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(54) **FLIP-TOP DISPENSING CLOSURE MADE OF FOAMED PLASTIC MATERIAL**

KLAPPKAPPE AUS GESCHÄUMTEM KUNSTSTOFF

CAPUCHON À RABAT EN MATIÈRE PLASTIQUE EXPANSÉE

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Description

[0001] The present invention relates to a flip-top dispensing closure for a bottle intended to contain, for example, a fluid. Such closures usually comprise a base and a lid joined by a hinge, the base including a top deck with a dispensing orifice and the lid comprising a top plate. It also relates to a process for manufacturing a closure with a hinged lid.

[0002] Plastic caps are conventionally manufactured from plastic materials that are converted in a thermoplastic injection moulding process that consists in melting the material in a regulated screw/barrel assembly and in pushing the material into a multi-cavity mould in order to enable the material to be formed and cooled.

[0003] Operators in this field are confronted with the costs of the plastic materials used which increase proportionally with the cost of hydrocarbons.

[0004] US4744478 describes the use of foamed plastics in the production of screw caps.

[0005] The present invention provides a flip-top dispensing closure comprising a base and a lid joined by a hinge, the base including a top deck with a dispensing orifice and the lid comprising a top plate, in which the top deck and/or the top plate comprise a layer of foamed plastics material sandwiched between two layers of unfoamed plastics material, in which the hinge is formed from unfoamed plastics material.

[0006] Thus, the presence of the foamed plastic material makes it possible to achieve a sufficient cap thickness to ensure that the necessary stiffness is obtained, while limiting the amount of raw materials used. A reduction in the weight of the caps then enables the reduction of the costs while retaining the functional, physical and chemical properties of the caps. The expression "unfoamed plastic material" is understood in the present document to mean a solid plastic material corresponding to "unfoamed plastic material" or "plain material".

[0007] Furthermore, the layers formed of unfoamed plastic material correspond to what is sometimes referred to as "the skin" and the region formed of foamed plastic material is sometimes referred to as the "foamed core".

[0008] The closure may be obtained from a formulation comprising at least one propylene-based polyolefin and at least one blowing agent in a proportion of active components of between 0.3% and 2.5% by weight.

[0009] This formulation leads to good foaming under the conditions of manufacture by thermal injection moulding via the use of a masterbatch which includes at least one blowing agent in dilute form in a matrix compatible with the resin converted. The homogenization and thermal activation of the blowing agent take place in a screw/barrel assembly.

[0010] When the closure is intended for applications in the food, pharmaceutical or paramedical field, the blowing agent is advantageously selected from endothermic agents such as citric acid, sodium bicarbonate or a mixture of these agents.

[0011] The formulation may comprise a melt flow index of between 20 and 50 g/10 min so that the sealing portion has an impact strength of 3.5 to 10 kJ/m^2 in a notched Izod impact test at 23°C. These values are obtained according to the ISO 179/1eA standard. Furthermore, such a melt flow index enables the formulation to be injected at relatively low temperatures, of the order of 200-210°C. This reduces the time needed for the cooling of the cap, which corresponds to the longest length of time in the process, so that the cycle time is substantially reduced.

[0012] Also, the material of the sealing portion comprises an expansion ratio of between 30% and 70%. This makes it possible to achieve sufficient stiffness despite a reduced amount of material.

[0013] Advantageously, the top deck and/or top plate may have a thickness of between 1.3 and 1.7 mm so as to have an apparent flexural modulus of 800 to 1500 MPa. Indeed, this thickness of the sealing portion is critical considering the expansion ratio.

[0014] The hinge portion consists of the unfoamed plastic material so that it has sufficient mechanical fatigue strength (or hinge endurance) properties in order to be stressed and folded several times without breaking during the opening and closure of the orifice.

[0015] According to a second aspect, the invention also provides a process for manufacturing a closure (100), comprising the steps of:

- a) providing a plastics formulation comprising at least one blowing agent,
- b) providing an injection mould,
- c) arranging the mould so as to create a first gap,
- d) injecting the formulation into the injection mould so as to substantially fill the first gap, and
- e) moving the mould so as to form a second gap greater than the first gap so that the blowing agent generates expansion of the formulation until substantially the whole of the second gap is filled whereby to selectively foam part of the closure,
- in which the closure (100) includes a base (120) with a top deck (123) and a lid (121) with the top plate (126), the base and lid being joined by a hinge (122) and in which the hinge has a thin thickness such that it is very quickly cooled and solidified before the mould is opened for foaming.

[0016] This process then makes it possible to easily manufacture a closure, the portions of which perpendicular to the opening direction of the mobile part may be foamed. The portions of the cap parallel to the opening direction of the mobile part of the mould having little space during the opening of the mould remain solidified, made of unfoamed plastic material. It is thus possible to manufacture a closure, the top deck of which is foamed whilst the fastening portions are made of unfoamed material.

