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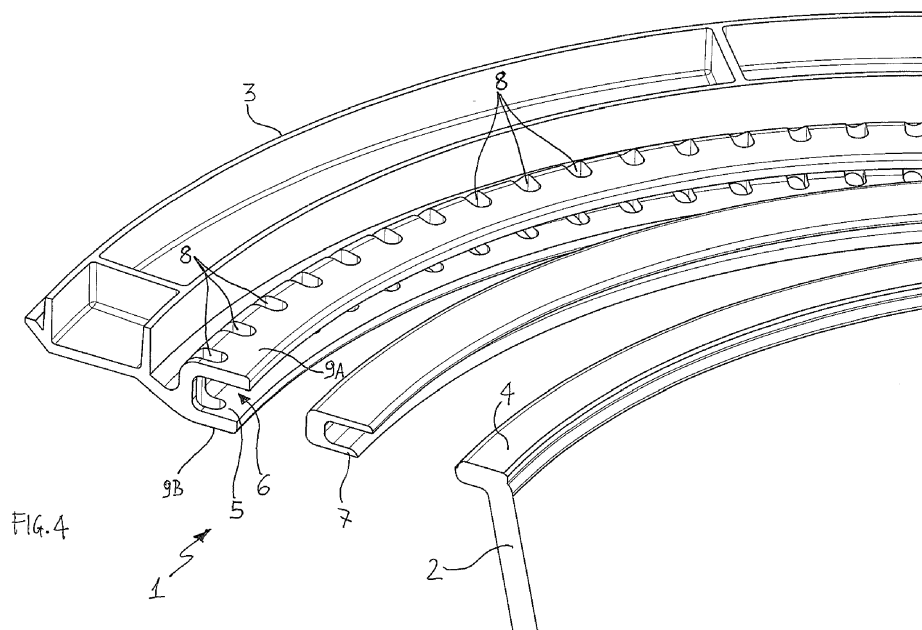
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(54) **Component, in particular for household appliances, made of framed brittle material and related method of production**

(57) The present invention refers to a component (1, 101), made of brittle material, such as glass, glass ceramic and similar materials, provided with a frame of polymeric material over-injected on the edge of the glass, in particular for household appliances, such as laundry treatment machines, refrigerators, cooking hobs and similar devices. A component (1, 101) according to the invention includes a body (2, 102) of brittle material surrounded by a frame (3, 103) of polymeric material over-injected in a peripheral region (4, 104) of said body (2,

102), and means (7, 107), interposed between said frame (3, 103) and the body (2, 102), for absorbing the dimensional shrinkage of said polymeric material,. The component (1, 101) is **characterized in that** said frame (3, 103) includes one or more of first chambers (6, 106) provided to receive said shrinkage absorbing means (7, 107) and one or more of second chambers (8, 108) provided to absorb at least one part of the deformation of said shrinkage absorbing means (7, 107).

The invention also refers to a method of manufacturing said component (1, 101).



Description

[0001] The present invention refers to a component made of brittle material, such as glass, glass ceramic and similar materials, provided with a frame of polymeric material over-injected on the edge of the brittle material, said component being in particular for household appliances, such as laundry treatment machines, refrigerators, cooking hobs and similar devices. The invention also refers to a method of manufacturing said component.

[0002] In the field of household appliances, a wide use is made of glass components surrounded by a frame of polymeric material. Typical examples of such applications are the doors that close the load compartment of laundry treatment machines, such as washing machines, dryers, washing-drying machines, as well as the shelves subdividing the refrigerated areas of food conservation devices.

[0003] In general, the above-mentioned elements of brittle material of known type are made up of a plate of brittle material in which are interference-fitted profiles of polymeric material, or of a frame and a counter-frame that hold between them the element of brittle material. This type of solution requires numerous assembling operations, such as for example the installation of a sealing gasket around the brittle material, the tightening of numerous screws, the application of adhesives, and also requires particular design solutions capable of guaranteeing the perfect anchoring of the brittle material on the polymeric frames. These solutions have thus the drawback of being complicated to mount, and for this reason are subject to frequent assembling errors and relatively long production times. A further drawback consists of the fact that the production of said glass elements is particularly costly both in economic terms and in terms of materials and energy resources applied to form the frame and the counter-frame.

[0004] As partial solution of these shortcomings, some proposed embodiments provide for the over-injection of the polymeric material that forms the support frame directly on the edge of the glass. An example of such an embodiment is disclosed in GB 2237293. However, this document does not address a rather significant problem in the scope of over-injection of frames of polymeric material around a brittle material such as glass. This problem consists of the fact that the diversity of the mechanical characteristics of the contact materials, as well as the high thermal expansion coefficient of the polymeric material compared to glass, cause a considerable shrinkage of the polymer in the cooling phase following the over-injection, with the consequent development of tensions so high as to generate the breakage of the glass. Thus, the strong dimensional shrinkages of a polymeric material over-injected to form the frame of a glass can determine an unacceptable number of production rejects. This problem has presented serious obstacles in the practicability of the methods of production of the over-injected glass elements proposed up to now.

[0005] A component provided with means for absorbing the dimensional shrinkage of a polymeric material over-injected on the edge of a brittle material is disclosed in US patent 5944324. Substantially, this document envisages the interposition of shrinkage absorbing means between the over-injected frame and the glass edge. According to US 5944324, the shrinkage absorbing means can consist of a compressible element, such as for example a silicone profile, or a plurality of cavities formed integrally in the over-injected frame around the brittle material. The embodiments disclosed in US 5944324 have some shortcomings.

[0006] A first one of such shortcomings connected with the use of a shrinkage absorbing means consisting of a silicone profile, lies in the fact that the tension caused by the dimensional shrinkage of the over-injected polymeric frame can be relaxed as long as the silicone profile is deformable. This entails a rather difficult choice of the silicone material, of its dimensions, as well as the dimensions of the chamber that receives the silicone profile. The solution shown in US 5944324 can be prone to breakage of the glass if the shrinkage, even if local, of the over-injected frame is such as to compress the silicone profile beyond its maximum compressibility.

[0007] Another shortcoming connected with the use of a shrinkage absorbing means made up of a silicone profile lies in the fact that the profile subjected to compression can become deformed in a direction parallel to the plate of brittle material, resulting in accumulations of material outside the frame body of polymeric material that have no mechanical or aesthetic use and that therefore must be removed with subsequent restart operations, which can compromise the integrity of the brittle material as well as the possible watertightness of the silicone profile.

[0008] A further shortcoming of the solution proposed in US 5944324, in which the shrinkage absorbing means are made up of a plurality of cavities formed integrally in the frame over-injected around the brittle material, lies in the fact that said plurality of cavities is not only dimensioned to absorb the shrinkage of the frame by reducing its volume, but is at the same time also dedicated to receiving frame parts that support the brittle material and that become deformed due to the shrinkage of the polymeric material. Similarly to what previously noted, the shrinkage of the polymeric material could be such as to reduce, even locally, the volume of the cavity by such a quantity as to make it more suitable to receive the deforming frame portions. These latter could thus create tensions sufficiently strong to break the brittle material or deform the polymeric frame.

