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(54) **Container**

(57) A container has wall means (52', 53', 54') made by deforming a thermoformable sheet material (100) and defining a cavity (51) that is suitable for receiving a product (80) and is closed by a further sheet material (200); the wall means (52', 53', 54') comprises a portion that is deformable for varying an internal volume of said cavity (51) and further comprises a side wall (53'), a bottom wall (52') and a connecting wall (54'), the connecting wall (54') being interposed between the side wall (53') and the bottom wall (52'), the deformable portion comprising the bottom wall (52'); the bottom wall (52'), excluding a peripheral portion (52a') thereof, has a thickness that is substantially the same thickness of side wall (53') and has a substantially cap shape, a thickness of said peripheral portion (52a') and of said connecting wall (54') being thinner than a thickness of said side wall (53').

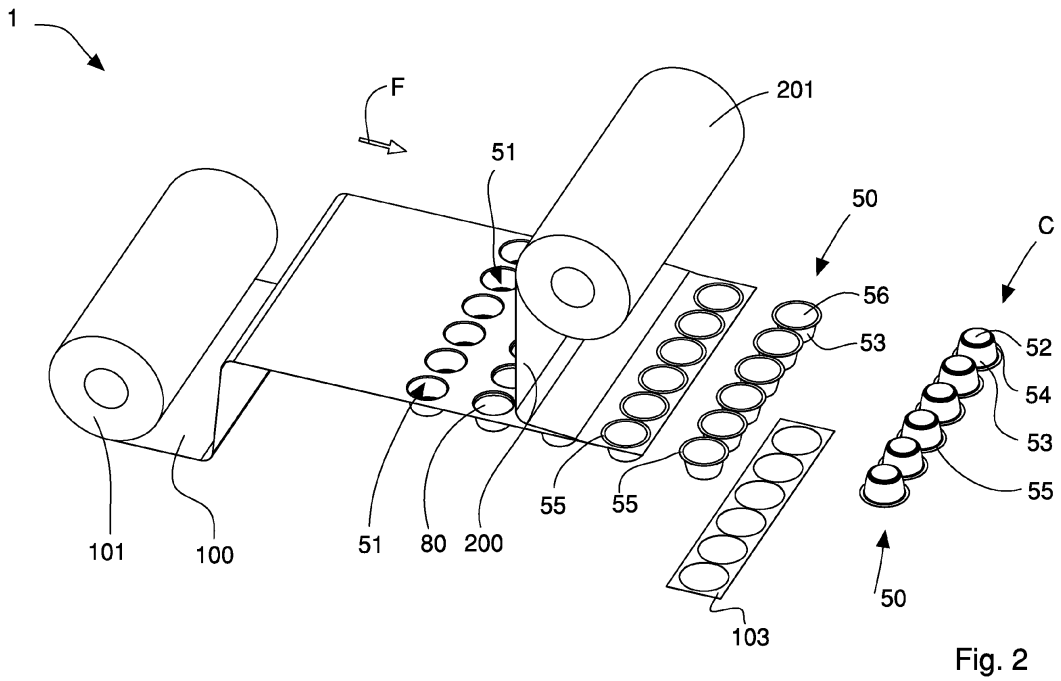

Fig. 2

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Description

[0001] The present invention relates to processes and containers for packaging products, in particular, refers to a container that is obtained from sheet material by a hot-deformation process, hot-filled with a product and hermetically closed.

[0002] Thermoformed containers for products are known, for example for food products, comprising a shell or cavity in which a product is batched and a sheet or film which is coupled along an upper peripheral edge of the shell, by welding, to close the container hermetically.

[0003] In packaging of food products that are not in liquid, fluid or semisolid form, for example drinks, juices and the like, in order to ensure the hygiene and asepticity of the process, it is necessary to proceed, in the case of cold-filling of the containers with the product, to a preventive sterilisation of both the material to be thermoformed and/or of the thermoformed container and of the closing film, before the aforesaid filling. For this purpose, the materials have to be suitable for sterilisation treatment, which is generally performed by using hydrogen peroxide in liquid form as a sterilising agent.

