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(54) **A CLOSURE WITH FOAMED REGION AND METHOD OF FORMING SAID CLOSURE**

VERSCHLUSS MIT GESCHÄUMTEM BEREICH UND VERFAHREN ZUR HERSTELLUNG DIESES VERSCHLUSSES

FERMETURE À RÉGION ALVÉOLAIRE ET PROCÉDÉ DE FORMATION DE LADITE FERMETURE

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Description

Field of the Invention

[0001] The present invention relates to a cap, closure, top or the like for a bottle intended to contain, for example, a fluid. It also relates to a process for manufacturing a cap or the like.

Background of the Invention

[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 hydrocarbon:

WO2015/128303 discloses a closure according to the preamble of claim 1.

Summary of the Invention

[0004] According to a first aspect there is provided a closure as claimed in claim I. According to a second aspect there is provided a method for forming a closure according to the first aspect as claimed in claim 14.

[0005] A closure comprising a top plate and a sidewall depending from the periphery of the top plate, the closure including a sealing member which depends from the top plate within the sidewall, in which the top plate includes a foamed region which is restricted to being within a boundary defined by the sealing member, the sealing member being substantially unfoamed, is disclosed.

[0006] The sealing member may be formed integrally with the top plate. The sealing member may be, for example, a crab claw type seal or a plug seal.

[0007] Alternatively or additionally the sealing member may be formed separately from, and be attachable to, or located adjacent, the top plate.

[0008] Selective foaming via mould movements could be used in order to remain "inside" (i.e. between) the seal feature/s. This makes it possible to maintain dimensional repeatability and functional sealing performance. For example the sealing feature may be generally annular and the foamed region is restricted to being radially inwards of the feature.

[0009] The extremity of the foamed region is spaced from the sealing member by between 0.5mm and 5mm, for example between 1mm and 2mm. In other words foaming is induced inside the seal features and between 0.5mm and 5mm of gap is left to ensure seal performance is not altered or modified.

[0010] A closure comprising a top plate and a sidewall, the closure including a sealing liner which depends from the top plate, in which at least part of the top plate includes a foamed region, is also disclosed.

[0011] The liner may be generally disc-shaped or otherwise shaped so as to substantially cover the underside of the top plate.

[0012] The sidewall may comprise a screw thread formation. The screw thread formation extends radially inwards and the foamed plastics material may not extend beyond a boundary defined by the radial extent of the formation.

[0013] A closure comprising a top plate and a sidewall, the closure comprising a separate liner for providing a seal in use, the liner being secured or securable to the top plate and defining a non-sealing region of the top plate within the liner, in which at least part of the non-sealing region includes a foamed region, is disclosed.

[0014] At least part of the sidewall may have a foamed region.

[0015] A closure comprising a top plate and a sidewall depending from the periphery of the top plate, in which at least part of the sidewall is formed from foamed plastics material, is disclosed.

[0016] At least part of the top plate is formed from foamed plastics material.

[0017] The sidewall may comprise a screw thread formation.

[0018] Conventionally, in closures with a side skirt that has a screw thread formation the skirt is actually quite thick due to the fact that sufficient material must be used to limit the creation of "sink marks" on the outer surface of the skirt.

[0019] In some examples the foaming agent is present throughout the formulation i.e. in parts of the closure which will be subject to mould movement expansion and parts which will not. The present inventors have realised that it is possible to rely on the fact that the foaming agent makes it possible to compensate the sink marks in the skirt. Accordingly it is possible to make these parts of the closure thinner than normal whilst not suffering the problem of sink marks.

[0020] Therefore, a closure may be formed with a foamed core top plate and a reduced thickness sidewall.

[0021] Hence the foaming agent, added as a master batch, has two effects:

- significant foaming in the top plate thanks to the core back leaving a controlled amount of space for foaming to occur

- "swelling" in the skirt region that automatically compensates shrinkage.

[0022] A moulded closure formed from a foamable plastics material, the closure comprising a top plate and a sidewall, the plastics material forming part of the top plate being intentionally unfoamed and having an apparent density of R, the rest of the material forming the top plate being intentionally foamed and having an apparent density in the range of 0.2-0.9 R, for example in the range 0.4R to 0.8R, the sidewall including a screw thread formation, the material forming the sidewall at least in the region of the formation having an apparent density in the range 0.8-0.99 * R whereby shrinkage has been compensated by natural foaming, is disclosed.

[0023] For example, for PP, R will be equal to 0.9 and for HDPE, R will be between 0.93 and 0.96.

[0024] Sink marks in injection moulded plastic closures can develop when material in the region of screw threads shrinks more than the material in the adjacent wall. The presence of the screw threads creates an effectively thicker region that cools more slowly than neighbouring regions. Differential rates of cooling result in a depression on the adjacent surface that is known as a sink mark.

[0025] Currently the maximum depth of a thread formation is up to around 80% of the sidewall thickness if sink marks are to be avoided.

[0026] In examples in which the sidewall comprises a screw thread formation the depth of the formation may be more than 80% of the depth of the sidewall. The use of a foamable plastics material means that depressions in the sidewall are compensated for by natural expansion of the foamable plastics material.

[0027] In some examples the formation depth may be up to 120% of the depth of the sidewall.

[0028] A method of forming a closure as described herein, comprising the steps of: providing an injection mould with a fixed part and a mobile part; positioning the mould parts to define a first gap; injecting a foamable plastics material formulation to fill the first gap; and moving the mobile part to define a second gap so that the formulation expands to fill the second gap, is disclosed.

[0029] The ratio between the second gap and the first gap may be between 1.1 and 1.8. It is thus possible to obtain an average expansion ratio of the plastic material of the order of 10% to 80%.

[0030] The ratio between the second gap and the first gap may be between 1.3 and 1.7. The expansion ratio that can be achieved is then between 30% and 70%.

[0031] The method may further comprise an in-mould labelling step.

[0032] The moving part of the mould may be an external mould part to cause foaming of part of the body.

[0033] The top plate may be formed so as to include a depending sealing member. The sealing member may extend generally perpendicular to the parting line of the mould.

[0034] The method may further comprise the step of loading a label into the mould prior to injection moulding the body whereby to facilitate in-mould labelling of the body.

[0035] In some examples the present invention aims to reduce the costs by proposing a cap for a bottle intended to contain a fluid, the cap comprising at least a sealing portion (or top plate) and a lateral portion (or sidewall) intended to be fastened to the bottle, the sealing portion comprising along a direction substantially perpendicular to the lateral portion a first layer formed of unfoamed plastic material, a second layer formed of foamed plastic material and a third layer formed of unfoamed plastic material, the second layer being positioned between the first layer and the third layer.

[0036] Thus, the presence of the second layer made of 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.

[0037] The expression "foamable plastics material" is understood in the present document to mean plastics material which is capable of foaming, either naturally or deliberately (for example by movement of a mould part).

[0038] The expression "foamed region" is understood in the present document to mean an area of a closure wall (such as a top plate or a sidewall) which has been caused to foam deliberately i.e. by a specific step in a moulding process, such as movement of a mould part.

[0039] The expression "unfoamed plastics material" is understood in the present document to mean a solid plastic material corresponding to "unfoamed plastic material" or "plain material" (density R).

[0040] The expression "foamed material" means material which has been caused to expand by movement of a mould part and a pressure released while the material is locally still molten (density between 0,2R and 0,9R).

[0041] The expression "expanded material" means material which expands into a mould cavity without movement of the mould i.e. naturally "swelling" to fill a gap and naturally taking up any shrinkage (density between 0,9R and 0,99R).

[0042] Closures formed in accordance with the present invention can have one or more regions of: unfoamed material (intentionally unfoamed); expanded material (naturally foamed); and foamed material (intentionally foamed). Intentionally foamed regions will normally be formed from foamed as well as unfoamed material (e.g. a foamed core with unfoamed skins either side).

[0043] In the "thickness" of a foamed wall (e.g. top plate or side wall) may be a succession of: skin - foamed core - skin.

[0044] Closures formed in accordance with the present invention may be obtained from a formulation comprising at least one polyolefin, for example polypropylene or polyethylene.

[0045] Closures formed in accordance with the present invention may be obtained from a formulation comprising at least one propylene-based polyolefin and at least one foaming agent in a proportion of active components of between 0.3% and 2.5% by weight introduced with a carrier.

[0046] 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 foaming agent in dilute form in a matrix compatible with the resin converted. The homogenization and thermal activation of the foaming agent take place in a screw/barrel assembly.

[0047] When the cap is intended for applications in the food, pharmaceutical or paramedical field, the foaming agent is advantageously selected from endothermic agents such as citric acid, sodium bicarbonate or a mixture of these agents. In a preferred embodiment a mixture of citric acid and sodium bicarbonate is selected. The endothermic agent or mixture of endothermic agents is used in order to adjust the cell size.

[0048] In some examples, the closure may be formed from plastics material having a melt flow index in the range of 20 to 50 g/10 min.

[0049] Preferably, the formulation comprises 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/m2 in a notched Izod impact test at 23°C. These values are obtained according to the ISO 179/leA 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.

[0050] The material of foamed portions may comprise an expansion ratio of between 30% and 70%. This makes it possible to achieve sufficient flexural stiffness despite a reduced amount of material by increasing inertia.