[0017] Furthermore, depending on the thickness of the portions of the closure extending substantially perpendicular to the opening direction of the mould, certain por-

tions will be cooled before being able to foam.

[0018] Preferably, the ratio between the second gap and the first gap is between 1.2 and 1.8. It is thus possible to obtain an expansion ratio of the plastic material of the order of 20% to 80%.

[0019] Also preferably, the ratio between the second gap and the first gap is between 1.3 and 1.7. The expansion ratio that can be achieved is then between 30% and 70%.

the formulation may comprise a melt flow index of between 20 and 50 g/10 min.

[0020] Thus, the cooling of the injected formulation is very rapid.

[0021] During the opening of the mould, only the plastic material of the thickest portions of the cap will have the time to foam. It is then possible to obtain a hinge portion that extends perpendicular to the opening direction of the mould made of unfoamed material so that this portion retains its fatigue strength properties ("hinge effect" typical of unfoamed polypropylene) as for a conventional cap.

[0022] The formulation may be devoid of mineral fillers and comprises at least one polyolefin selected from a copolymer of propylene and ethylene PP, a homopolymer, a statistical copolymer or a mixture of these materials.

[0023] The statistical copolymer is commonly referred to as random copolymer or RCP.

[0024] The formulation may comprise a nucleating agent, such as nucleating talc, sodium benzoate (NaBz such as sodium 2,2'-methylenebis(4,6-di-tert-butylphenyl)phosphate from Asahi Denka Kogyo K.K., known commercially under the name NA-II®), a phosphate ester salt or a calcium metal salt (Hyperform® HPN-20E) in a proportion of between 300 and 1500 ppm.

[0025] The formulation may comprise a clarifying agent, such as a derivative of sorbitol (1,3:2,4-dibenzylidene sorbitol - DBS - Irgaclear D from CIBA or Millad 3905 from Milliken, 1,3;2,4-di-p-methyldibenzylidene sorbitol MDBS - Irgaclear DM from CIBA or Millad 3940 from Milliken, 1,3:2,4-di-m,p-methylbenzylidene sorbitol DMDBS, Millad 3988 from Milliken) in a proportion of between 500 and 2000 ppm or a derivative of nonitol (1,2,3-trideoxy-4,6:5,7-bis-O-[(4-propylphenyl)methylene]nonitol) in a proportion of between 3000 and 5000 ppm.

[0026] Advantageously, the active components of the blowing agent are in a proportion of between 0.3% and 2.5% by weight.

[0027] The blowing agent may be selected from citric acid, sodium bicarbonate or a mixture of these compounds.

[0028] Different aspects and embodiments of the invention may be used separately or together.

[0029] Further particular and preferred aspects of the present invention are set out in the accompanying independent and dependent claims. Features of the dependent claims may be combined with the features of the independent claims as appropriate, and in combination other than those explicitly set out in the claims.

[0030] Other aspects, objectives and advantages of the present invention will appear more clearly on reading the following description of several embodiments thereof, given by way of non-limiting examples and with reference to the appended drawings. The figures are not necessarily to scale for all the elements represented so as to improve the readability thereof. In the remainder of the description, for the sake of simplicity, identical, similar or equivalent elements of the various embodiments bear the same numerical references.

[0031] The present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 and 2 represent an example of foamed cap, which does not form part of the present invention;

Figure 3 represents a cap according to an embodiment of the invention;

Figure 4A represents a cap according to a further example, which does not form part of the present invention;

Figure 4B illustrates a cross-sectional view along an axis A-A' of the cap represented in Figure 4A;

Figures 5 and 6 illustrates an example of a the process for manufacturing a cap, which does not form part of the present invention; and

Figures 7 and 8 illustrate a process for manufacturing a cap according to the present invention.

[0032] Examples and embodiments are described below in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternate forms and should not be construed as limited to the examples set forth herein.

[0033] Accordingly, while embodiments can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included. Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate.

[0034] The terminology used herein to describe embodiments is not intended to limit the scope. The articles "a," "an," and "the" are singular in that they have a single referent, however the use of the singular form in the

present document should not preclude the presence of more than one referent. In other words, elements referred to in the singular can number one or more, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," "comprising," "includes," and/or "including," when used herein, specify the presence of stated features, items, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, items, steps, operations, elements, components, and/or groups thereof.

[0035] Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealized or overly formal sense unless expressly so defined herein.

[0036] Figure 1 illustrates the shape of a precursor 1 of a cap before blowing of the formulation of the plastic material and Figure 2 illustrates the cap 100 for a bottle intended to contain a fluid, after blowing of the plastic material. The cap 100 comprises a sealing portion 2, having the general shape of a disc intended to seal a bottle, and a lateral portion 6 comprising a screw thread for fastening to the bottle. The lateral portion 6 has a cylindrical general shape solidly attached to the sealing portion 2. After blowing as illustrated in Figure 2, the sealing portion 2 of the cap 100 has three regions that extend in a plane parallel to the plane of the disc: a first region 3 made of unfoamed plastic material, commonly referred to as the skin, a second region 4 made of foamed plastic material commonly referred to as the foamed core and a third region 5 made of unfoamed plastic material or skin. The expansion ratio of the plastic material of the sealing portion 2 is around 50% so that it has a thickness of around 1.5 mm. This thickness and this expansion ratio make it possible to achieve mechanical properties similar to those of a conventional sealing portion 2. The lateral portion 6 is made of unfoamed plastic material, it has a thickness of around 1 mm.