[0004] These sterilising processes are nevertheless complex and costly to achieve and to incorporate in the container production and filling process. Further, remnants of sterilising agent remain on the sterilised materials that may determine variations in the appearance and in the surface finish of the containers.

[0005] Packaging processes are known in which a high degree of hygiene and asepticity is ensured by hot-filling of the containers with the product to be packaged. The product to be packaged is preventively sterilised at a high temperature, typically 70-80°C, and is maintained at this temperature even during filling of the containers, which are subsequently closed hermetically.

[0006] The high temperature of the product in fact enables the container to be purified, air to be extracted from the container (which is in a vacuum when cooling has occurred) and gives stability to the product, inactivating enzymes and microorganisms.

[0007] In order to achieve hot-filling of a food product, it is nevertheless necessary to use suitable stiff containers that are able to withstand the thermal change and the subsequent mechanical stresses.

[0008] In the case of containers obtained by thermoforming sheet material made of plastics, it is necessary to use a material having appropriate thermal resistance and a sufficiently great thickness to prevent the container, during the cooling step, from becoming deformed or even imploding due to the vacuum that is created in the interior of the container. Such materials are, however, very costly.

[0009] A further drawback of these containers consists of the fact that the thermoforming process for thermoforming these sheet materials is more complex and costly.

[0010] US 2736656 discloses a method for manufacturing and filling packages for individual servings of foods. A strip of thermoplastic material is subjected to the action of heat, pressure and suitable forming dies to form a succession of cups having side walls, bottom walls and a border of undeformed strip material. The cups are filled with a product and a cover of elastic plastic material is sealed to the border strip surrounding the individual cups. The cup packages so formed are severed form the strip ready for the use. The cover and the bottom wall of the cup are deformable so as to allow a contraction of the air inside the cup (i.e. when the hot filled product cools) or to allows the expansion of the air inside the cup (i.e. when exterior air pressure decreases).

[0011] WO 93/24391 discloses a container comprising a side wall, a base and means for sealing the container. The base includes a standing ring on which the container is adapted to stand and a diaphragm portion which extends from the inner edge of the standing ring thus forming a central portion of the base of the container. The diaphragm portion is adapted to axially deform by bowing either inwardly or outwardly preferentially to the side wall so to accommodate changes in pressure in the container wherein the portion of the diaphragm adjacent to and extending from the inner edge of the standing ring is substantially continuous.

[0012] An object of the present invention-is to improve the known containers made by forming sheet material, in particular increasing the mechanical resistance of the containers and lowering the manufacturing costs of the containers.

[0013] Another object is to make containers that are suitable for hot-filling and that ensure a high degree of protection to the contained product.

[0014] According to the invention a container is provided as defined in claim 1.

[0015] The container has wall means made through deformation of thermoformable sheet material and defining a cavity suitable for receiving a product, said cavity being closed by further sheet material; the wall means comprises a deformable portion for varying an internal volume of said closed cavity. This portion, in particular, is elastically deformable and can fold inwards said cavity so as to reduce said internal volume for compensating a variation in the volume, in particular due to cooling of said hot batched product.

[0016] The wall means of the cavity comprises a side wall, a bottom wall and a connecting wall, the connecting wall being interposed between said side wall and said bottom wall. The deformable portion comprises at least the bottom wall that can be deformed or collapsed in a controlled manner from an initial configuration, in which the bottom wall is convex and curved outwards said cavity, and a final configuration, in which the bottom wall is concave and curved inwards said cavity.

[0017] The localised and partial deformation of the container is made possible by the shape of the bottom wall and of the suitably shaped connecting wall and by the reduced thickness of the aforesaid walls, which have an elasticity and a flexibility that are greater than those of

the side wall.

[0018] Owing to the invention, it is possible to make a container to be subsequently hot-filled with a product, in particular a food product, using any sheet material that is suitable for alimentary use and resistant to the temperature of the batched product, and having a thickness that would cause the known containers to be deformed or broken.

[0019] The deformable portion in fact, by becoming deformed in a controlled manner, ensures the integrity and structural stability of the container, which, hot-filled and hermetically closed, ensures a high degree of protection for the contained product.