[0009] Another shortcoming connected with the use of a shrinkage absorbing means made up of a plurality of cavities formed integrally in the over-injected frame around the brittle material, lies in the fact that the structure of portions of frame designed in US 5944324 to deform as a result of the dimensional shrinkage of the polymeric material, are not suitable to guarantee a homogeneous

distribution of the deformation in the case in which the brittle material has an edge formed according to a curvilinear rather than a rectilinear profile. In fact, structures of deformable elements made up of lamellae all inclined in one preferential direction imply the deformation of the same lamellae in the direction of inclination that can lead to undesirable accumulations of polymeric material in those regions where the profile of the brittle material changes the radius of curvature and/or deformations of the polymeric frame directed tangentially to the curved profile rather than radially, as would be more suitable to avoid undesirable ripples and/or cracks in the shrinking polymeric material.

[0010] One further shortcoming of the solution proposed in US 5944324 in which the shrinkage absorbing means consists of a plurality of cavities formed integrally with the frame over-injected around the brittle material, lies in the fact that the structure of portions of frame expected to deform due to the dimensional shrinkage of the polymeric material, is formed on only one side of the support frame of the brittle material. This configuration, which is provided so that the exposed part of the brittle material support frame is made up, after the over-injection step, of a continuous surface, devoid of openings and/or unsightly portions of deformed material, entails a different relaxation of the shrinkage tensions of the parts of the frame placed on or under the frame of brittle material. In particular, the frame portion that will be visible when the formed component is placed in operation and that is substantially without shrinkage absorbing means, remains subject to internal tensions, since it is not capable of relaxing them by deformation. On the contrary, the portion of the frame below the brittle material (portion not visible) where the shrinkage absorbing means are concentrated, alters to a greater extent its own geometrical configuration, thus generating a support frame that will have relaxed tensions unevenly between the part that forms above the brittle material and the part that forms below it. Thus, although the relaxation of the tensions is effective for the purpose of avoiding the breakage of the brittle material, the embodiment disclosed in US 5944324 is unsatisfactory due to the distorted geometrical configuration that the frame takes on after the shrinkage of the polymeric material is completed. For this purpose, US 5944324 proposes the use of a metal or plastic reinforcing structure to install on the part of the frame that undergoes the greatest deformation, that is, the part where there is a greater concentration of the shrinkage absorbing means. The reinforcement serves to increase the mechanical resistance of the frame of polymeric material that is formed around the brittle material and that otherwise would offer only the resistance of the part lacking the shrinkage absorbing means. This increases the constructive complication of the framed brittle material as well as the relative production costs.

[0011] One objective of the present invention is therefore to provide a component, in particular for household appliances, such as laundry treatment machines, refrigerators,

cooking hobs and similar devices, made of brittle material, such as glass, glass ceramic and similar materials, provided with a frame of polymeric material over-injected on the edge of the brittle material, as well as to provide the relative production method; said component and said method being capable of overcoming the drawbacks and disadvantages of the components of framed brittle material and of the relative methods of production of known type.

[0012] In the scope of the above objective, one purpose of the present invention is to realize a component of brittle material surrounded by a frame of over-injected polymeric material in which the tensions due to the shrinkage of the polymeric material are evenly relaxed to avoid deformations, ripples and/or cracks in the body of the polymeric frame.

[0013] Another purpose of the invention is provide a component of brittle material surrounded by a frame of over-injected polymeric material in which the element of brittle material has one or more curvilinear and/or rectilinear peripheral portions.

[0014] One still further purpose of the present invention is to provide a component of brittle material bordered by a frame of over-injected polymeric material in which the element of brittle material is stably incorporated in the support frame of over-injected polymeric material.

[0015] Still another purpose of the present invention is to provide a component of brittle material surrounded by a frame of over-injected polymeric material in which said frame supporting the brittle material includes structural portions suitable for the connection of the component to the body of a household appliance.

[0016] A further purpose of the present invention is to achieve a method of production of a component of brittle material bordered by a frame of over-injected polymeric material which reduces the risk of breakages of the element of brittle material due to the shrinkage of the over-injected polymeric material.

[0017] One yet other purpose of the present invention is to provide a method of production of a component of brittle material surrounded by a frame of over-injected polymeric material that does not require further restart operations to finish the assembling of the element of brittle material on the frame body of polymeric material.

[0018] A further purpose of the present invention is to achieve a method of production for a component of brittle material surrounded by an over-injected frame of polymeric material that makes it possible to fasten the body of brittle material stably and reliably to the frame.

[0019] One not least important purpose of the invention is to achieve a method of production for a component of brittle material surrounded by an over-injected frame of polymeric material that can be obtained by means of normal polymer injection systems of known type.

[0020] The above-mentioned objective and purposes are achieved by a component of brittle material surrounded by an over-injected frame of polymeric material having the characteristics set forth in the enclosed claims. Char-

acteristics and advantages of the invention will become evident from the description which follows, by way of non-limiting example, with reference to the enclosed drawings, wherein:

- Figure 1 shows a rear perspective view of a first embodiment of a component according to the invention in the form of a rear part of a first door for closing a loading port of a household appliance;
- Figure 2 is a front view of the door of Figure 1;
- Figure 3 is a cross-sectional view along the III-III axis of Figure 2;
- Figure 4 is a perspective exploded view of the cross section along the IV-IV line of Figure 2;
- Figure 5 shows a front perspective view of a second embodiment of a component according to the invention in the form of a rear part of a second door for closing a loading port of a household appliance;
- Figure 6 shows an enlarged perspective view of the detail IV of Figure 5;
- Figure 7 shows a perspective exploded view of a second door for closing a loading port of a household appliance;
- Figure 8 is a cross-sectional view of the second door of Figure 7 in an assembled configuration.

[0021] In the enclosed Figures are shown two embodiments of a component according to the present invention. By way of example, the invention is embodied in the form of a back part of a door for closing a loading port of a household appliance, such as a laundry treatment machine. Naturally, the principles of the invention that will be described below can also be applied to embody components that are different from those illustrated in the enclosed Figures and can take on, in particular, the form of a support surface for refrigerators, cooktops and similar devices.

[0022] Figures 1 to 4 illustrate a first embodiment of the present invention. The component 1 includes a body 2 made of brittle material such as glass, glass ceramic or similar materials, and a frame 3 arranged around a peripheral region 4 of the body 2. In this embodiment, the body 2 is made substantially in the shape of a cup provided with an annular border on which is stably connected the frame 3 of the component 1. The frame 3 of polymeric material is formed on the peripheral region 4 by placing the body 2 in a mould and over-injecting on said peripheral region 4 a quantity of polymeric material such as to incorporate it in the frame 3 through a support surface 5 that extends around it.

[0023] To compensate for the dimensional shrinkage of the polymeric material that takes place after the over-injection, suitable shrinkage absorbing means 7 are arranged on the peripheral region 4 of the body 2 before carrying out the over-injection of the polymeric material forming the frame 3. The frame will therefore be configured so as to provide one or more first chambers 6 in which to receive the shrinkage absorbing means 7, which

at the end of the over-injection are arranged between the frame 3 and the body 2 of brittle material.