[0037] According to one variant of the cap 100 that is not illustrated, the sealing portion 2 and the lateral portion 6 have other shapes. In another variant, the lateral portion 6 is devoid of a screw thread but comprises any other type of device for fastening to the bottle.

[0038] According to one variant that is not illustrated, the expansion ratio is between 20% and 80%. According to yet another variant, the expansion ratio is between 30% and 70%.

[0039] Figure 3 illustrates a cap 100 according to the invention. This cap 100 differs in particular from the cap 100 from the first example in that it comprises an orifice 7 for the passage of a fluid and a closure portion 9 for closing the orifice 7, connected to the sealing portion 2 via a hinge portion 8. The sealing portion 2 and the closure portion 9 are formed of at least one foamed plastic material with an expansion ratio of 70%. The thicknesses of said portions 2, 9 are around 1.7 mm. Furthermore, the hinge portion 8 made of plastic material has a thickness of around 0.7 mm of unfoamed plastic material. Indeed, this thin thickness is very quickly cooled after injection of the formulation, so that when the mould is opened for the foaming, this portion 8 is already solidified. The lateral portion 6 is made of unfoamed material for the same reasons as those mentioned above.

[0040] Figure 4A illustrates a cap 100 which differs from the preceding two in that the face of the sealing portion 2 located on the side of the lateral portion 6 is equipped with a reinforcing element 11 that has the shape of a rib made of unfoamed plastic material that increases the mechanical strength of the sealing portion 2. Figure 4B illustrates the same embodiment along a cross-sectional view along the axis A-A'. According to other possibilities that are not illustrated, the rib 11 may be curvilinear, may have several concentric circles, form a cross and any other shape that makes it possible to reinforce the sealing portion 2. According to yet another possibility that is not illustrated, the rib 11 is provided on the closure portion 9 of a cap 100.

[0041] The cap 100 illustrated in Figures 1 to 4 is obtained from a formulation comprising at least one propylene-based polyolefin and at least one blowing agent in a proportion of active components of between 0.3% and 2.5% by weight and a melt flow index of between 20 and 50 g/l0 min. According to another variant, the polyolefin comprises a copolymer of propylene and ethylene PP, a homopolymer, a statistical copolymer or a mixture of these materials.

[0042] Figures 5 and 6 illustrate a process for manufacturing a cap 100.

[0043] Figure 5 illustrates an injection mould 200 comprising a fixed part 12 and a mobile part 13 that are positioned with respect to one another so as to form a first gap 14. The formulation comprising a blowing agent is injected until the space formed by the first gap 14 is filled. The thinnest portions, such as the hinge portion 8 for example, cool very rapidly so that the plastic material solidifies. Then, as illustrated in Figure 6, the mobile part 13 of the mould is moved with respect to the fixed part 12 so as to open the mould 200 by forming a second gap 15 larger than the first gap 14. The formulation then foams in a direction parallel to the opening direction (arrow 16) of the mould. Thus, the portions oriented in a direction substantially perpendicular to the opening direction 16 of the mould may foam until the whole of the space delimited by the second gap 15 is filled. Therefore, the sealing portion 2 of the cap 100 has at least one region 4 made of foamed plastic material between two skins 3, 5 and the lateral portion 6 has a plastic material that is not foamed due to lack of space.

[0044] The difference between the first gap 14 and the second gap 15 is determined by the desired expansion ratio. The second gap 15 is between 1.2 and 1.8 times the first gap 14.

[0045] Thus, the present example shows a light cap

100 that requires less raw material than a conventional cap while having the same properties. Furthermore, the invention also proposes a process for the manufacture of such caps which is simple and rapid to implement.

[0046] Figures 7 and 8 illustrate an alternative moulding process.

[0047] Figure 7 shows a first moulding phase in which a foamable plastics material is injected into a mould cavity to form an intermediate piece 115.

[0048] Thereafter an internal movement within the mould forms an enlarged cavity for a second moulding phase shown in Figure 8 in which the material foams to fill the cavity to form the final piece 100.

[0049] In this embodiment the piece 100 is a flip-top dispensing closure with a base 120 and a lid 121 joined by a hinge 122. The base 120 includes a generally disc-shape, circular top deck 123 with a dispensing orifice 124 and a generally cylindrical sidewall 125 depending from the periphery of the deck 123. The lid 121 includes a disc-shape, generally circular top plate 126 with a generally cylindrical truncated sidewall 127 depending from the periphery thereof.