[0051] The 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 top plate is critical considering the expansion ratio. If the thickness was smaller, the top plate could display failures in terms of mechanical stiffness so that the cap would not be able to be suitable for all uses.

[0052] According to one arrangement, the formulation used to manufacture closures in accordance with the present invention comprises 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-11®), a phosphate ester salt or a calcium metal salt (Hyperform® HPN-20E) in a proportion of between 300 and 1500 ppm.

[0053] 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.

[0054] Different aspects and embodiments of the invention may be used separately or together.

[0055] Further particular and preferred aspects of the present invention are set out in the accompanying independent and dependent claims.

[0056] The example embodiments are described 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.

[0057] Accordingly, while embodiment 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.

[0058] 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.

[0059] In the following description, all orientational terms, such as upper, lower, radially and axially, are used in relation to the drawings and should not be interpreted as limiting on the invention.

[0060] The present invention will now be more particularly described, by way of example, with reference to the accompanying drawings.

Figure 1 shows a core back moulding process used to form closures in accordance with embodiments of the present invention.

Figure 2 shows an alternative core back moulding process using an inside injection point and an external movable mould part.

Figure 3 shows an alternative moulding process with an inside injection point and a movable side core.

Figure 4 shows a further moulding process with an inside injection point and an external movable mould part.

Figure 5 illustrates an example of the difference between a standard cap and a cap formed using a core back moulding and foaming process.

Figure 6 illustrates an example of a section of a closure formed in accordance with the present inventior

Figure 7 illustrates an example of a closure not forming part of the present invention.

Figures 8 to 10 show closures formed in accordance with different embodiments of the present invention.

Figures 11 to 15 show a wide mouth closure formed in accordance with the present invention.

Figure 16 shows a closure not forming part of the present invention.

Figure 17 illustrates a sequential moulding process not forming part of the present invention.

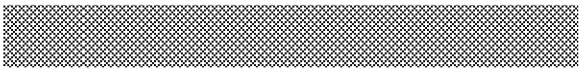
Figure 18 shows a known closure sidewall.

Figure 19 shows a closure sidewall according to an embodiment of the present invention.

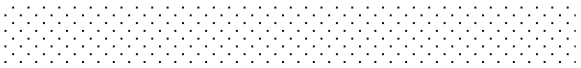
KEY:

[0061] Unfoamed Material (i.e. intentionally unfoamed)

[0062] Expanded Material (i.e. naturally foamed)



[0063] Foamed Material (i.e. intentionally foamed)



[0064] In Figure 1 a "core back" moulding process suitable for use as part of the present invention is shown.

[0065] In a first step molten (foamable) plastics material 5 is injected through a nozzle 10 into a cavity 15 formed by a fixed mould part 20 and a moving mould part 25.

[0066] In a second step the cavity fill is complete and a short holding phase is provided, during which time the outer skins of the plastics material cool and begin to solidify.

[0067] In a third step the moving mould part 25 is moved and the pressure drop causes foaming of the material in the enlarged cavity. As a result the material between the outer skins of the top plate 30 of the moulded closure foams.

[0068] In Figure 2 a similar core back foaming process is shown, except that in this embodiment the injection nozzle 110 is "inside" the mould cavity. This means that the mobile mould part 125 can be positioned on the other side of the closure top plate 130.

[0069] Figure 3 is similar to Figure 2, with an inside injection point. In this embodiment the core back movement is at the outside face of one side of the sidewall 235.

[0070] Figure 4 is also similar to Figure 2, with an exterior core back movement "above" the top plate 330. In Figures 2 and 4 the top plates 130, 330 include a depending annular seal 132, 332. In Figure 2 the movable mould part is

positioned so that the cavity gap is formed radially inwards of the seal 132. However, the present inventors have realised that it is possible to cause foaming of the top plate "above" the seal without causing foaming in the seal itself because the seal is perpendicular to the mould parting line (so they will maintain their dimensional integrity). Accordingly, in Figure 4 the movable mould part 325 is an outside part and extends wider than the seal. With an inside injection point and an outside core back function this means that a larger area can be foamed than with an inside injection/inside movement system and consequentially a larger area can be foamed.

[0071] Figures 5 and 6 illustrate some examples of foaming conducted in accordance with the present invention.

[0072] The closure 450 of Figure 7 does not form part of the invention. It includes a disc-shape top plate 455 and a generally cylindrical sidewall 460 depending from the periphery of the plate 455. The sidewall 460 includes an internal screw thread formation 462. The sidewall (excluding the thickness of the formation) is thinner than the top plate. The top plate 455 is unfoamed and the sidewall 460 is expanded.

[0073] In Figure 8 the closure 550 includes an expanded side wall 560. An annular plug seal 565 depends from the underside of the top plate 555. The top plate 555 includes a foamed core region 557 and an unfoamed region 559 (radially) outside of the core region 557. The seal 565 is located in the unfoamed region 559 so there is no foaming of the seal 565, which maintains dimensional repeatability and functional sealing performance.

[0074] Figure 9 shows a closure 650. Expanded material in the sidewall 660 is only in the region of the formation 662. The top plate 655 includes an unfoamed peripheral region 659 and a central region 657 with a foamed core. An annular seal 665 depends from the top plate in the region 659.

[0075] In Figure 10 the closure 750 includes a top plate 755 with a foamed core within the boundary of a sealing member 765, and an unfoamed, unexpanded sidewall 760.

[0076] Figures 11 and 12 show a jar lid generally indicated 850. The lid 850 comprises a generally disc shape top plate 855 and a cylindrical sidewall 820. The top plate 855 includes a disc-shape central region 857 and an inclined, shoulder-like peripheral region 859 which merges into the sidewall 860.

[0077] The region 859 includes a sealing arrangement comprising an annular crab claw seal 858.

[0078] Figure 12 shows the closure prior to foaming.

[0079] The closure is manufactured using a foamable plastics composition and by a core back process illustrated in Figure 13, in which part of the core corresponding to the central region moves to cause foaming. Foaming is thereby restricted so as to be within only the central region and therefore spaced from the seal (which remains unfoamed).

[0080] Figure 14 shows part of a closure similar to the closure of Figures 11 to 13. In this embodiment the thickness of the sidewall 860 is reduced. Because the entire closure is formed from a formulation containing a foaming agent, the material which enters the part of the mould cavity corresponding to the sidewall expands, avoiding sink marks.

[0081] Figure 15 shows a jar lid 800 formed according to a further embodiment. The lid 800 comprises a top plate 801 and a depending sidewall 802. An annular seal 803 depends from the top plate. A central region 804 of the top plate 801 is foamed (with a foamed core 804a sandwiched between outer skin layers 804b, 804c). The region 804 is inboard of the seal 803.

[0082] The sidewall 802 includes and internal screw thread formation 805. No specific foaming is induced in the sidewall. However, natural expansion of the inherently foamable material will compensate for any shrinkage in the area, in particular at the exterior of the sidewall adjacent the screw thread formation.

[0083] Figure 16 shows a closure 950 not forming part of the invention. The closure includes a top plate 955 with a depending sidewall 960. The sidewall 960 includes a screw thread formation 962. A separate sealing liner 970 is provided and fits under the top plate 955. The top plate 955 has a foamed region 957. The foamed region is restricted to be within a boundary defined by the radial extent of the formation 962.

[0084] Figure 17 shows a sequential moulding process not forming part of the invention, in which there is an initial injection moulding phase to form a closure body 1070, followed by a foaming phase to form a body. Following the foaming phase a layer of material 1075 is moulded over the body. This would allow, for example, a cheaper material to be used for the initial body followed by a more expensive "finish" material.

[0085] Figure 18 shows a known closure sidewall 1160 with an internal screw thread formation 1162. Conventionally the thickness t of the screw thread is no greater than 80% of the thickness f of the sidewall if sink marks in the exterior face of the sidewall "behind" the thread are to be avoided.

[0086] Referring to Figure 19, the present inventors have found that the relative thickness of a thread 1262 can be significantly increased with respect to a sidewall 1260 (i.e. the thickness of the sidewall can be reduced) by using a foamable plastics material. During the moulding process the foamable material expands to naturally counteract material shrinkage in the mould which would otherwise form sink marks in the exterior face of the sidewall.

[0087] 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 closure (750) comprising a top plate (755) and a sidewall (760) depending from the periphery of the top plate (755), the closure (750) including a sealing member (765) which depends from the top plate (755) within the sidewall (760), **characterised in that** the top plate (755) includes a foamed region which is restricted to be within a boundary defined by the radially inward extent of the sealing member (765), and **in that** the sealing member (765) is substantially unfoamed and located at an unfoamed region of the top plate (755), the unfoamed region radially outside of the foamed region.

2. A closure (750) as claimed in claim 1, in which the sealing member (765) is formed integrally with the top plate (755).

3. A closure (750) as claimed in claim 2, in which the sealing member (765) is a crab claw type seal (858) or a plug seal (565).

4. A closure (750) as claimed in claim 1, in which the sealing member (765) is formed separately from, and attached to, the top plate (755).

5. A closure (750) as claimed in claim 4, in which the sealing member (765) is a liner, the liner secured to the top plate (755) and defining a non-sealing region of the top plate (755) within the liner, in which at least part of the non-sealing region includes the foamed region.