[0020] The invention can be better understood and implemented with reference to the attached drawings, which show some embodiments thereof by way of non-limiting example, in which:

Figure 1A is a schematic front view of an apparatus to make the containers of the invention;
Figure 1B is a schematic perspective view of the apparatus in Figure 1A;
Figure 2 is a schematic perspective view of a thermoformable sheet material subjected to a plurality of operating steps of a method for making the containers of the invention;
Figures 3A, 3B are respectively front and perspective views of a container of the invention obtained by thermoforming the sheet material in Figure 2;
Figure 4 is a section view according to plane IV-IV in Figure 2A, in which the container is filled with a product;
Figures 5A, 5B are section views of the container in Figure 4, closed by further sheet material in a respectively partial and complete manner;
Figures 6 is an enlarged view of a detail of the container of Figure 5 showing wall portions of said container;
Figures 7A, 7B are respectively front and perspective views of the closed container in
Figure 6 overturned and having a bottom wall facing upwards, in an initial outward curved configuration;
Figure 8 is a section view according to plane VIII-VIII in Figure 7A;
Figure 9 is a section view of the container in Figure 7A in which the bottom wall is in a final inward curved configuration;
Figure 10 is an enlarged partial section view of a version of the container that is not part of the present invention;
Figure 11 is an enlarged partial section view of the container of the invention.

[0021] With reference to Figures 1A and 1B, there is illustrated an apparatus 1 for making and then filling with product 80 containers 50 obtained by thermoforming from sheet material 100, for example material made of plastics.

[0022] The sheet material 100 unwound from a reel 101 is moved, for example in an indexed manner, by advance means 19 along an advance direction F through a plurality of operating stations indicated below:

- a heating station 7 where heating means 8 heats the sheet material 100 to a temperature near the softening temperature;
- a forming station 2 in which forming means 3 deforms portions of the sheet material 100 that define cavities 51;
- a filling station 4 in which the cavities 51 receive a product 80 to be packaged;
- a closing station 5 in which a further sheet material 200 is superimposed on and fixed to said sheet material 100 to close the cavities 51;
- a blanking station 11 in which cutting means 12 separates from the sheet material 100 formed, filled and closed containers 50; and
- an overturning station 13 in which said containers 50 are rotated by 180° so as to have a respective bottom wall 52 facing upwards.

[0023] The forming means 3 may comprise mechanical forming means, such as drawing tools or punches and/or pneumatic forming means, such as compressed-air dispensing nozzles. The forming means 3 makes on the sheet material 100 a plurality of cavities 51 arranged in one or more rows that are substantially orthogonal to the advance direction F.

[0024] In particular, the forming means 3 is configured so as to make a cavity 51, for example shaped as a glass, provided with wall means comprising a bottom wall 52, a side wall 53 and a connecting wall 54.

[0025] The bottom wall 52 has a shape that is substantially externally convex in a direction opposite to that of the sheet material 100, in an initial outward curved configuration E. The bottom wall 52 forms, for example, a cap surface, with a double curve.

[0026] The bottom wall 52 is connected to the side wall 53 of said cavity 51 by the connecting wall 54 of a substantially annular shape.

[0027] The side wall 53 forms, for example, a cylindrical or conical surface.

[0028] The connecting wall 54 comprises a first portion 54a, connected to the side wall 53 and a second portion 54b that forms a resting surface lying on a plane A that is substantially parallel to the sheet material 100 and is connected to a peripheral portion 52a of the bottom wall 52.

[0029] The bottom wall 52 is shaped so as to form a deformable portion of said wall means.

[0030] In the filling station 4 the cavities 51 are filled with hot-batched product 80 up to a preset level (Figure 4).

[0031] Inserting means 9 is provided in the closing station 5 for spreading said further sheet material 200 and superimposing the further sheet material 200 on the

sheet 100, so as to close the aforesaid cavities 51. The further sheet material 200 is, for example, a film of coupled aluminium or plastics unwound from a further reel 201.

[0032] The closing station 5 further comprises welding means 10 that performs a welding, for example a "peelable" welding, between the sheet material 100 and the further sheet material 200. More precisely, the welding means 10 performs welding on an edge portion 55 of each cavity 51, said edge portion 55 having a substantially annular shape and a substantially constant width. Welding allows to close hermetically the cavity 51 that in this manner encloses a defined quantity of batched product 80 and an initial volume 81 of air at the same temperature as the product (Figure 5B).