[0050] In this embodiment the movement of the mould expands the cavity in the region of the base top deck 123 and the lid top plate 126 to form a foamed core 123b, 126b sandwiched between two non-foamed layers 123a, 123c, 126a, 126c.

[0051] It goes without saying that the invention is not limited to the embodiment described above by way of example, but that it comprises all the technical equivalents and variants of the means described and also combinations thereof.

[0052] Although illustrative embodiments of the invention have been disclosed in detail herein, with reference to the accompanying drawings, it is understood that the invention is not limited to the precise embodiments shown and that various changes and modifications can be effected therein by one skilled in the art without departing from the scope of the invention as defined by the appended claims

Claims

1. A flip-top dispensing closure (100) comprising a base (120) and a lid (121) joined by a hinge (122), the base including a top deck (123) with a dispensing orifice (124) and the lid comprising a top plate (126), **characterised in that** the top deck (123) and/or the top plate (126) comprise a layer of foamed plastics material (123b, 126b) sandwiched between two layers of unfoamed plastics material (123a, 123c, 126a, 126c), in which the hinge (122) is formed from unfoamed plastics material.

2. A closure (100) as claimed in claim 1, in which the top deck (123) and the top plate (126) both have a foamed core (123b, 126b) sandwiched between two non-foamed layers (123a, 123c, 126a, 126c).

3. A closure (100) as claimed in claim 1 or claim 2, in which the closure (100) is obtained from a formulation comprising at least one propylene-based polyolefin and at least one blowing agent in a proportion of active components of between 0.3% and 2.5% by weight

4. A closure (100) according to any of claims 1 to 3, in which the material of the top deck (123) and/or top plate (126) comprises an expansion ratio of between 30% and 70%.

5. A closure (100) according to any preceding claim, in which the closure is obtained from a formulation having a melt flow index of between 20 and 50g/10min.

6. A process for manufacturing a closure (100), comprising the steps of:

   - a) providing a plastics formulation comprising at least one blowing agent,
   - b) providing an injection mould,
   - c) arranging the mould so as to create a first gap,
   - d) injecting the formulation into the injection mould so as to substantially fill the first gap, and
   - e) moving the mould so as to form a second gap greater than the first gap so that the blowing agent generates expansion of the formulation until substantially the whole of the second gap is filled whereby to selectively foam part of the closure,
   - in which the closure (100) includes a base (120) with a top deck (123) and a lid (121) with the top plate (126), the base and lid being joined by a hinge (122) and in which the hinge has a thin thickness such that it is very quickly cooled and solidified before the mould is opened for foaming.

7. Process according to claim 6 and comprising the steps of:

   - providing at step a) a formulation comprising at least one propylene-based polyolefin and at least one blowing agent in a proportion of active components of between 0.3% and 2.5% by weight,
   - providing at step b) an injection mould (200) comprising a fixed part (12) and a mobile part (13),
   - at step c) positioning the mobile part (13) over the fixed part (12) so as to create a first gap (14),
   - at step d) injecting the formulation into the injection mould (200) so as to fill the first gap (14), and

- at step e) moving the mobile part (13) of the injection mould (200) in an opening direction (16) with respect to the fixed part (12) of the injection mould (200) so as to form a second gap (15) greater than the first gap (14) so that the blowing agent generates the expansion of the formulation in a direction perpendicular to the opening direction (16) of the injection mould (200) until the whole of the second gap (15) is filled.

8. Process according to Claim 7, in which the ratio between the second gap (15) and the first gap (14) is between 1.2 and 1.8.

9. Process according to any of claims 6 to 8, in which formulation has a melt flow index of between 20 and 50g/10min.

Patentansprüche

1. Klappkappe (100), die einen Boden (120) und einen Deckel (121) aufweist, die durch ein Gelenk (122) verbunden sind, wobei der Boden eine obere Abdeckung (123) mit einer Ausgabeöffnung (124) aufweist und der Deckel eine obere Platte (126) aufweist, **dadurch gekennzeichnet, dass** die obere Abdeckung (123) und/oder die obere Platte (126) eine Schicht aus geschäumtem Kunststoff (123b, 126b) aufweisen, die zwischen den zwei Schichten aus nicht geschäumtem Kunststoff (123a, 123c, 126a, 126c) angeordnet ist, wobei das Gelenk (122) aus nicht geschäumtem Plastik hergestellt ist.

2. Verschluss (100) nach Anspruch 1, wobei die obere Abdeckung (123) und die obere Platte (126) einen geschäumten Kern (123b, 126b) haben, der zwischen zwei nicht geschäumten Schichten (123a, 123c, 126a, 126c) dazwischen angeordnet ist.

3. Verschluss (100) nach Anspruch 1 oder Anspruch 2, wobei der Verschluss (100) aus einer Rezeptur erhalten wird, die wenigstens ein Propylenbasiertes Polyolefin und wenigstens ein Treibmittel in einem Anteil der aktiven Komponenten von zwischen 0,3 und 2,5 Gewichtsprozent aufweist.