[0024] In this first embodiment of the invention, the shrinkage absorbing means 7 are made up of a compressible material, such as for example rubber or silicone, resistant to a temperature range between 200 and 300°C, so as to be able to withstand the thermal conditions existing during the phase of over-injection of the polymeric material without altering its structure. The dimensional shrinkage of the frame 3, which encloses the shrinkage absorbing means 7, results in a compression of the latter around the rim of the peripheral region 4 of the body 2. One part of the compression of the shrinkage absorbing means 7 is absorbed by one or more second chambers 8 formed in said frame 3. The second chambers 8, the number of which depends on the extent of the shrinkage that can be estimated for the type of polymeric material used in making the frame 3, although they can be provided on only one part of the frame 3 with respect to the body 2, are preferably formed on both sides of the frame 3 that holds the body, forming a through cavity as can be seen in Figures 3 and 4. The relaxation of the deformation of the shrinkage absorbing means 7 will take place along a direction that is substantially orthogonal to the peripheral region 4 of the body 2. In this regard, the second chambers 8, which during the shrinkage of the polymeric material of the frame 3 fill up at least partially with the material making up the shrinkage absorbing means 7, are formed on at least one of the walls 9A, 9B that define, or form, the first chambers 6 so as to be in communication with the latter. The at least partial filling of the second chambers 8 forms a further gripping of the frame 3 on the body 2 of brittle material.

[0025] Since said second chambers 8 can be found on visible parts of the frame 3, that is, parts that are not covered by other structural and/or decorative elements of the component 1, it is preferable to ensure that one end of said chambers 8 is closed by a bottom wall (not shown in the Figures) so as to hide from view the inside of the same that is at least partially occupied by the shrinkage absorbing means 7. The bottom wall that closes the second chambers 8 on one side can be formed by a very thin film that extends the outermost side of the walls 9A, 9B above the cavities of each one of the second chambers 8. In this manner, when its moulding is completed, the frame 3 of the component 1 will display continuous surfaces free of ripples, and the shrinkage absorbing means will in fact remain concealed.

[0026] In the first embodiment of the invention, the peripheral region 4 of the body 2 of brittle material includes an annular shape in which said one or more first chambers 6 are formed on the frame so as to extend in a circumferential direction of the body 2, while the second chambers 8 extend in a radial direction of the body 2 and preferably form cavities through the surfaces 9A and 9B. If it is preferred, the second chambers 8 can also extend in the circumferential direction and can be equidistant from each other or arranged in groups. If the configuration

of the body 2 requires it, said second chambers 8 can be grouped together more densely in the regions of the frame 3 that exhibit the greater shrinkage deformations, such as for example angular portions of the frame 3. This solution is particularly effective in the production of a surface of brittle material bordered with a polymeric frame 3, for example, in creating compartments of a cooled space of a refrigerator.

[0027] The frame 3 can be made with portions 10 suitable for supporting structural elements such as for example a hinge to rotatably support the component 1.

[0028] In Figures 5 to 8, a second embodiment of the present invention is shown in the form of a rear part of a second door for closing a loading port of a household appliance.

[0029] The component 101 includes a body 102 made of a brittle material such as glass, glass ceramic or similar materials, and a frame 103 that is arranged around a peripheral region 104 of the body 102. Similarly to what has been described with reference to the first embodiment of the invention, the body 102 is configured substantially in the shape of a cup provided with an annular border on which is stably connected the frame 103 of the component 101. The frame 103 is made by over-injecting a polymeric material near the peripheral region 104 of the body 102 so as to incorporate said region 104 within the frame 103 through a support surface 105 that extends around it.

[0030] The peculiarity of this second embodiment lies in the fact that the means 107 for absorbing the dimensional shrinkage of the polymeric material that takes place after the over-injection are formed integrally to the body of the frame 103 in such a position as to be interposed between the more peripheral part of the frame 103 and the body 102 of brittle material. The shrinkage absorbing means 107 and the frame 103 form in effect a single piece of polymeric material, in which the tensions due to shrinkage are relaxed by the absorbing means 107, avoiding the breakage of the body 102 of brittle material or the uncontrolled deformation of the frame 103 of brittle material due to the resistance opposed by the body 102.

[0031] In this second embodiment, the frame 103 is formed with a plurality of first chambers 106 that are provided to receive the means 107 for absorbing the dimensional shrinkage of the polymeric material. A plurality of second chambers 108 that are separate from, that is, not communicating with, said first chambers 106, are formed to accommodate the deformation of the shrinkage absorbing means 107 that occurs during the phases following the moulding of the frame 103, when the over-injected polymeric material cools down from the injection temperature, included between 200 and 300°C, to the ambient temperature.

[0032] In this second embodiment of the invention, too, the peripheral region 104 of the body 102 of brittle material includes an annular shape in which said one or more first chambers 106 are formed on the frame 103 so

as to extend in a circumferential direction of the body 102, while the second chambers 108 extend in a radial direction of the body 102. Preferably, the plurality of second chambers 108 are provided on the walls 109A and 109B that define the plurality of first chambers 106, so that the yielding of said walls due to the shrinkage is at least partly accommodated within the second chambers 108.

[0033] A preferred form for the second chambers 108 is made up of hollow polygonal elements 112, more specifically hollow cylinders, having a longitudinal axis extending in a direction transversal to the peripheral region 104. The polygonal elements 112 are formed on the walls 109A, 109B that extend between the support surface 105 of the body 102 and a perimetric region of the frame 103. Although in Figures 5 and 8 the polygonal elements 112 are shown in the shape of hollow cylinders, these elements 112 are not limited to this shape.

[0034] The configuration of the shrinkage absorbing means 107 is particularly advantageous from the standpoint of making the relaxation of the tensions caused by the shrinkage of the polymeric material more uniform in a circumferential direction of the body 102 of brittle material. In this manner, when the shrinkage is completed, the frame 103 will not display any shape distortions and will fit perfectly.

[0035] Figures 7 and 8 illustrate the component 101 respectively disassembled and assembled on the elements making up a door for closing a loading port of a laundry treatment machine. On the frame 103, which in the over-injection phase was formed to include portions 110 suitable for supporting structural elements of said door, are connected a door-opening handle 114 provided with a locking means 115, and a hinge 116 made up of a support 117 and a pin 118, in addition to the body 102 of brittle material. A cover element 119 is removably connected on the front part of the component 101, for example, by means of snap couplings formed integrally in the frame 103 and in the cover element 119. The cover element 119 hides the second chambers 108 from view because it lies over them when it is mounted on the frame 103. In the back part of the component 101, the second chambers 108 remain visible, and therefore, similarly to what was described with reference to the first embodiment of the invention, it can be seen that one end of said chambers 108 is closed by a bottom wall (not shown in the Figures), so that their inside is hidden from view. If it is desired, said bottom wall may also extend to the first chambers 106 and close one of their ends. In this manner, the first and/or the second chambers formed integrally in the frame 103 by over-injection will not be visible from outside and the frame 103 of the component 101 will appear like a continuous surface that incorporates a body of brittle material 102. The bottom wall may be formed by a very thin film that extends above the chambers 108, closing one or even both of them.