6. A closure (750) as claimed in claim 5, in which the liner is generally disc-shaped.

7. A closure (750) as claimed in any of claims 1 to 5, in which the sealing member (765) is generally annular.

8. A closure (765) as claimed in any preceding claim, in which the extremity of the foamed region is spaced from the boundary defined by the radially inward extent of the sealing member (765) by between 0.5mm and 5mm, for example by between 1mm and 2mm.

9. A closure (765) as claimed in any preceding claim, in which the sidewall (760) comprises a screw thread formation (962), and in which the screw thread formation (962) extends radially inwards and in which the foamed region does not extend beyond a boundary defined by the radially inward extent of the formation (962).

10. A closure (765) as claimed in any preceding claim, the closure (765) formed from a foamable plastics material, the plastics material forming part of the top plate (755) being intentionally unfoamed and having an apparent density of R, the rest of the plastics material forming the top plate (755) being intentionally foamed and having an apparent density in the range of 0.2-0.9 * R, the sidewall (760) including a screw thread formation (962), the plastics material forming the sidewall (760) at least in the region of the screw thread formation (962) having an apparent density in the range 0.8-0.99 * R whereby shrinkage has been compensated by natural foaming.

11. A closure (765) as claimed in any preceding claim, in which the sidewall (760) is thinner than the top plate (755) before and/or after foaming, and in which the thickness of the sidewall (760) is down-gauged by 20% to 80%, for example by approximately 50%.

12. A closure (765) as claimed in any preceding claim, in which the sidewall (760) comprises a screw thread formation (962) having a depth that is more than 80% of, and is up to 120% of, the depth of the sidewall (760).

13. A closure (765) as claimed in any preceding claim, in which at least part of the sidewall (760) has a foamed region.

14. A method of forming a closure (765) according to any preceding claim, the method comprising the steps of:

    - providing an injection mould with a fixed mould part and a mobile mould part;
    - positioning the fixed and mobile mould parts to define a first gap;
    - injecting a foamable plastics material formulation to fill the first gap;
    - moving the mobile mould part to define a second gap so that the foamable plastics formulation expands to fill the second gap.

15. A method as claimed in claim 14, in which

- the foamable plastics material is injected using an inside injection point; and
- the mobile mould part is an external movable mould part.

16. A method as claimed in claim 14 or claim 15, further comprising an in-mould labelling step comprising the step of loading a label into the mould prior to injection of the foamable plastics material whereby to facilitate in-mould labelling of the closure (765).

Patentansprüche

1. Verschluss (750) mit einer oberen Platte (755) und einer Seitenwand (760), die von der Peripherie der oberen Platte (755) herabhängt, wobei der Verschluss (750) ein Dichtungselement (765) aufweist, das von der oberen Platte (755) innerhalb der Seitenwand (760) herabhängt, **dadurch gekennzeichnet, dass** die obere Platte (755) einen geschäumten Bereich aufweist, der so beschränkt ist, dass er sich innerhalb einer Grenze befindet, die durch die radiale innere Weite des Dichtungselements (765) definiert ist, und dass das Dichtungselement (765) im Wesentlichen ungeschäumt ist und sich an einem ungeschäumten Bereich der oberen Platte (755) befindet, wobei der ungeschäumte Bereich radial außerhalb des geschäumten Bereichs liegt.

2. Verschluss (750) nach Anspruch 1, bei dem das Dichtungselement (765) mit der oberen Platte (755) einstückig ausgebildet ist.

3. Verschluss (750) nach Anspruch 2, bei dem das Dichtungselement (765) eine Krabbenklauendichtung (858) oder eine Stopfendichtung (565) ist.

4. Verschluss (750) nach Anspruch 1, bei dem das Verschlusselement (765) separat von der oberen Platte (755) ausgebildet und an dieser befestigt ist.

5. Verschluss (750) nach Anspruch 4, bei dem das Dichtungselement (765) eine Auskleidung ist, wobei die Auskleidung an der oberen Platte (755) befestigt ist und einen nicht abdichtenden Bereich der oberen Platte (755) innerhalb der Auskleidung definiert, in dem zumindest ein Teil des nicht abdichtenden Bereichs den geschäumten Bereich einschließt.

6. Verschluss (750) nach Anspruch 5, bei dem die Auskleidung im Allgemeinen scheibenförmig ist.

7. Verschluss (750) nach einem der Ansprüche 1 bis 5, bei dem das Dichtungselement (765) im Allgemeinen ringförmig ist.

8. Verschluss (765) nach einem der vorhergehenden Ansprüche, bei dem das äußere Ende des geschäumten Bereichs von der Grenze, die durch die radial nach innen gerichtete Ausdehnung des Dichtungselements (765) definiert ist, zwischen 0,5 mm und 5 mm beabstandet ist, beispielsweise zwischen 1 mm und 2 mm.

9. Verschluss (765) nach einem der vorhergehenden Ansprüche, bei dem die Seitenwand (760) eine Schraubengewindeform (962) aufweist, und bei dem sich die Schraubengewindeform (962) radial nach innen erstreckt und bei dem der geschäumte Bereich sich nicht über eine Grenze hinaus erstreckt, die durch die radial nach innen gerichtete Ausdehnung der Ausbildung (962) definiert ist.

10. Verschluss (765) nach einem der vorhergehenden Ansprüche, wobei der Verschluss (765) aus einem schäumbaren Kunststoffmaterial gebildet ist, wobei das Kunststoffmaterial, das einen Teil der Deckplatte (755) bildet, absichtlich ungeschäumt ist und eine scheinbare Dichte von R hat, wobei der Rest des Kunststoffmaterials, das die Deckplatte (755) bildet, absichtlich geschäumt ist und eine scheinbare Dichte im Bereich von 0,2-0,9*R hat, wobei die Seitenwand (760) eine Schraubengewindeform (962) aufweist, wobei das die Seitenwand (760) bildende Kunststoffmaterial zumindest im Bereich der Schraubengewindeform (962) eine scheinbare Dichte im Bereich von 0,8-0,99*R aufweist, wobei die Schrumpfung durch natürliches Schäumen kompensiert wurde.

11. Verschluss (765) nach einem der vorhergehenden Ansprüche, bei dem die Seitenwand (760) vor und/oder nach dem Schäumen dünner ist als die Deckplatte (755), und bei dem die Dicke der Seitenwand (760) um 20% bis 80%, beispielsweise um etwa 50%, verringert ist.

12. Verschluss (765) nach einem der vorhergehenden Ansprüche, bei dem die Seitenwand (760) eine Schraubengewindeform (962) mit einer Tiefe aufweist, die mehr als 80% und bis zu 120% der Tiefe der Seitenwand (760) beträgt.

13. Verschluss (765) nach einem der vorhergehenden Ansprüche, bei dem zumindest ein Teil der Seitenwand (760) einen geschäumten Bereich aufweist.

14. Verfahren zum Bilden eines Verschlusses (765) nach einem der vorhergehenden Ansprüche, wobei das Verfahren folgende Schritte aufweist:

- Bereitstellen einer Spritzgussform mit einem festen Formteil und einem beweglichen Formteil;
- Positionieren der festen und beweglichen Formteile, um einen ersten Spalt zu definieren;
- Einspritzen einer schäumbaren Kunststoffmasse, um die erste Lücke zu füllen;
- Bewegen des beweglichen Formteils, um einen zweiten Spalt zu definieren, so dass sich die schäumbare Kunststoffmasse ausdehnt, um den zweiten Spalt zu füllen.

15. Verfahren nach Anspruch 14, bei dem

- das schäumbare Kunststoffmaterial über einen inneren Einspritzpunkt eingespritzt wird, wobei
- das bewegliche Formteil ein äußeres bewegliches Formteil darstellt.

16. Verfahren nach Anspruch 14 oder 15, weiterhin aufweisend einen In-Mould-Etikettierungs-Schritt mit dem Schritt des Einlegens eines Etiketts in die Form vor dem Einspritzen der schäumbaren Kunststoffmasse zur Erleichterung der In-Mould-Etikettierung des Verschlusses (765).

Revendications

1. Moyen d'obturation (750) comprenant une plaque de sommet (755) et une paroi latérale (760) qui est dépendante de la périphérie de la plaque de sommet (755), le moyen d'obturation (750) incluant un élément d'étanchéité (765) qui est dépendant de la plaque de sommet (755) à l'intérieur de la paroi latérale (760), **caractérisé en ce que** la plaque de sommet (755) inclut une région alvéolaire qui est restreinte de manière à ce qu'elle soit à l'intérieur d'une frontière qui est définie par l'étendue radialement interne de l'élément d'étanchéité (765), et **en ce que** l'élément d'étanchéité (765) est sensiblement non alvéolaire et est localisé au niveau d'une région non alvéolaire de la plaque de sommet (755), la région non alvéolaire s'étendant radialement à l'extérieur de la région alvéolaire.

2. Moyen d'obturation (750) tel que revendiqué selon la revendication 1, dans lequel l'élément d'étanchéité (765) est formé d'un seul tenant avec la plaque de sommet (755).

3. Moyen d'obturation (750) tel que revendiqué selon la revendication 2, dans lequel l'élément d'étanchéité (765) est une étanchéité du type en pince de crabe (858) ou une étanchéité en bouchon (565).