[0033] In the blanking station 11, the cutting means 12 performs a shaped blanking and separates the thermoformed, filled and closed containers 50 from the sheet material 100 and from the further sheet material 200. The blanking scraps 103 are discharged outside the apparatus. The cutting means 12 is of known type and is not illustrated in detail, can be of hot-shaped dinking die, punch-die, or longitudinal and transverse blades cutting type.

[0034] The cutting means 12 can be configured so as to obtain from the sheet material 100 a plurality of separate and distinct containers 50. Each container 50 that is thus obtained has an edge portion 55 on which a respective cover 56 is welded that is obtained by blanking from said further sheet material 200. The edge portion 55 forms a protruding annular edge by means of which the container 50 can be grasped and supported during movement.

[0035] In an embodiment that is not illustrated, the cutting means 12 is arranged to separate from the sheet 100 a row of containers 50 that are joined together by connecting strips at the edge portions 55.

[0036] The separated containers 50 that are thus obtained are moved through an overturning station 13 in which they are overturned so as to rest on the respective edge portions 55 and have the bottom walls 52 facing upwards.

[0037] The containers 50 are maintained in this upturned position to enable the product 80 and the air contained in the containers 50 to be cooled. Following this cooling, the air in the cavity 51 reduces in volume causing the container 50 to deform, in the specific case causing the deformation of the bottom wall 52, which folds inwards in a controlled manner, passing from the initial outward curved configuration E to the final inward curved configuration G. This localised and partial deformation of the container 50 is made possible both by the cap-shape of the bottom wall 52 and of the suitably shaped connecting wall 54, and by the reduced thickness of the aforesaid walls that have an elasticity and flexibility that are greater than that of the side wall 53.

[0038] In this manner, it is possible to use, for making the container 50 to be hot-filled with a product 80, any thermoformable sheet material that is suitable for alimentary use and resistant to the temperature of the batched product, nevertheless using thicknesses that would cause the known containers to be deformed or broken.

[0039] In the final configuration G, each container 50 contains, in addition to the defined quantity of batched product 80, a residual volume 81' of air at ambient temperature. In this configuration, the second portion 54b of the connecting wall 54 acts as a stable resting surface for the container 50.

[0040] With reference to Figure 11 that show an enlarged partial section view of the container 50' of the invention, the bottom wall 52', by excluding the peripheral portion 52a', has a thickness that is substantially the same as that of the side wall 53' and has a substantially cap shape.

[0041] The thickness of the peripheral portion 52a' and of the connecting wall 54' is on the other hand thinner.

[0042] The flexibility of the bottom wall 52' is such as to ensure the deformation of the bottom wall 52' from the initial configuration E to the final configuration G. The peripheral portion 52a' and the connecting wall 54' with the respective portions 54a', 54b' act as an elastic hinge for facilitating the deformation of the bottom wall 52'.

[0043] In a further embodiment of the container that is not illustrated in the figures, the bottom wall is substantially flat whilst the side wall has a substantially annular portion that is externally convex, i.e. outwardly curved, having a reduced thickness. This portion is connected to the side wall so as to be able to be deformed in a controlled manner to a concave configuration, during cooling of the hot product batched in the container for compensating the reduction in volume of the air contained in the container.

Claims

1. Container having wall means (52', 53', 54') made by deforming a thermoformable sheet material (100) and defining a cavity (51) suitable for receiving a product (80), said cavity (51) being closed by a further sheet material (200), said wall means (52', 53', 54') comprising a portion that is deformable for varying an internal volume of said cavity (51), said wall means (52', 53', 54') comprising a side wall (53'), a bottom wall (52') and a connecting wall (54'), the connecting wall (54') being interposed between said side wall (53') and said bottom wall (52'), said deformable portion comprising said bottom wall (52'), said container being **characterized in that** said bottom wall (52'), excluding a peripheral portion (52a') thereof, has a thickness that is substantially the same thickness of said side wall (53') and has a substantially cap shape, a thickness of said peripheral portion (52a') and of said connecting wall (54') being thinner than said side wall (53').