[0036] It was thus ascertained that the invention achieved the predetermined objective and purposes,

having realized a component of brittle material surrounded by an over-injected frame of polymeric material free of deformations, ripples and/or cracks due to the dimensional shrinkage of the polymer. Advantageously, the tensions due to the shrinkage of the over-injected polymeric material on the peripheral region of the brittle material, such as glass, glass ceramic or similar material, are successfully relaxed by shrinkage absorbing means that can also grip mechanically to the structure of the frame, guaranteeing an optimal fastening of the brittle material on the over-injected frame.

[0037] The present invention can be achieved by over-injecting a polymeric material near a peripheral region of a brittle material without causing the breakage and/or cracking of the latter. In particular, said peripheral region may have one or more curvilinear and/or rectilinear portions that the polymeric frame follows precisely, that is, without deformations or accumulations of material, stably incorporating the element of brittle material.

[0038] A component of brittle material bordered by an over-injected frame of polymeric material according to the invention can be advantageously provided with structural portions suitable for connecting the component to the body of a household appliance. Said structural portions do not suffer from geometrical alterations due to the shrinkage of the polymeric material.

[0039] The invention can be advantageously applied in a household appliance such as for example a laundry treatment machine or a refrigerator.

[0040] Naturally, the materials as well as the shapes and dimensions of the individual components of the invention can be the most suitable to meet the specific requirements.

Claims

1. Component (1, 101), in particular for household appliances, comprising a body (2, 102) of brittle material framed in a frame (3, 103) of polymeric material over-injected in a peripheral region (4, 104) of said body (2, 102), shrinkage absorbing means (7, 107) interposed between said frame (3, 103) and the body (2, 102) for absorbing the dimensional shrinkage of said polymeric material, **characterized in that** said frame (3, 103) comprises one or more first chambers (6, 106) provided to receive said shrinkage absorbing means (7, 107) and one or more second chambers (8, 108) provided to absorb at least one part of the deformation of said shrinkage absorbing means (7, 107).
2. Component (1, 101) according to claim 1, wherein said one or more first chambers (6, 106) are defined by walls (9A, 9B; 109A, 109B) on at least one of which extend said one or more second chambers (8, 108).

3. Component (1, 101) according to claim 1 or 2, wherein said body (2, 102) of brittle material comprises a circumferential peripheral region (4, 104) along which extend said one or more first chambers (6, 106), and wherein said one or more second chambers (8, 108) extend in radial directions.
4. Component (1) according to any of the previous claims, wherein said one or more first chambers (6) and said one or more second chambers (8) communicate with each other.
5. Component (101) according to any of the previous claims from 1 to 3, wherein said one or more first chambers (106) and said one or more second chambers (108) are separate.
6. Component (1, 101) according to any of the previous claims, wherein said one or more second chambers (8, 108) comprise at least one bottom wall that closes one of their ends.
7. Component (1, 101) according to claim 6, wherein said at least one bottom wall closes one end of said at least one or more first chambers (6, 106).
8. Household appliance comprising one component (1, 101) with a body (2, 102) of brittle material framed in a frame (3, 103) of over-injected polymeric material according to one or more of claims 1 to 7.
9. Appliance according to claim 8, wherein said component (1, 101) forms a door for closing an opening or forms a supporting surface.
10. Method for the production of a component (1, 101) according to one or more of claims 1 to 7, comprising a body (2, 102) of brittle material framed in a frame (3, 103) formed by over-injecting polymeric material in a peripheral region (4, 104) of said body (2, 102), means (7, 107) for absorbing the dimensional shrinkage of said polymeric material being interposed between said frame (3, 103) and the body (2, 102), **characterized in that** the over-injection of said frame (3, 103) includes forming one or more first chambers (6, 106) provided to receive said shrinkage absorbing means (7, 107) and one or more second chambers (8, 108) provided to absorb at least one part of the deformation of the shrinkage absorbing means (7, 107).
11. Method of production according to claim 10, wherein said one or more second chambers (8, 108) are formed on walls (9A, 9B; 109A, 109B) defining said one or more first chambers (6, 106).
12. Method of production according to claim 10 or 11, wherein said shrinkage absorbing means (7) are

made up of a compressible material.

- 13.** Method of production according to claim 10 or 11, wherein said shrinkage absorbing means (107) are integrally formed with said frame (103) through said over-injection of polymeric material. 5
- 14.** Method of production according to claim 13, wherein said one or more second chambers (108) comprise hollow polygonal elements (112) having a longitudinal axis that extends transversely to the peripheral region (104) of said body (102) of brittle material, said polygonal elements (112) being formed on walls (109A, 109B) extending between a surface (105) supporting the body (102) and a perimetric surface of the frame (103). 10 15