4. Verschluss (100) nach einem der Ansprüche 1 bis 3, wobei das Material der oberen Abdeckung (123) und/oder der oberen Platte (126) ein Ausdehnungsverhältnis von zwischen 30 % und 70 % aufweist.

5. Verschluss (100) nach einem der vorhergehenden Ansprüche, wobei der Verschluss aus einer Rezeptur erhalten wird, die einen Schmelzflussindex von zwischen 20 und 50 g/10 min. aufweist.

6. Verfahren zum Herstellen eines Verschlusses (100), das die Schritte aufweist:

a) Vorsehen einer Plastikrezeptur, die wenigstens ein Treibmittel aufweist,
b) Vorsehen einer Spritzgießform,
c) Anordnen der Form, um so eine erste Aussparung zu erzeugen,
d) Einspritzen der Rezeptur in die Spritzgießform, um so im Wesentlichen die erste Aussparung zu füllen, und
e) Verschieben der Form, um so eine zweite Aussparung zu bilden, die größer als die erste Aussparung ist, sodass das Treibmittel eine Ausdehnung der Rezeptur erzeugt, bis im Wesentlichen die ganze zweite Aussparung gefüllt ist, um so in ausgewählter Weise einen Teil des Verschlusses aufzuschäumen,

- wobei der Verschluss (100) einen Boden (120) und eine obere Abdeckung (123) und einen Deckel (121) mit der oberen Platte (126) aufweist, wobei der Boden und der Deckel durch ein Gelenk (122) verbunden sind und wobei das Gelenk eine dünne Dicke dergestalt hat, dass es sehr schnell abgekühlt und verfestigt ist, bevor die Form zum Aufschäumen geöffnet wird.

7. Verfahren nach Anspruch 6, das die Schritte aufweist:

- Vorsehen in Schritt a) einer Rezeptur, die wenigstens ein Propylenbasiertes Polyolefin und wenigstens ein Treibmittel in einem Anteil der aktiven Komponenten von zwischen 0,3 und 2,5 Gewichtsprozent aufweist,
- Vorsehen in Schritt b) einer Spritzgießform (200), die ein feststehendes Teil (12) und ein bewegliches Teil (13) aufweist,
- in Schritt c) Positionieren des beweglichen Teils (13) über dem feststehenden Teil (12), um so einen ersten Abstand (14) zu erzeugen,
- in Schritt d) Einspritzen der Rezeptur in die Spritzgießform (200), um so den ersten Abstand (14) zu füllen, und
- in Schritt e) Verschieben des beweglichen Teils (13) der Spritzgießform (200) in einer Öffnungsrichtung (16) bezüglich des feststehenden Teils (12) der Spritzgießform (200), um so eine zweiten Aussparung (15) größer als die erste Aussparung (14) auszubilden, sodass das Treibmittel die Ausdehnung der Rezeptur in einer Richtung senkrecht zu der Öffnungsrichtung (16) der Spritzgießform (200) erzeugt, bis die gesamte zweite Aussparung (15) ausgefüllt ist.

8. Verfahren nach Anspruch 7, wobei das Verhältnis

zwischen der zweiten Aussparung (15) und der ersten Aussparung (14) zwischen 1,2 und 1,8 liegt.

9. Verfahren nach einem der Ansprüche 6 bis 8, wobei die Rezeptur einen Schmelzflussindex zwischen 20 und 50 g/10 min. hat.

Revendications

1. Capuchon de distribution à rabat (100) comprenant une base (120) et un couvercle (121) reliés par une articulation (122), la base incluant une plaque supérieure (123) présentant un orifice de distribution (124) et le couvercle comprenant une plaque supérieure (126), **caractérisé en ce que**
la plaque supérieure (123) et/ou la plaque supérieure (126) comprennent une couche de matière plastique expansée (123b, 126b) prise en sandwich entre deux couches de matière plastique non expansée (123a, 123c, 126a, 126c), où l'articulation (122) est formée à partir de matière plastique non expansée.

2. Capuchon (100) selon la revendication 1, dans lequel la plaque supérieure (123) et la plaque supérieure (126) présentent toutes deux une partie centrale expansée (123b, 126b) prise en sandwich entre deux couches non expansées (123a, 123c, 126a, 126c).

3. Capuchon (100) selon la revendication 1 ou la revendication 2, où le capuchon (100) est obtenu à partir d'une formulation comprenant au moins une polyoléfine à base de propylène et au moins un agent d'expansion dans une proportion de composés actifs comprise entre 0,3 % et 2,5 % en poids.

4. Capuchon (100) selon l'une quelconque des revendications 1 à 3, dans lequel la matière de la plaque supérieure (123) et/ou de la plaque supérieure (126) comprend un taux d'expansion compris entre 30 % et 70 %.