4. Moyen d'obturation (750) tel que revendiqué selon la revendication 1, dans lequel l'élément d'étanchéité (765) est formé séparément de la plaque de sommet (755) et lui est fixé.

5. Moyen d'obturation (750) tel que revendiqué selon la revendication 4, dans lequel l'élément d'étanchéité (765) est un chemisage, le chemisage étant fixé de façon ferme et sécurisée à la plaque de sommet (755) et définissant une région de non étanchéité de la plaque de sommet (755) à l'intérieur du chemisage, dans lequel au moins une partie de la région de non étanchéité inclut la région alvéolaire.

6. Moyen d'obturation (750) tel que revendiqué selon la revendication 5, dans lequel le chemisage présente la forme générale d'un disque.

7. Moyen d'obturation (750) tel que revendiqué selon l'une quelconque des revendications 1 à 5, dans lequel l'élément d'étanchéité (765) présente une forme générale annulaire.

8. Moyen d'obturation (765) tel que revendiqué selon l'une quelconque des revendications précédentes, dans lequel l'extrémité de la région alvéolaire est espacée de la frontière qui est définie par l'étendue radialement interne de l'élément d'étanchéité (765) d'une distance entre 0,5 mm et 5 mm, par exemple d'une distance entre 1 mm et 2 mm.

9. Moyen d'obturation (765) tel que revendiqué selon l'une quelconque des revendications précédentes, dans lequel la paroi latérale (760) comprend une formation de filet de vissage (962), et dans lequel la formation de filet de vissage (962) s'étend radialement vers l'intérieur et dans lequel la région alvéolaire ne s'étend pas au-delà d'une frontière qui est définie par l'étendue radialement interne de la formation (962).

10. Moyen d'obturation (765) tel que revendiqué selon l'une quelconque des revendications précédentes, dans lequel le moyen d'obturation (765) est formé à partir d'une matière plastique pouvant être rendue alvéolaire, la matière plastique formant une partie de la plaque de sommet (755) qui est intentionnellement non alvéolaire et qui présente une densité apparente de R, le reste de la matière plastique formant la plaque de sommet (755) qui est intentionnellement alvéolaire et qui présente une densité apparente dans la plage de 0,2 à 0,9 * R, la paroi latérale (760) incluant une formation de filet de vissage (962), la matière plastique qui forme la paroi latérale (760) au moins dans la région de la formation de filet de vissage (962) présentant une densité apparente dans la plage de 0,8 à 0,99 * R, d'où il résulte qu'un retrait a été compensé par l'effet naturel des alvéoles.

11. Moyen d'obturation (765) tel que revendiqué selon l'une quelconque des revendications précédentes, dans lequel la paroi latérale (760) est plus mince que la plaque de sommet (755) avant et/ou après la formation des alvéoles, et dans lequel l'épaisseur de la paroi latérale (760) est réduite de 20 % à 80 %, par exemple d'approximativement 50 %.

12. Moyen d'obturation (765) tel que revendiqué selon l'une quelconque des revendications précédentes, dans lequel la paroi latérale (760) comprend une formation de filet de vissage (962) qui présente une profondeur qui est supérieure à 80 % de la profondeur de la paroi latérale (760) et qui va jusqu'à 120 % de cette même profondeur de la paroi latérale.

13. Moyen d'obturation (765) tel que revendiqué selon l'une quelconque des revendications précédentes, dans lequel au moins une partie de la paroi latérale (760) comporte une région alvéolaire.

14. Procédé de formation d'un moyen d'obturation (765) selon l'une quelconque des revendications précédentes, le procédé comprenant les étapes constituées par :

- la fourniture d'un moule à injection qui comporte une partie de moule fixe et une partie de moule mobile ;
- le positionnement des parties de moule fixe et mobile de manière à définir un premier espace ;
- l'injection d'une formulation de matière plastique pouvant être rendue alvéolaire de manière à ce qu'elle remplisse le premier espace ; et
- le déplacement de la partie de moule mobile de manière à définir un second espace de telle sorte que la formulation de matière plastique pouvant être rendue alvéolaire prenne du volume par expansion pour remplir le second espace.

15. Procédé tel que revendiqué selon la revendication 14, dans lequel :

- la matière plastique pouvant être rendue alvéolaire est injectée en utilisant un point d'injection interne ; et
- la partie de moule mobile est une partie de moule déplaçable ou amovible externe.

16. Procédé tel que revendiqué selon la revendication 14 ou la revendication 15, comprenant en outre une étape d'étiquetage dans le moule qui comprend l'étape qui consiste à charger une étiquette à l'intérieur du moule avant l'injection de la matière plastique pouvant être rendue alvéolaire, d'où il résulte que l'étiquetage dans le moule du moyen d'obturation (765) est facilité.