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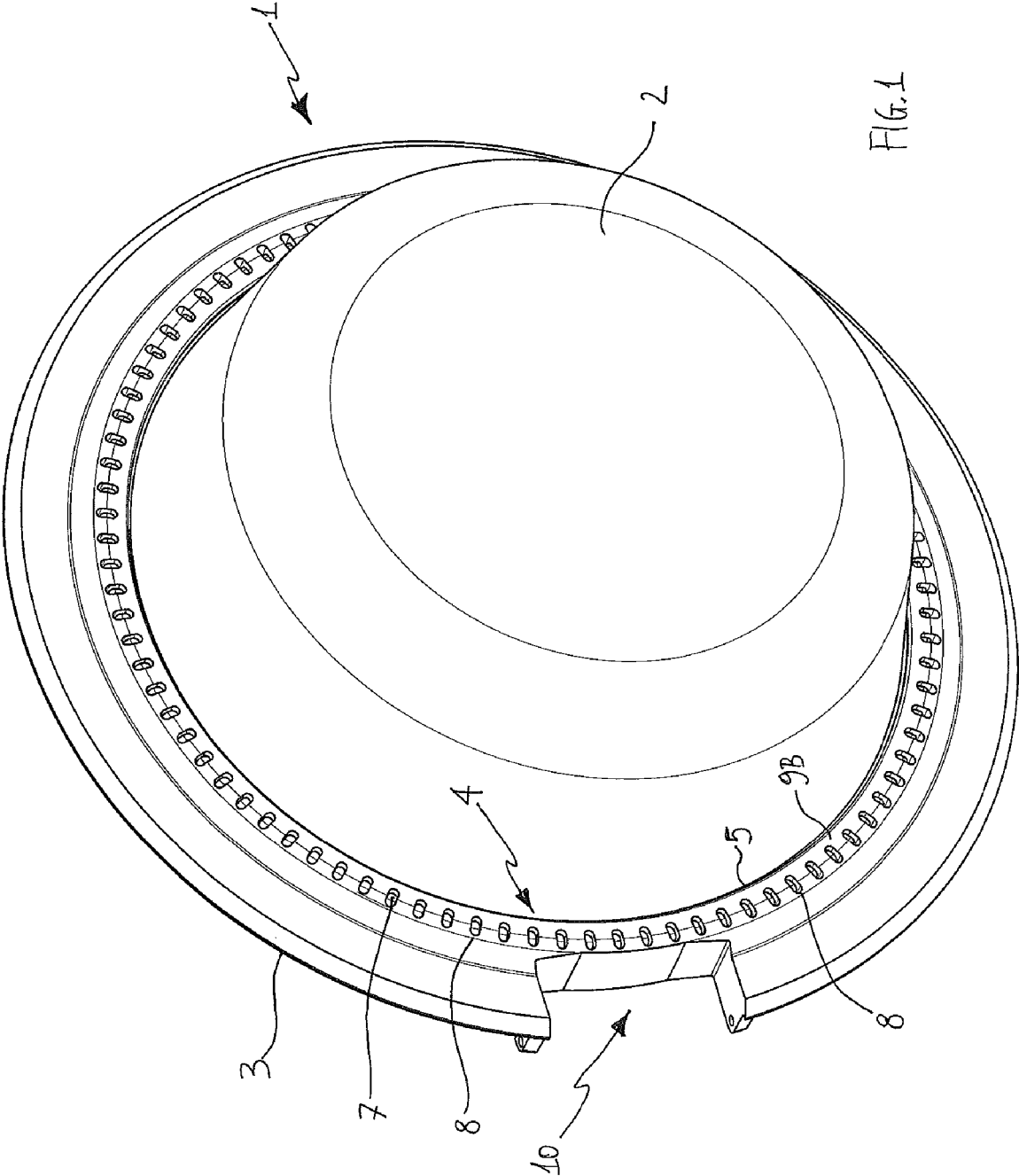