5. Capuchon (100) selon l'une quelconque des revendications précédentes, où le capuchon est obtenu à partir d'une formulation présentant un indice de fluidité à chaud compris entre 20 et 50 g/10 min.

6. Procédé de fabrication d'un capuchon (100), comprenant les étapes consistant à :

a) fournir une formulation de matière plastique comprenant au moins un agent d'expansion,
b) fournir un moule d'injection,
c) agencer le moule de sorte à créer un premier espace,
d) injecter la formulation dans le moule d'injection de sorte à sensiblement remplir le premier espace, et
e) déplacer le moule de sorte à former un second espace plus grand que le premier espace de sorte que l'agent d'expansion déclenche une expansion de la formulation jusqu'à ce que sensiblement l'ensemble du second espace soit rempli de sorte à expanser de manière sélective une partie du capuchon,
où le capuchon (100) inclut une base (120) présentant une plaque supérieure (123) et un couvercle (121) présentant une plaque supérieure (126), la base et le couvercle étant reliés par une articulation (122), et où l'articulation présente une fine épaisseur de telle sorte qu'elle est très rapidement refroidie et est solidifiée avant que le moule ne soit ouvert pour expansion.

7. Procédé selon la revendication 6 et comprenant les étapes consistant à :

- fournir lors de l'étape a) une formulation comprenant au moins une polyoléfine à base de propylène et au moins un agent d'expansion dans une proportion de composés actifs comprise entre 0,3 % et 2,5 % en poids,
- fournir lors de l'étape b) un moule d'injection (200) comprenant une partie fixe (12) et une partie mobile (13),
- lors de l'étape c), positionner la partie mobile (13) au-dessus de la partie fixe (12) de sorte à créer un premier espace (14),
- lors de l'étape d), injecter la formulation dans le moule d'injection (200) de sorte à remplir le premier espace (14), et
- lors de l'étape e), déplacer la partie mobile (13) du moule d'injection (200) dans une direction d'ouverture (16) par rapport à la partie fixe (12) du moule d'injection (200) de sorte à former un second espace (15) plus grand que le premier espace (14) de sorte que l'agent d'expansion déclenche l'expansion de la formulation dans une direction perpendiculaire à la direction d'ouverture (16) du moule d'injection (200) jusqu'à ce que l'ensemble du second espace (15) soit rempli.

8. Procédé selon la revendication 7, dans lequel le rapport entre le second espace (15) et le premier espace (14) est compris entre 1,2 et 1,8.

9. Procédé selon l'une quelconque des revendications 6 à 8, dans lequel la formulation présente un indice de fluidité à chaud compris entre 20 et 50 g/10 min.