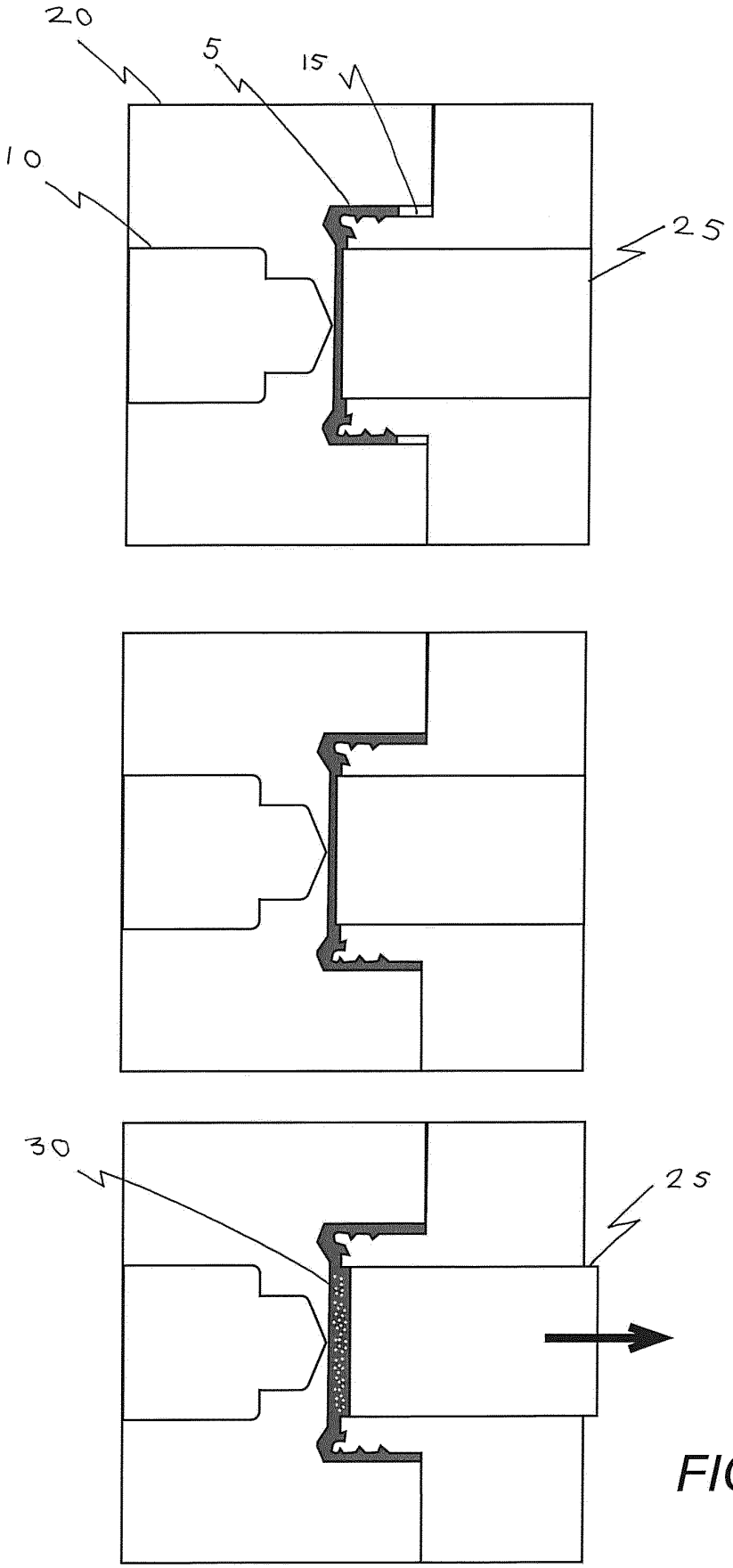


FIGURE 1

FIGURE 2

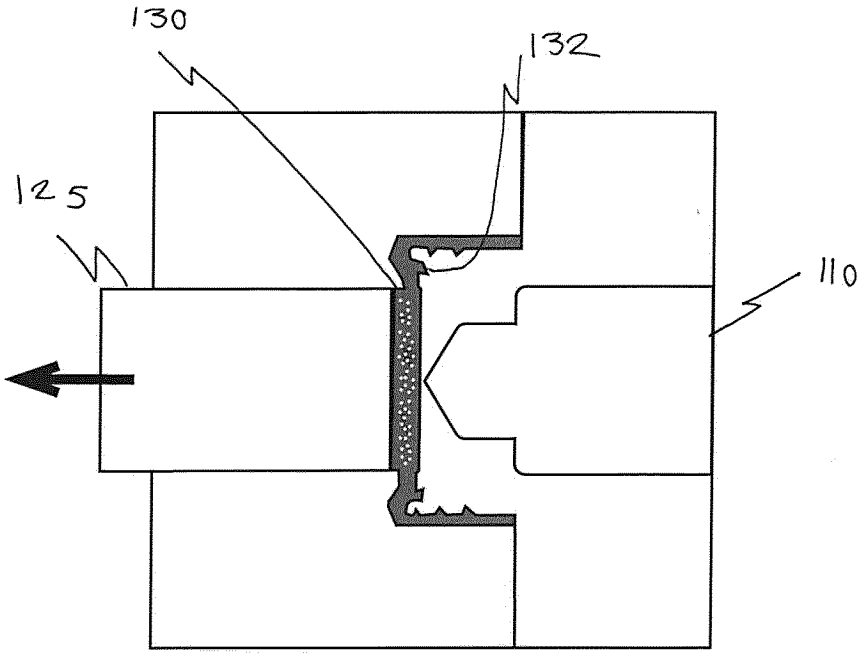
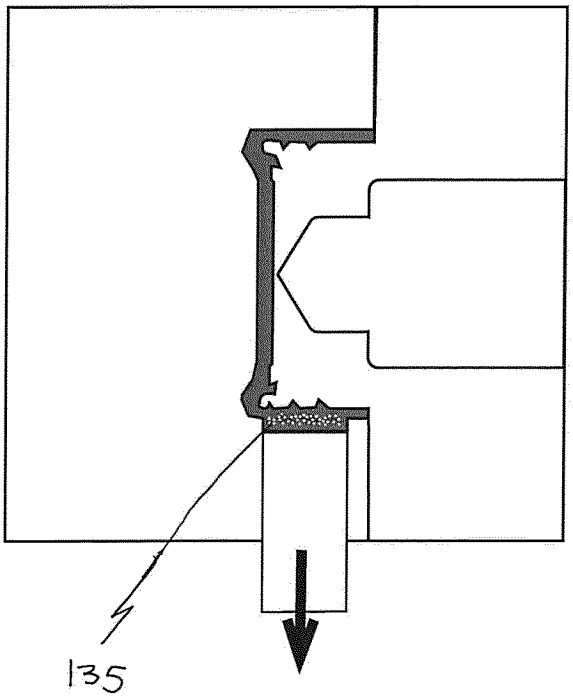


FIGURE 3



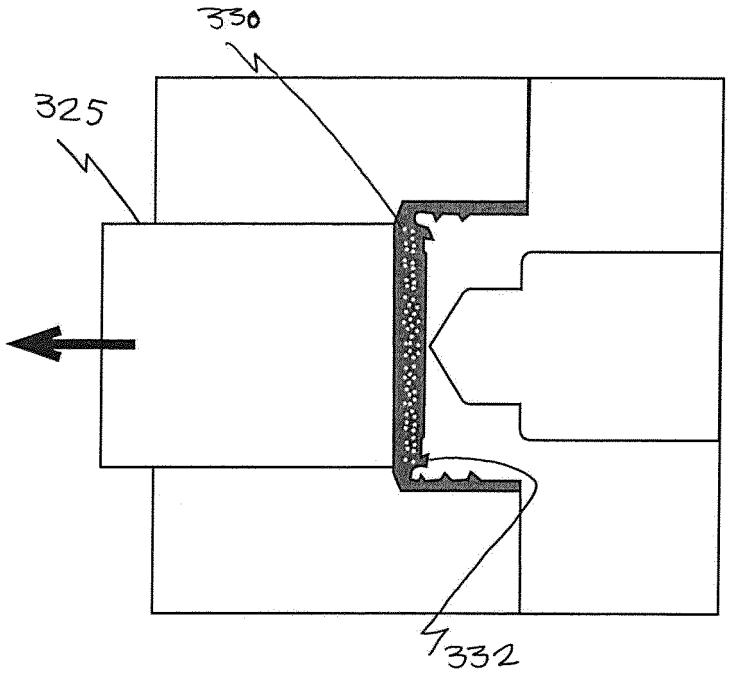


Figure 4

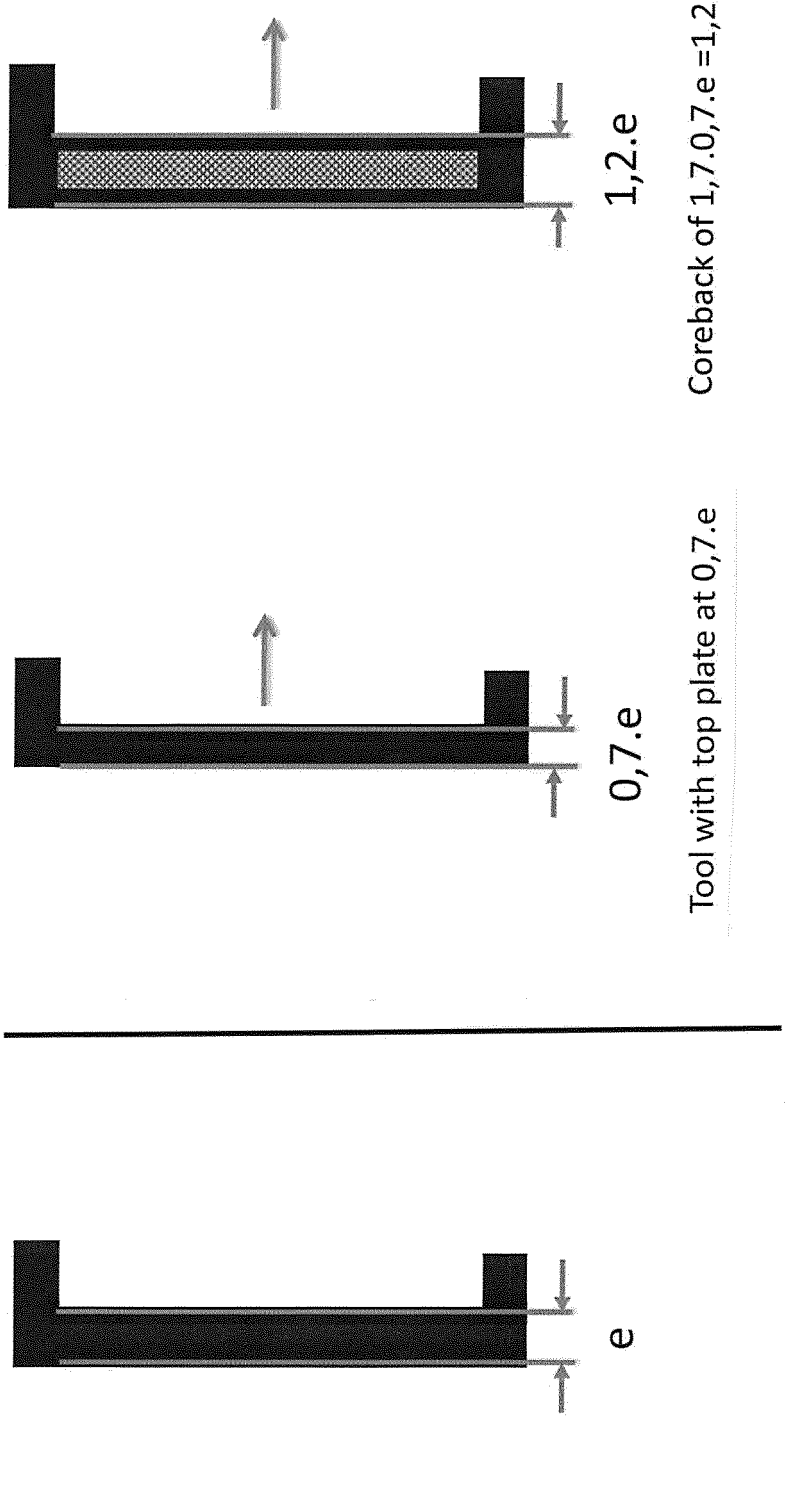

1,2.e
Coreback of 1,7.0,7.e =1,2 e
0,7.e
Tool with top plate at 0,7.e
e
Cap with coreback
Standard cap

