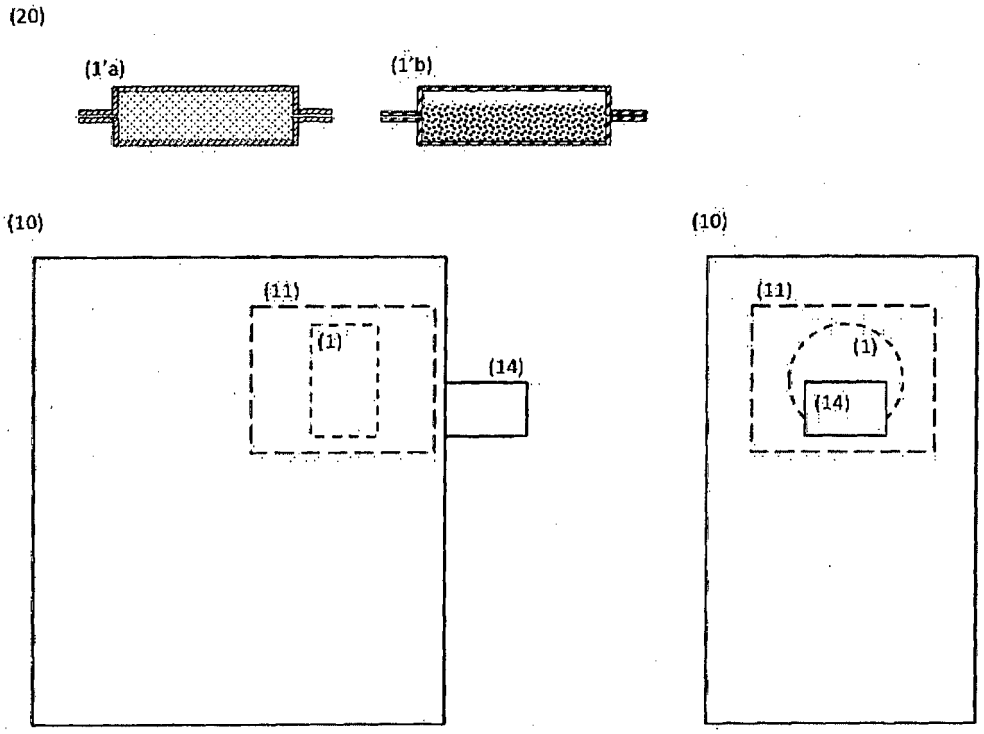

Fig.7

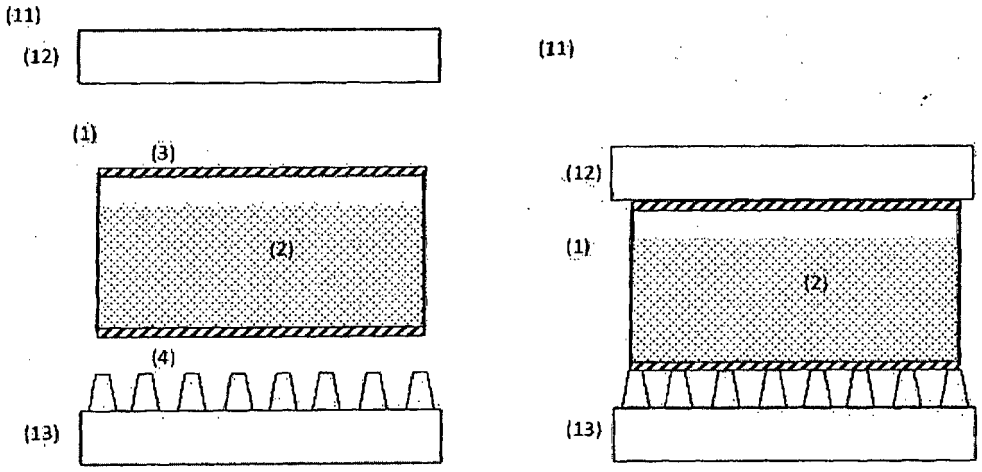

Fig.8

INTERNATIONAL SEARCH REPORT

International application No
PCT/PT2014/000044

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804
ADD.

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

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 521 510 A1 (NESTLE SA [CH]) 7 January 1993 (1993-01-07) column 2 - column 4; claims 1,5,6; figures 1-3,7	1-15
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 October 2014	03/11/2014

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

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INTERNATIONAL SEARCH REPORT

International application No
PCT/PT2014/000044

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 1 555 218 A1 (I T A CA S R L [IT]) 20 July 2005 (2005-07-20) the whole document	1-15
A	EP 2 230 195 A1 (NESTEC SA [CH]) 22 September 2010 (2010-09-22) the whole document	1-15
A	EP 0 540 999 A1 (YAMANAKA SANGYO CO LTD [JP]) 12 May 1993 (1993-05-12) the whole document	1-15

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International application No
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