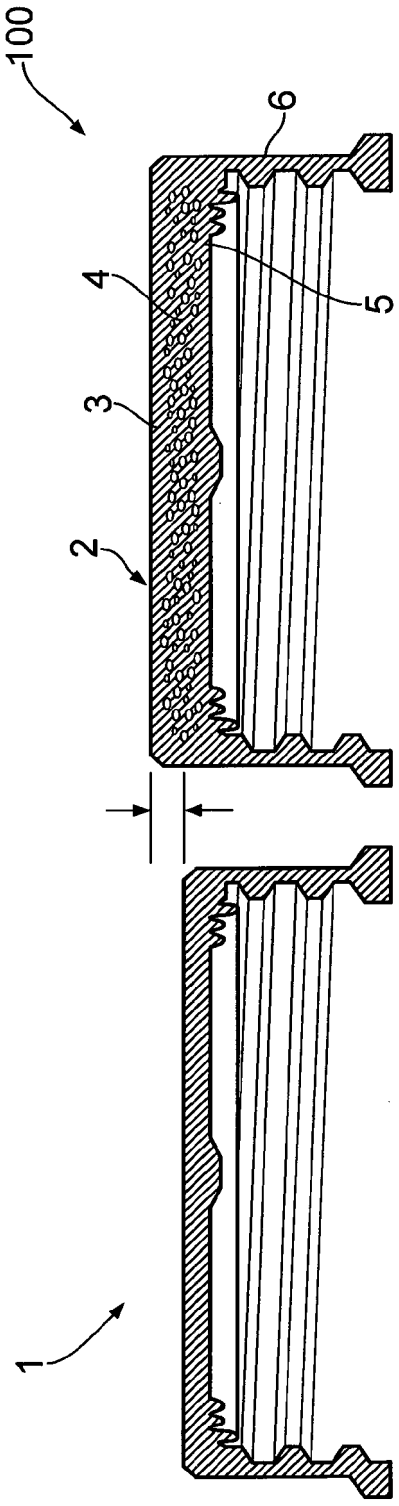

FIG. 2

FIG. 1

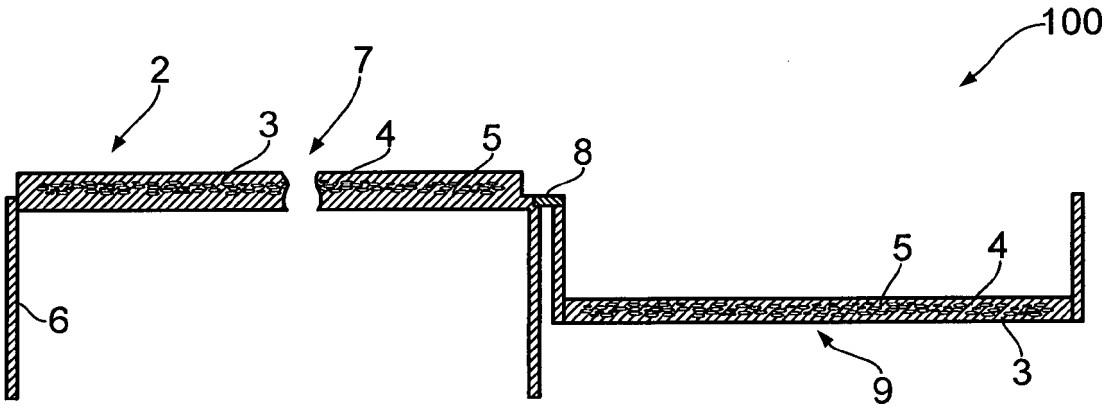

FIG. 3

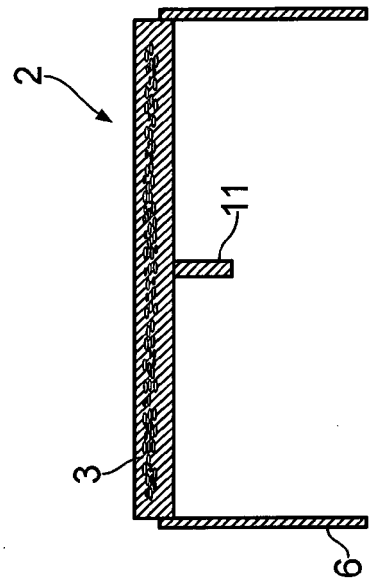

FIG. 4B

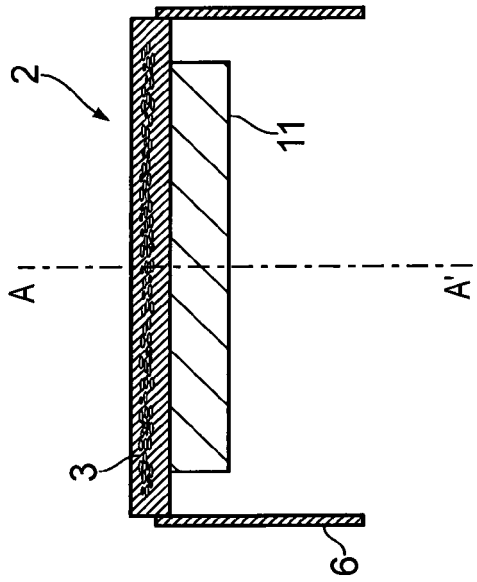

FIG. 4A

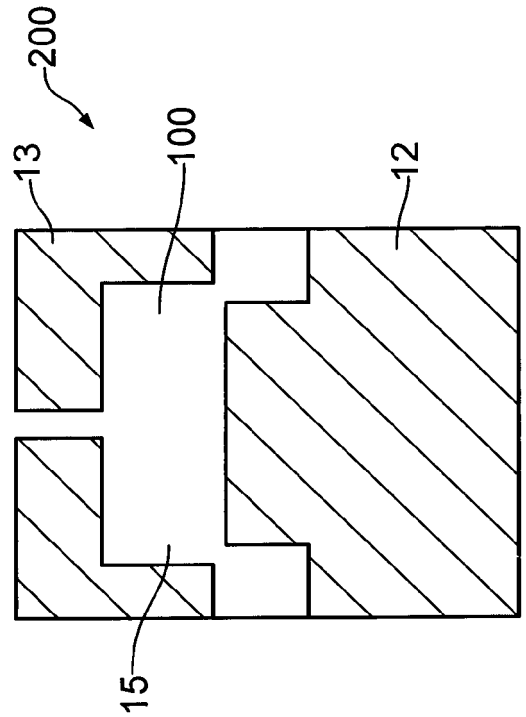

FIG. 6

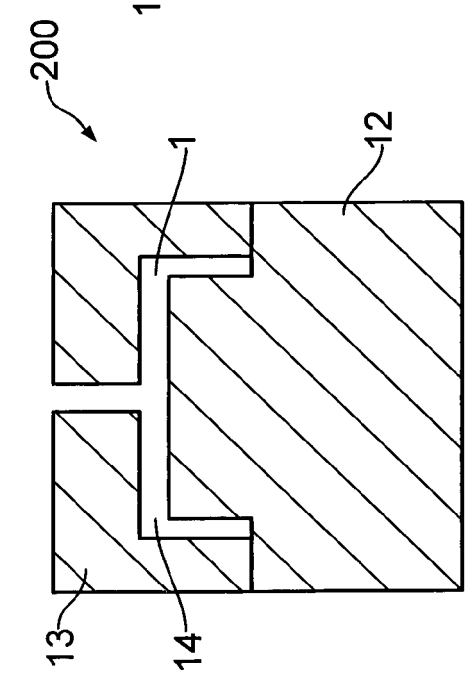