Figure 5

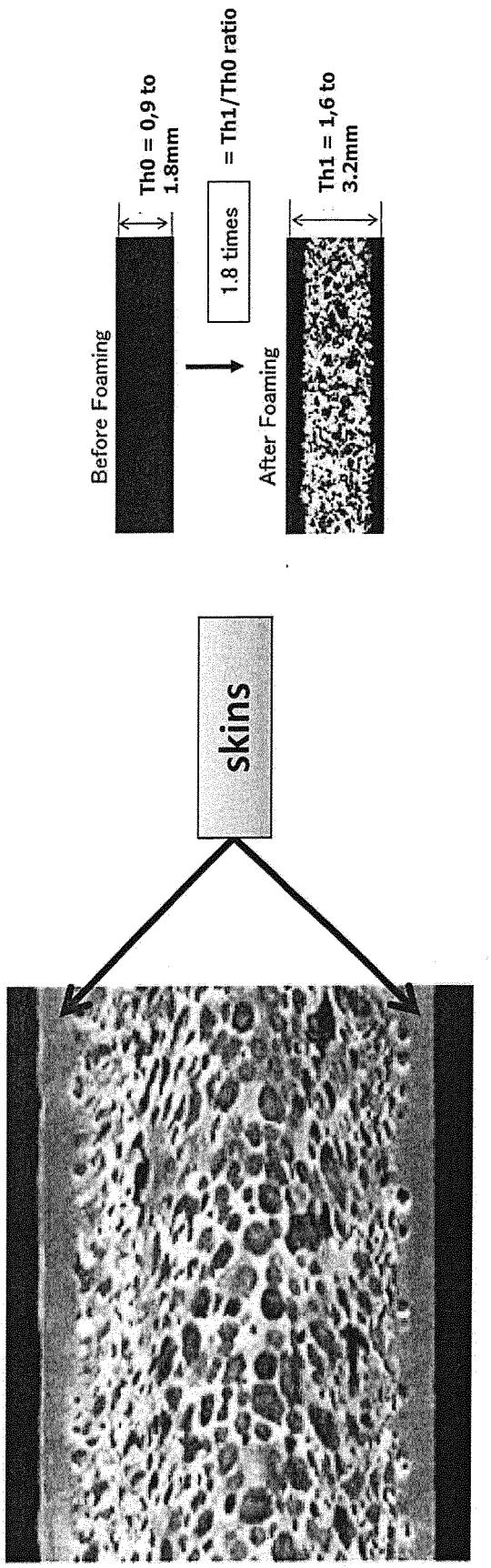

Th0 = 0,9 to 1.8mm
= Th1/Th0 ratio
1.8 times
Th1 = 1,6 to 3.2mm
Before Foaming
After Foaming
skins