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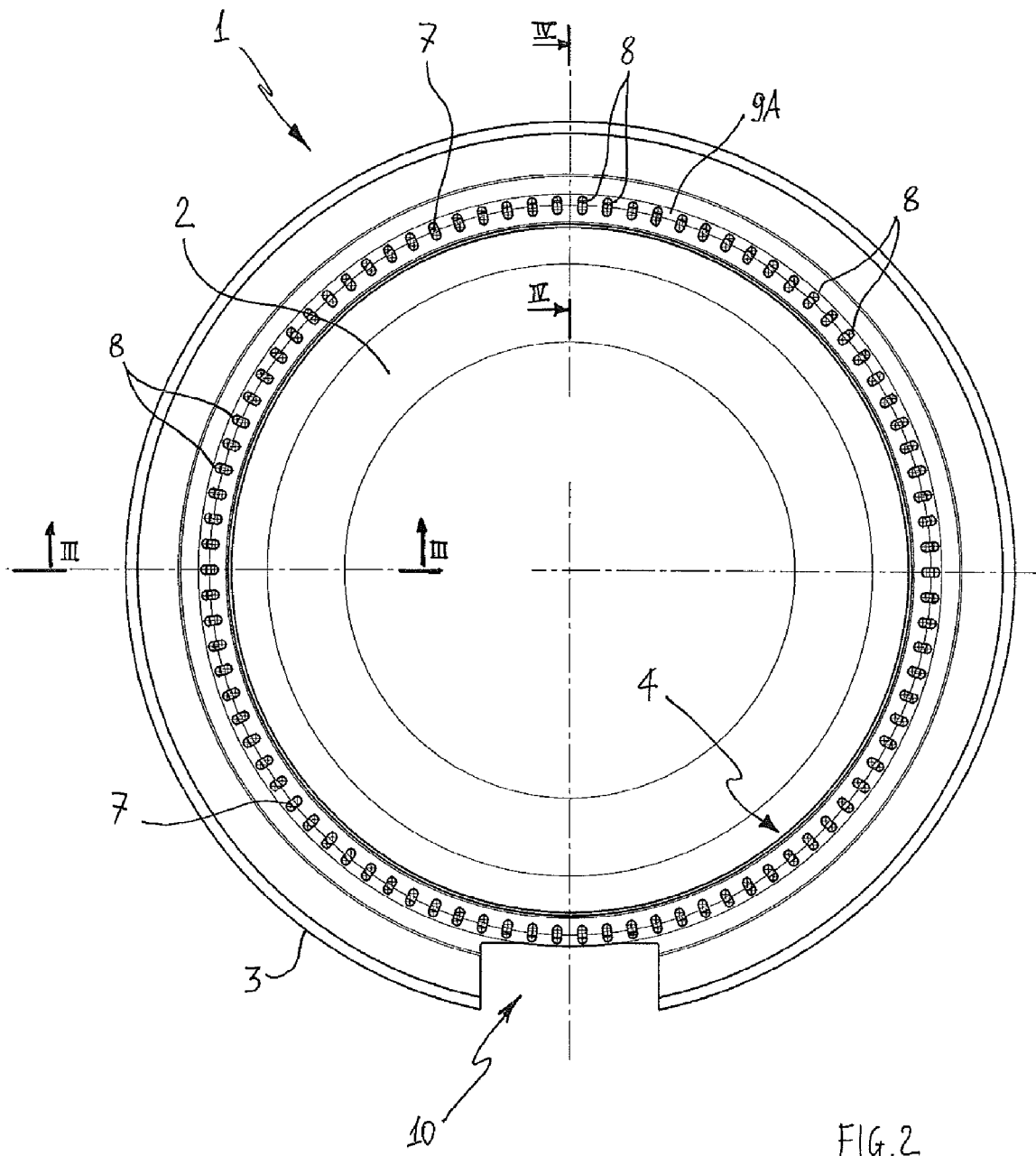
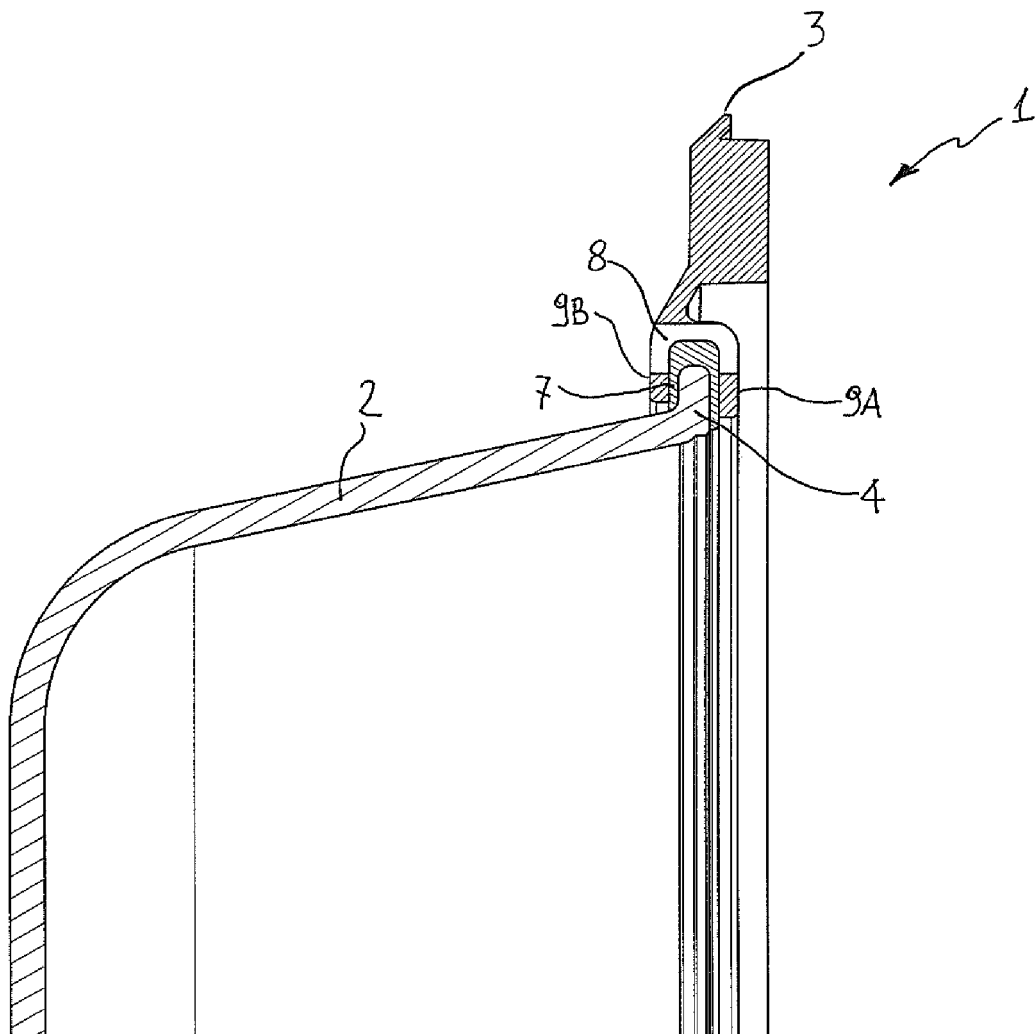