FIG. 5

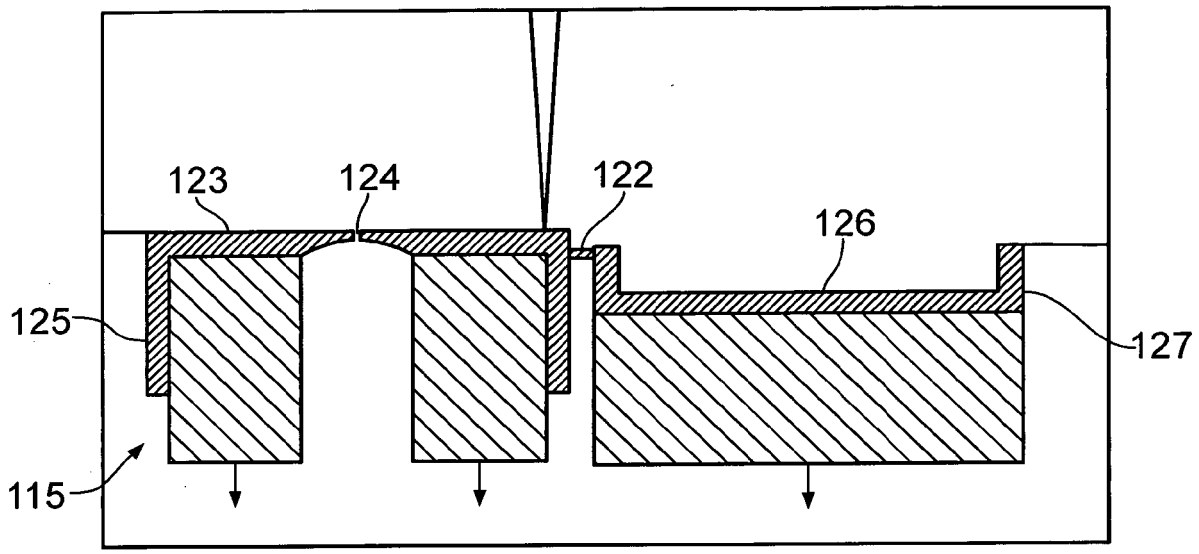
123
124
122
126
125
127
115

FIG. 7

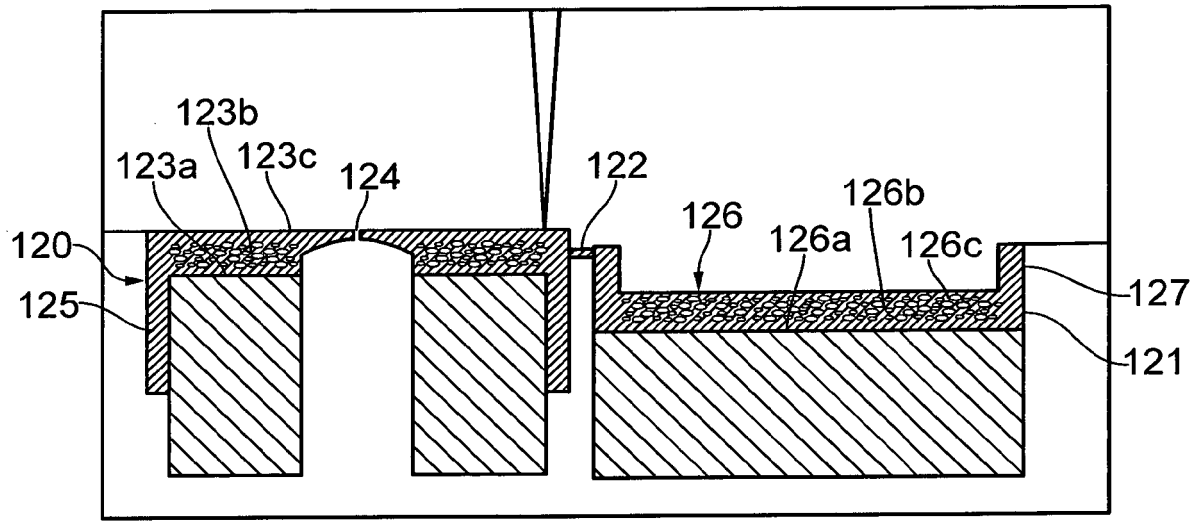
123b
123a
123c
124
122
126
126b
126a
126c
120
125
127
121

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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