Figure 6

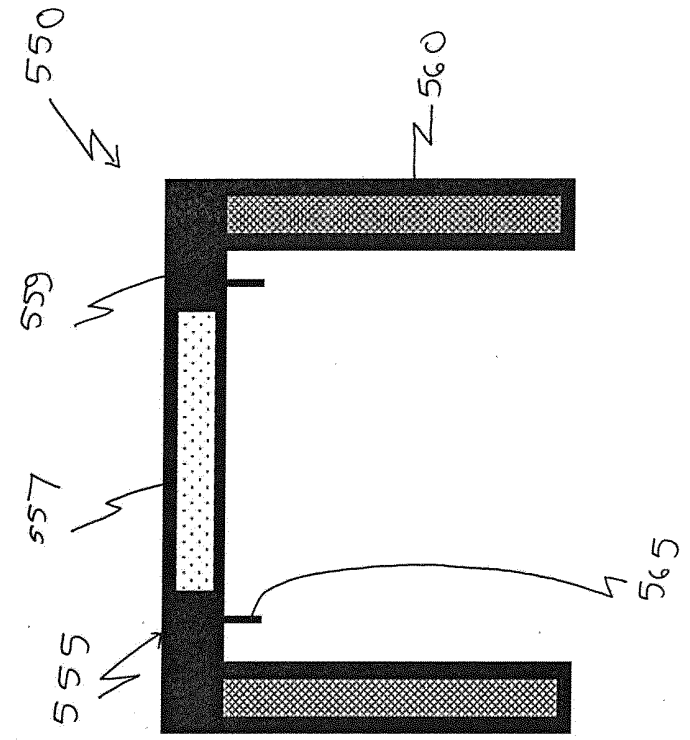


Figure 8

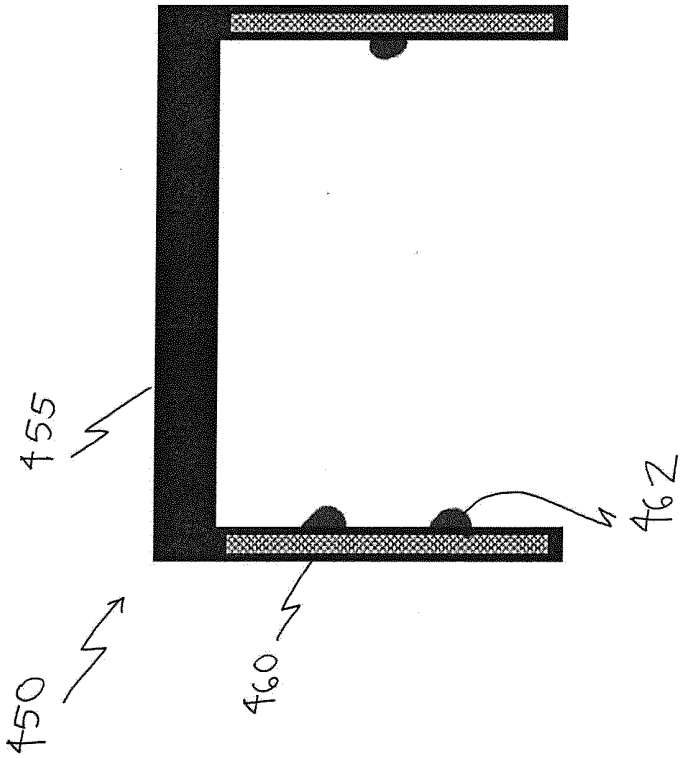


Figure 7

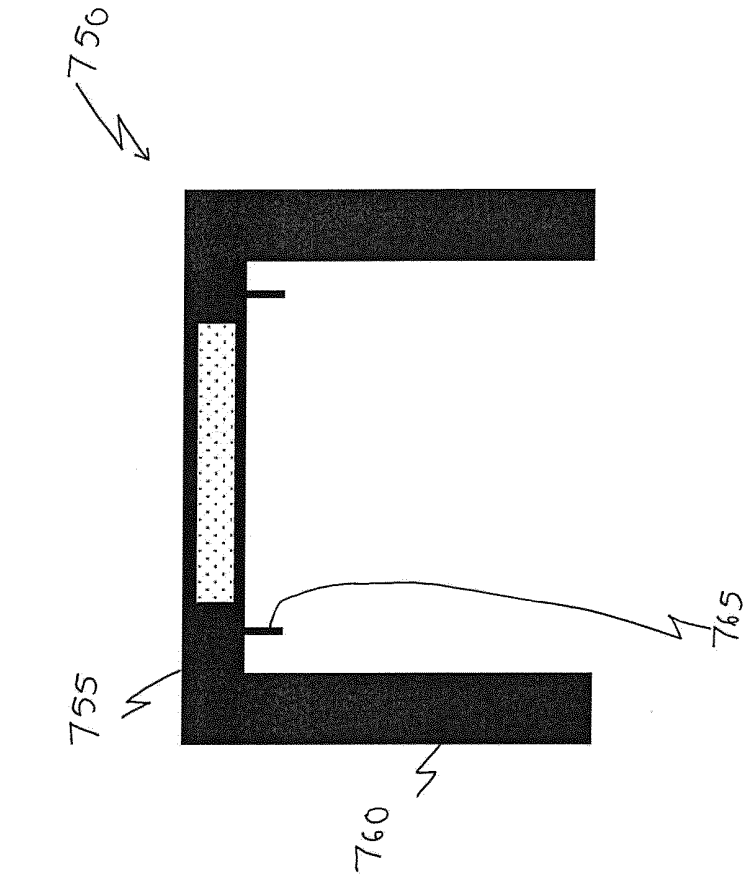


Figure 10

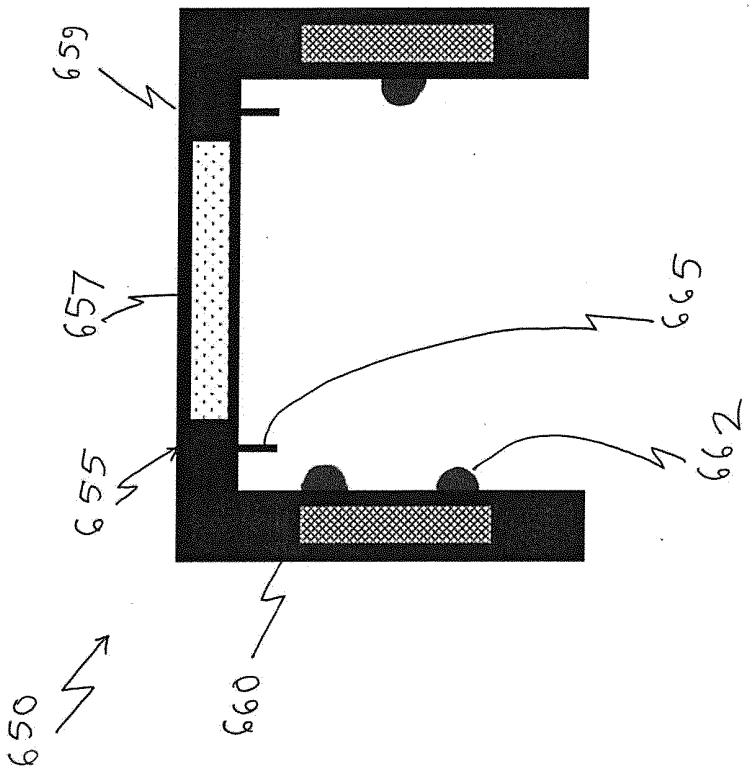


Figure 9

FIGURE 11

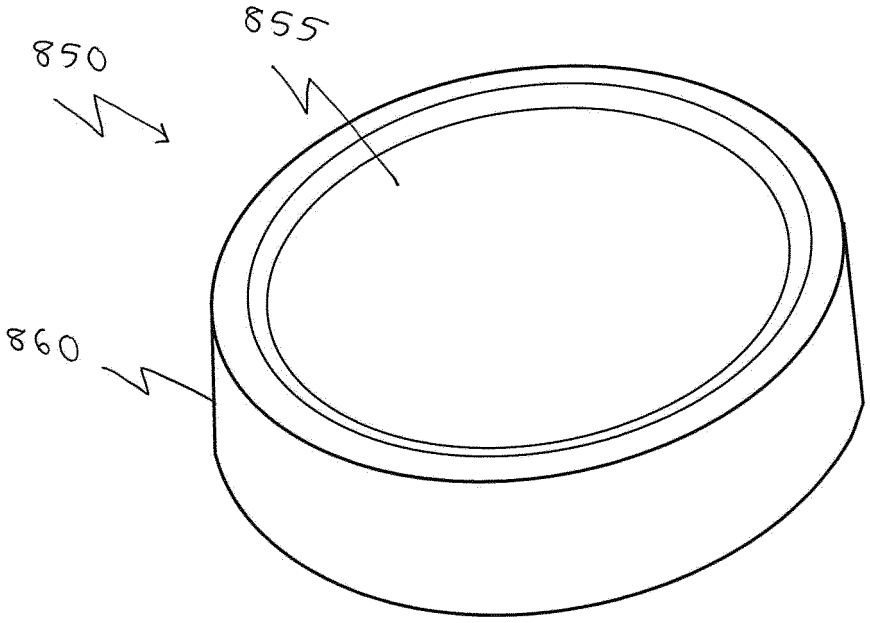
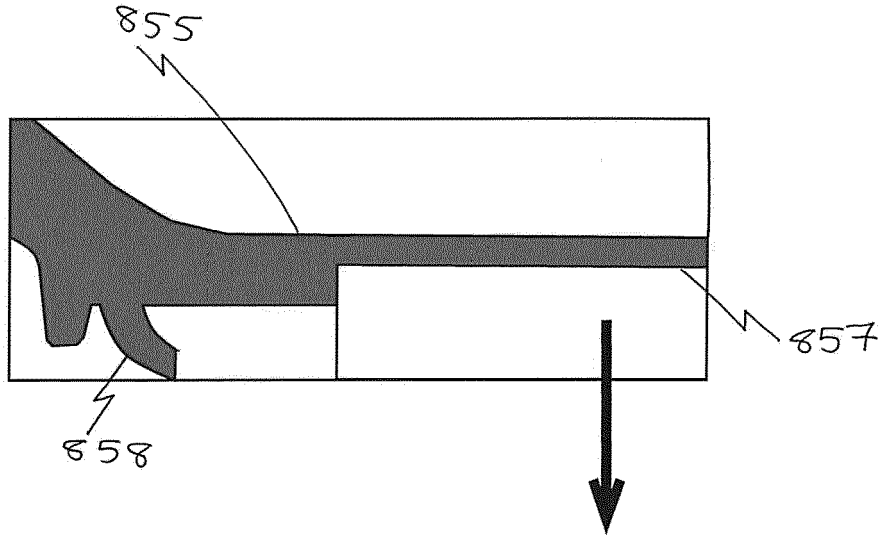