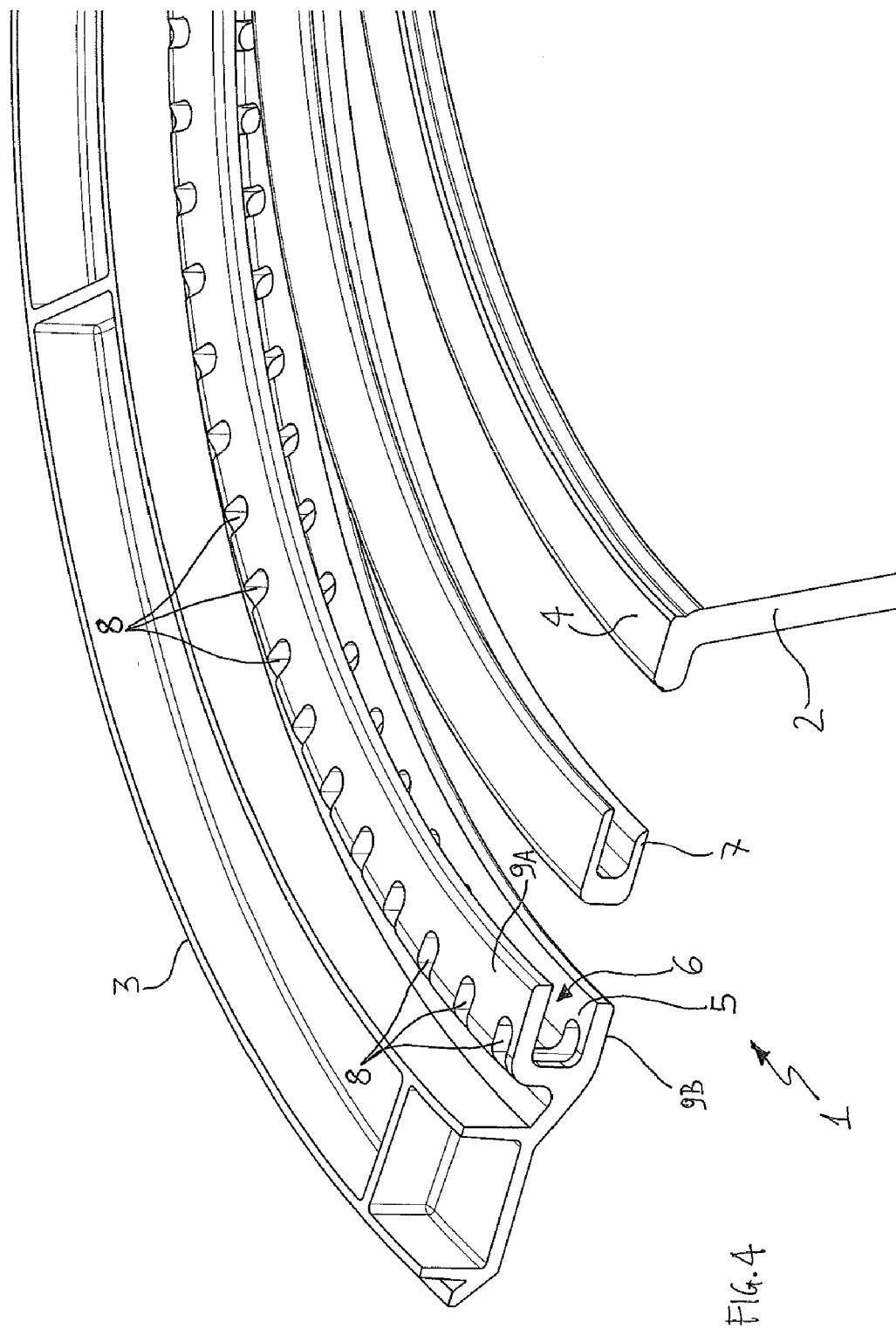
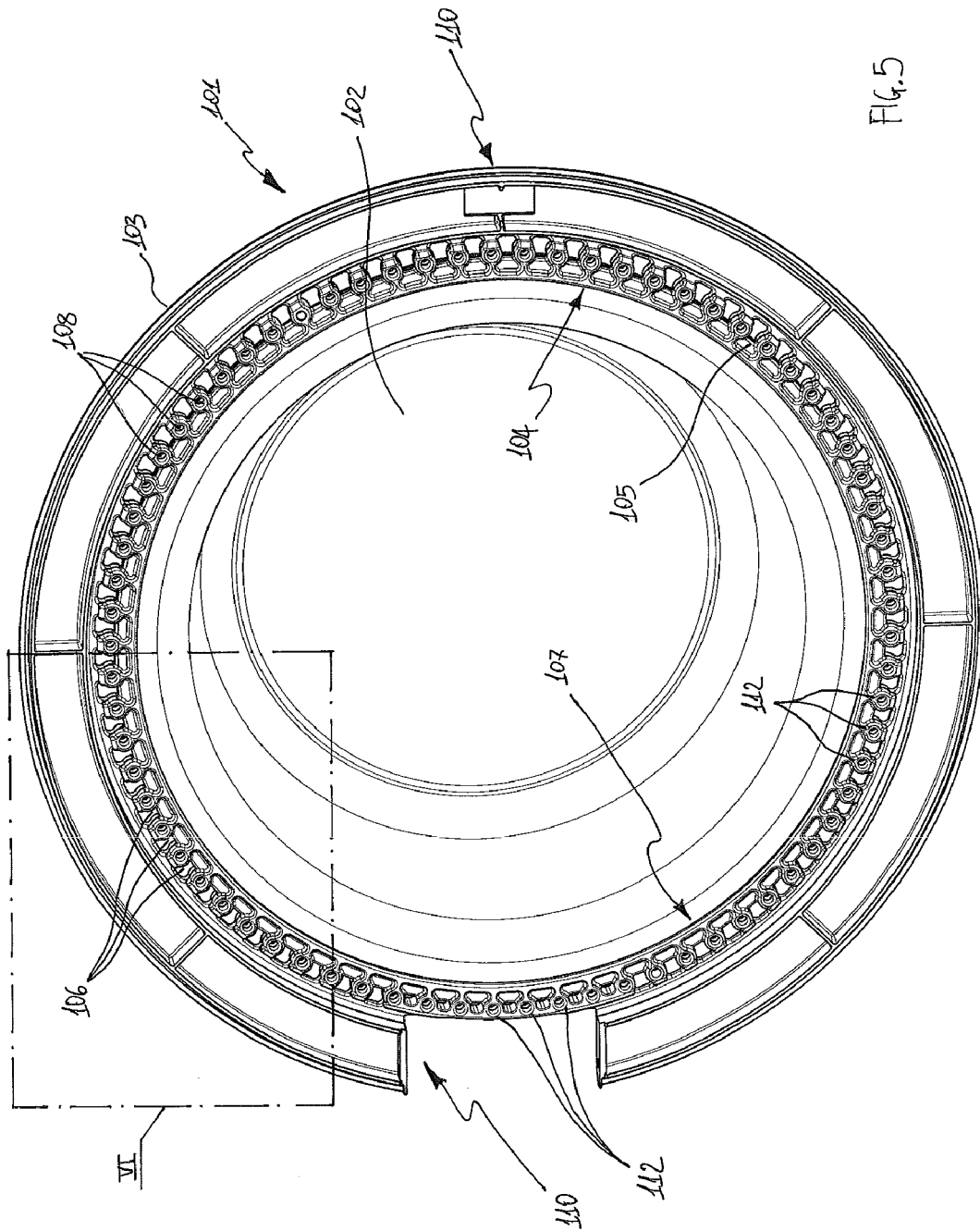
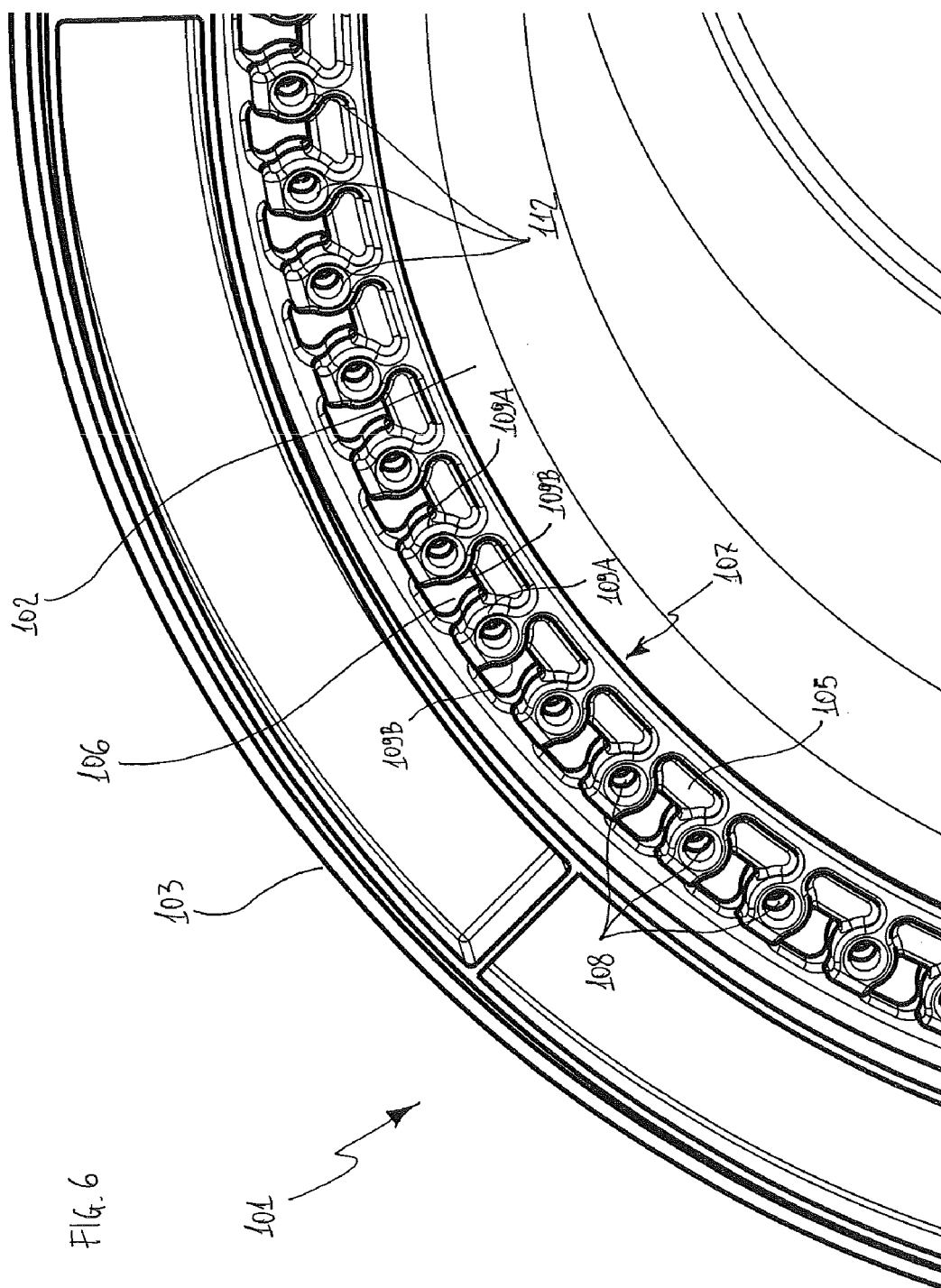