FIGURE 12



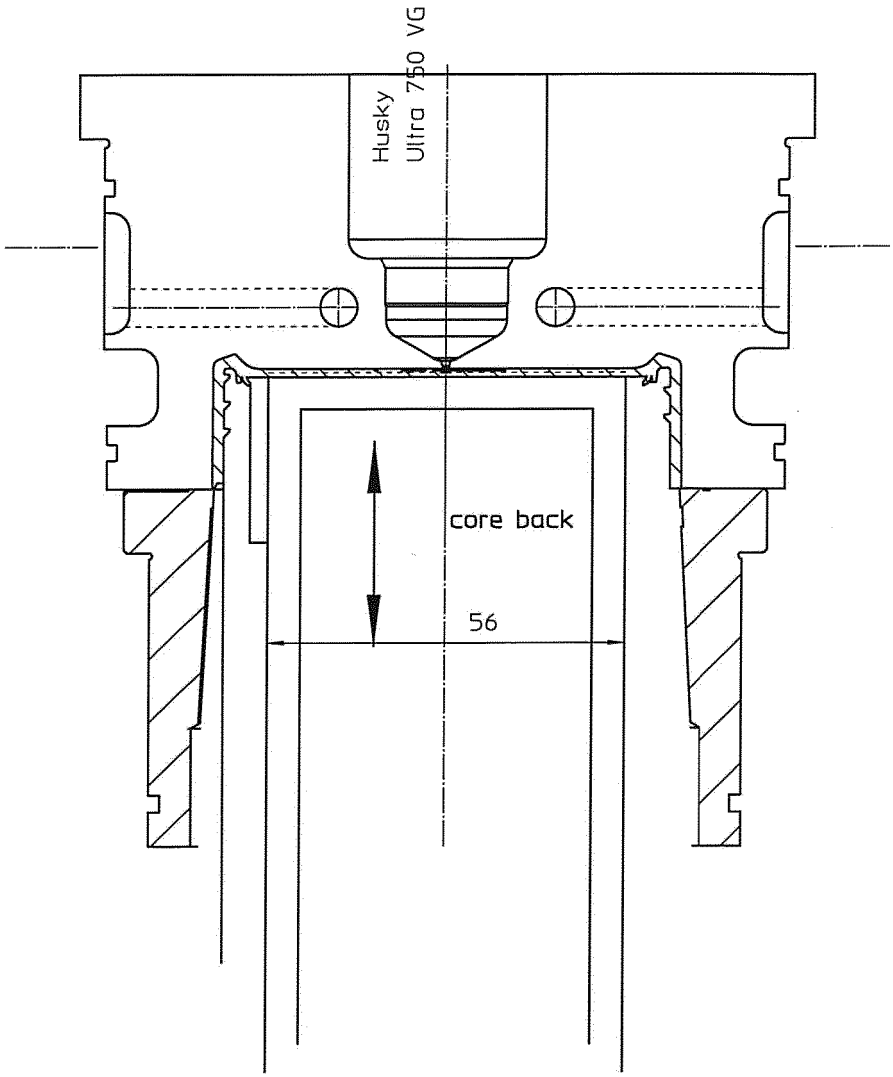


Figure 13

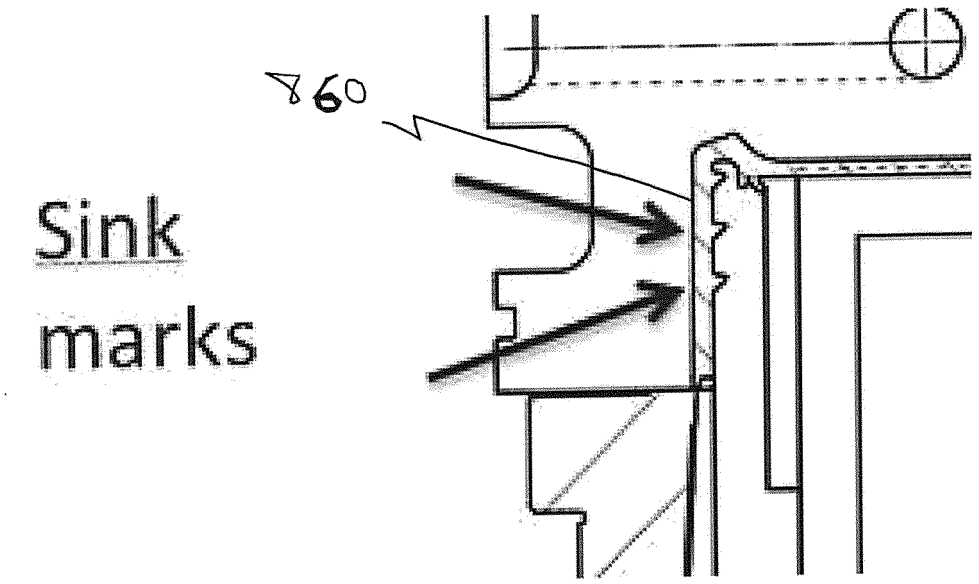


Figure 14

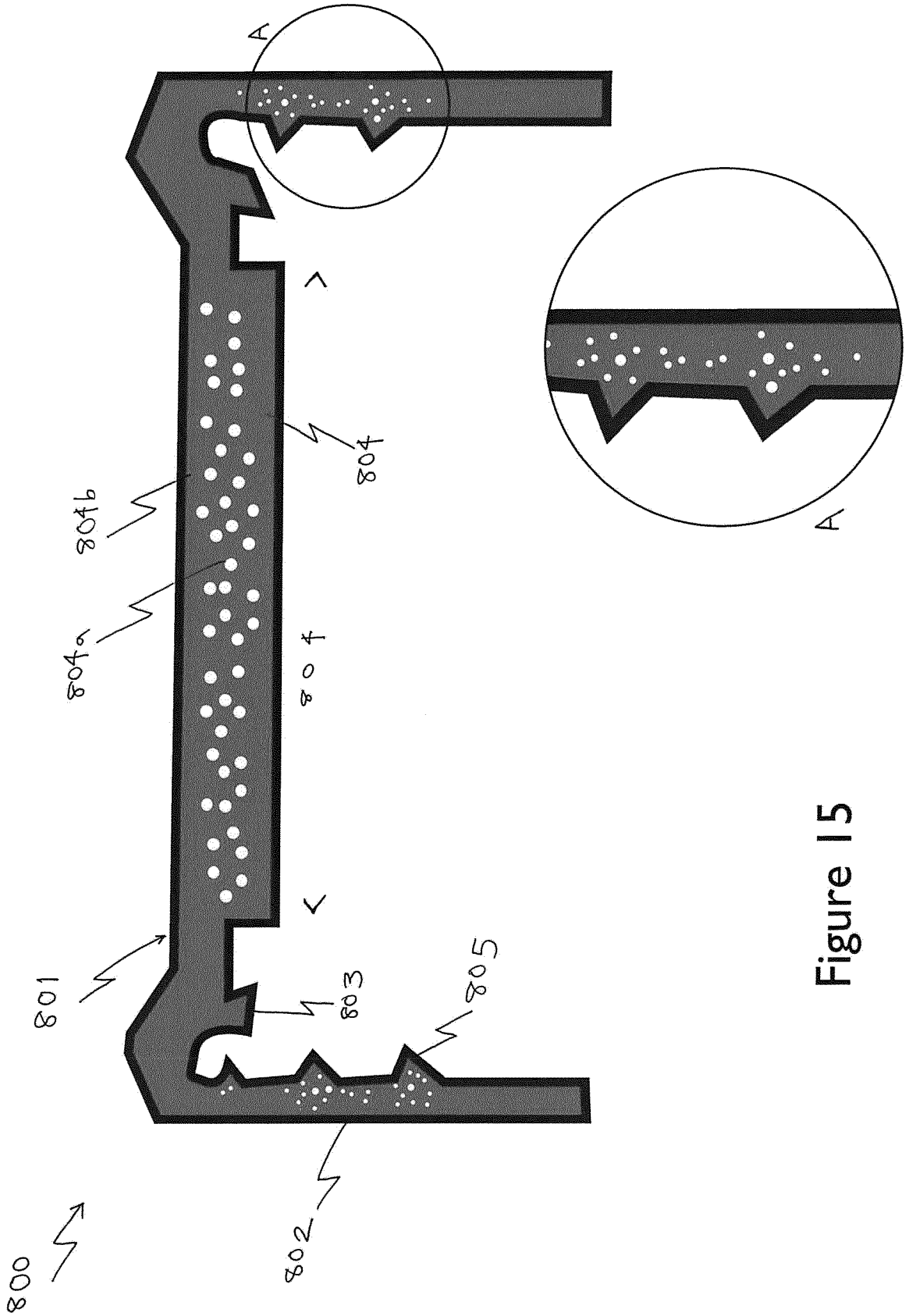


Figure 15

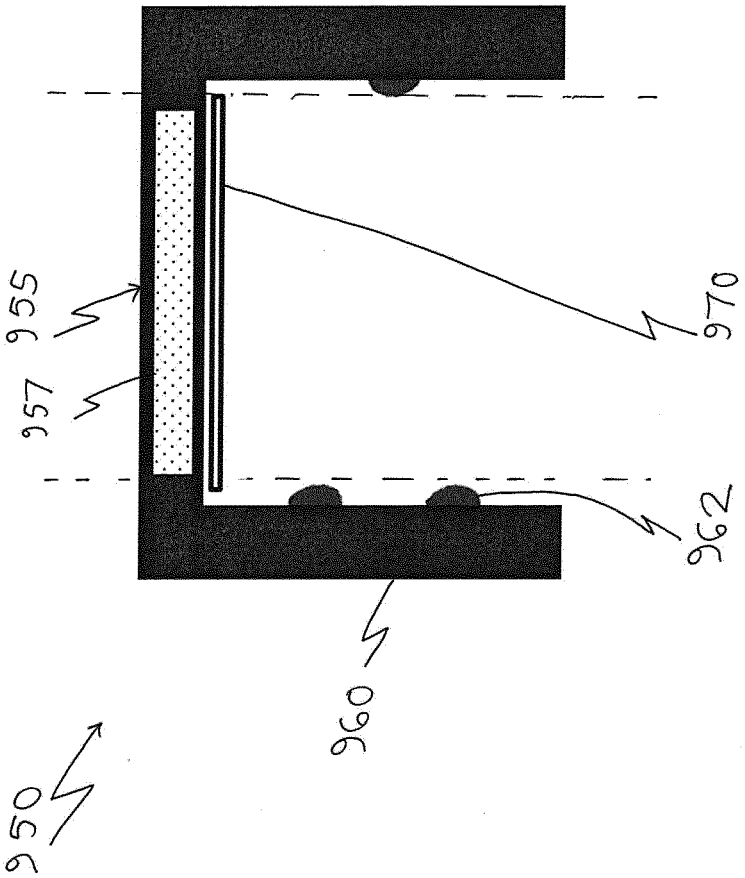


Figure 16

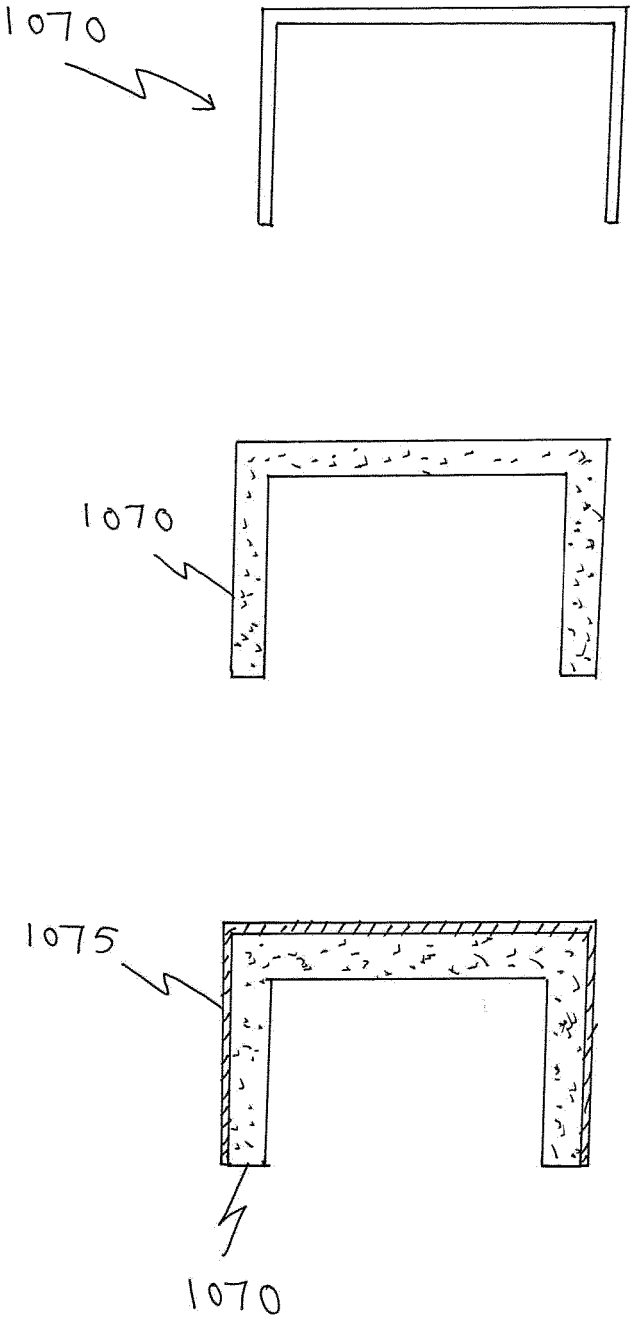


Figure 17

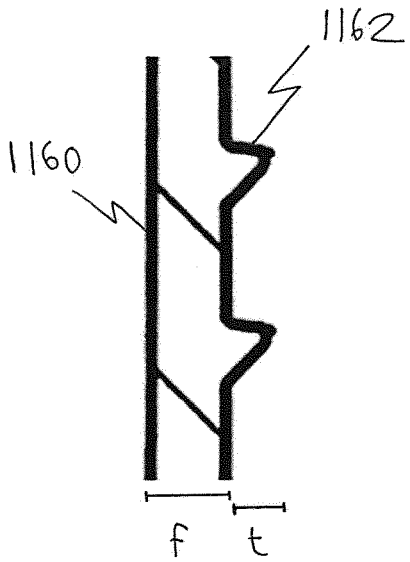


Figure 18

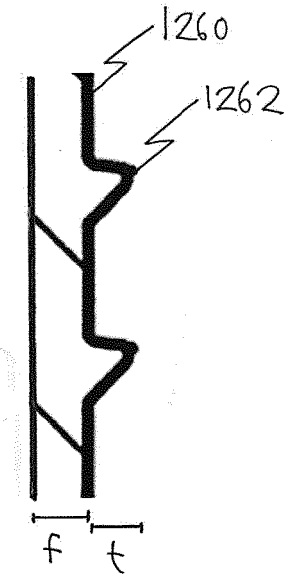


Figure 19

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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