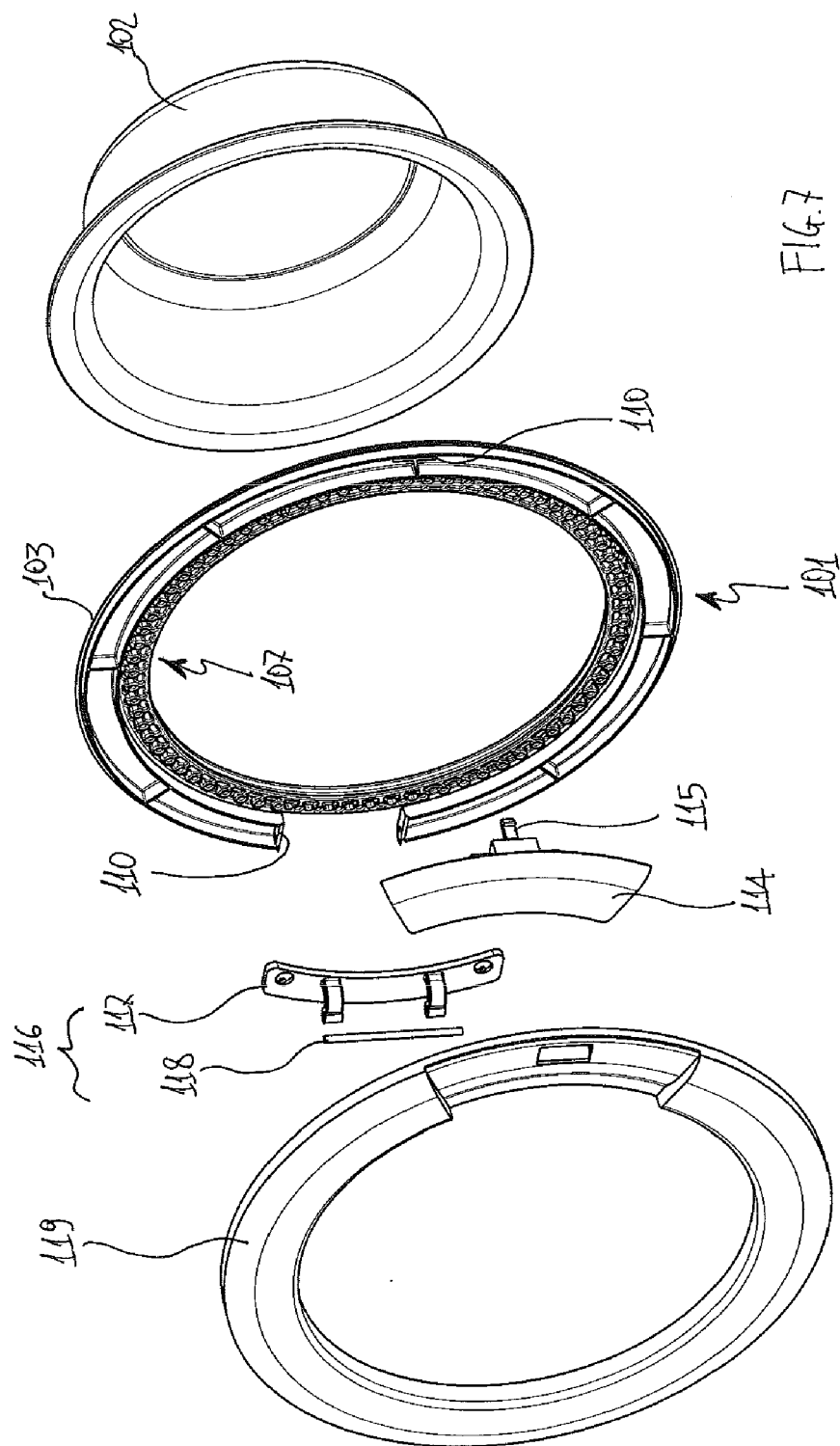
FIG. 3











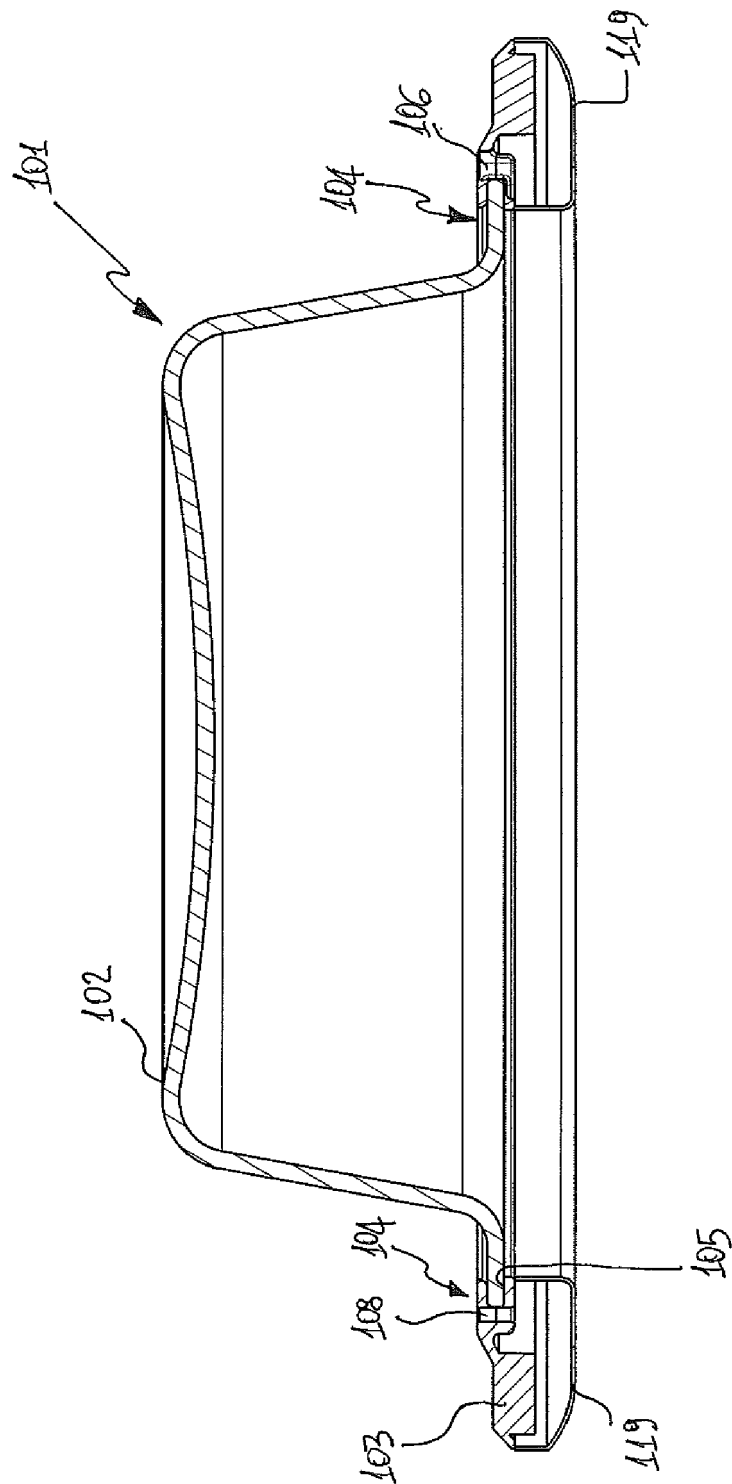


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7619

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	US 5 944 324 A (SCHULTHEIS BERND [DE] ET AL) 31 August 1999 (1999-08-31) * column 5, line 4 - column 6, line 22; figures 1-7 *	1-14	INV. D06F39/14 D06F37/28
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F F16J F25D A47B
Place of search		Date of completion of the search	Examiner
Munich		12 January 2012	Fachin, Fabiano
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 18 7619

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-01-2012

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