2. Container according to claim 1, wherein said portion (52') is elastically deformable.

3. Container to claim 1 or 2, wherein said deformable portion (52') can fold inwards said cavity (51) so as to reduce said internal volume for compensating a variation in the volume in said cavity (51), in particular due to the cooling of said hot batched product (80)

4. Container according to claim 1, wherein said bottom wall (52') is deformable between an initial configuration (E) in which said bottom wall (52') is convex and curved outwards said cavity (51), and a final configuration (G), in which said bottom wall (52') is concave and curved inwards said cavity (51).

5. Container according to any preceding claim, wherein said further sheet material (200) is welded to an edge portion (55) of said cavity (51).

6. Container according to any preceding claim, wherein said further sheet material (200) comprises a film of coupled material, in particular of aluminium and/or plastics.

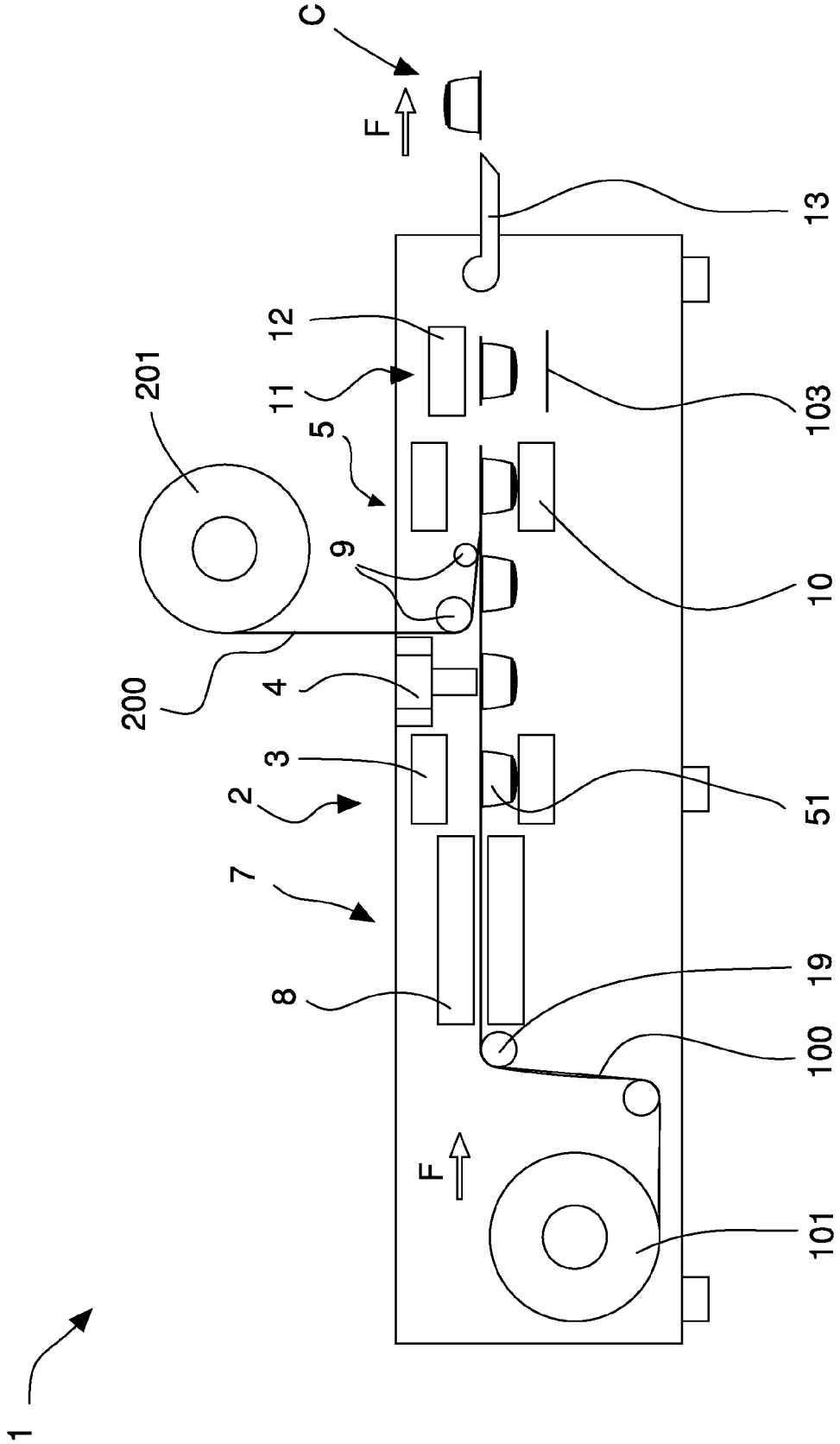


Fig. 1A

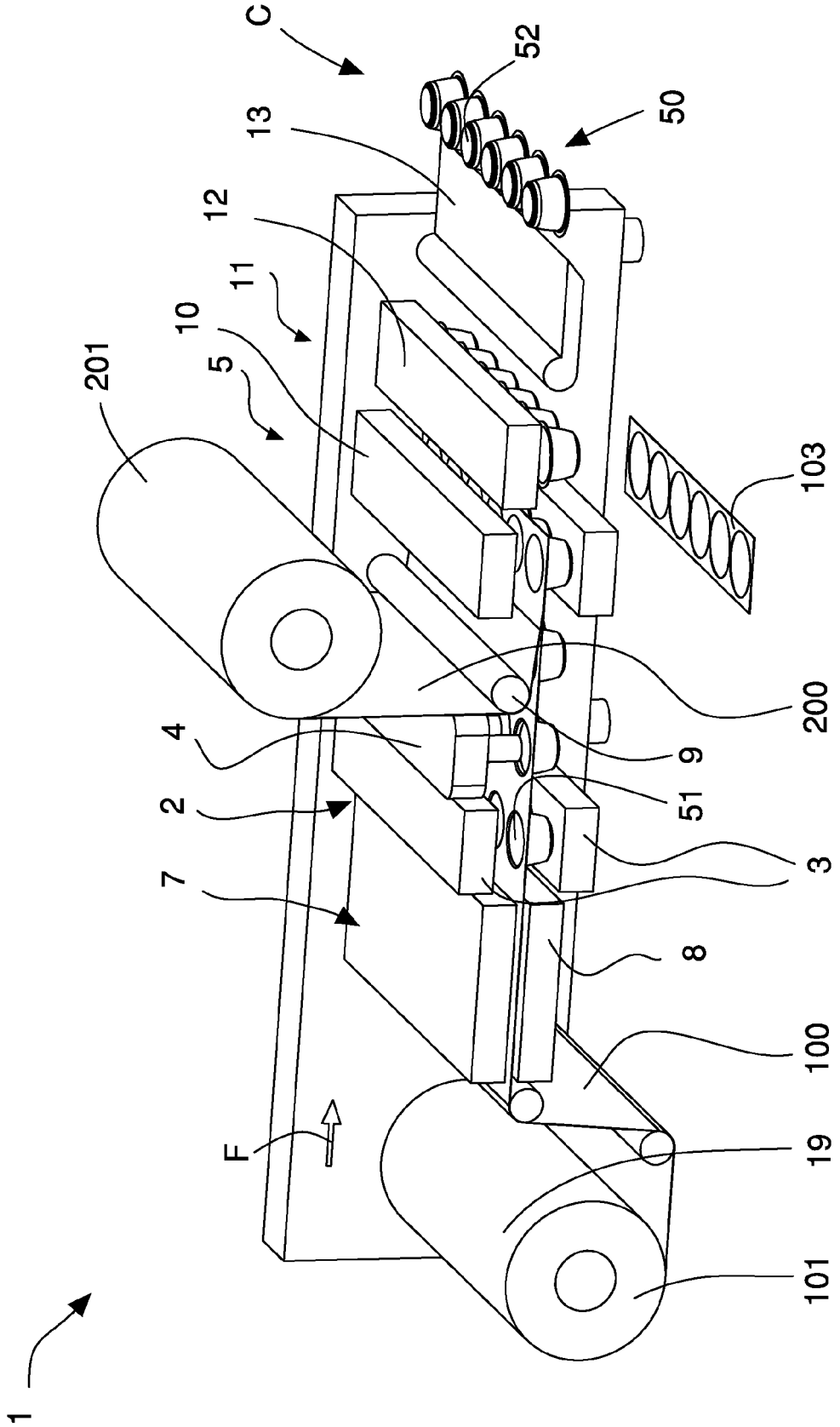


Fig. 1B

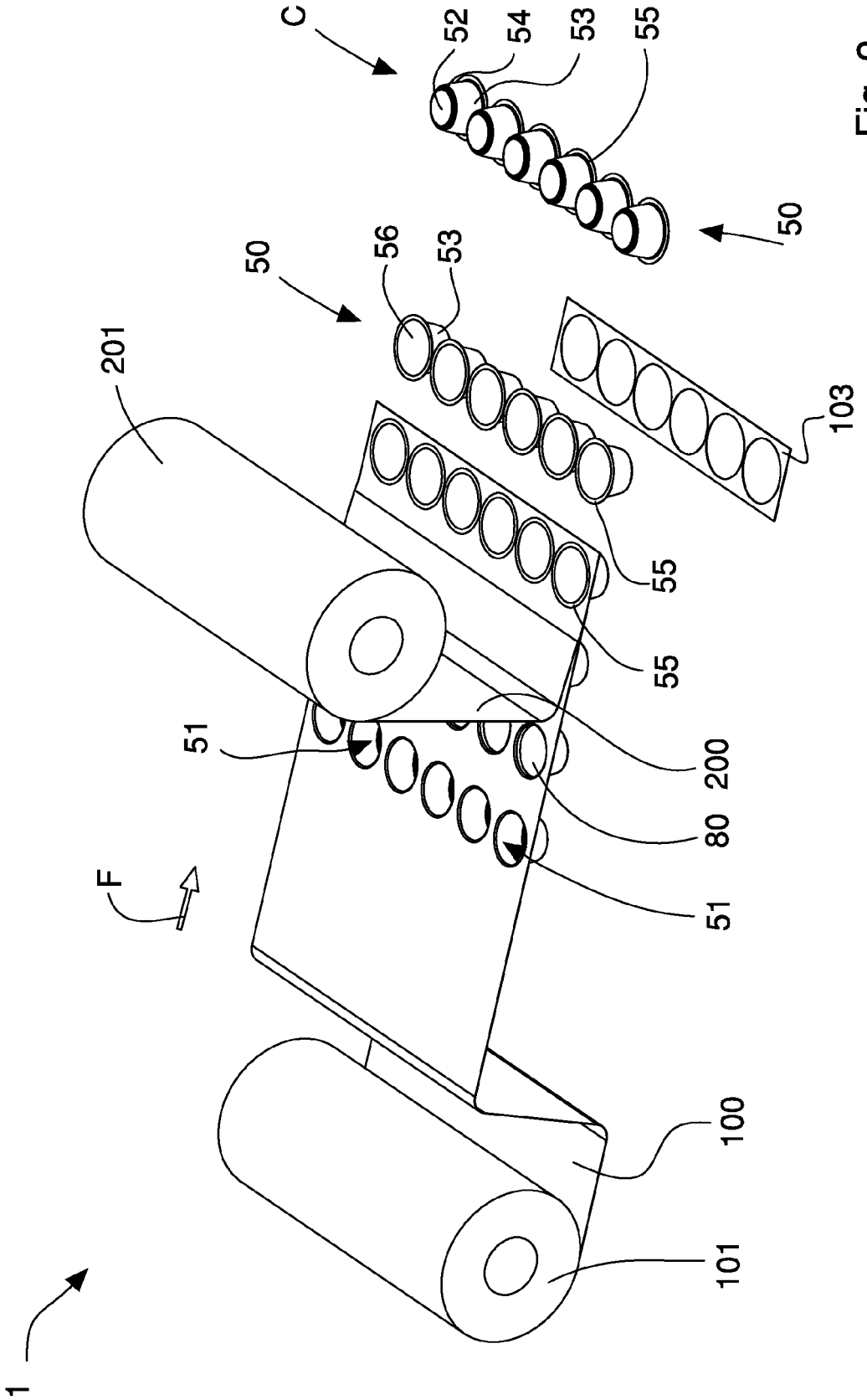


Fig. 2

Fig. 4

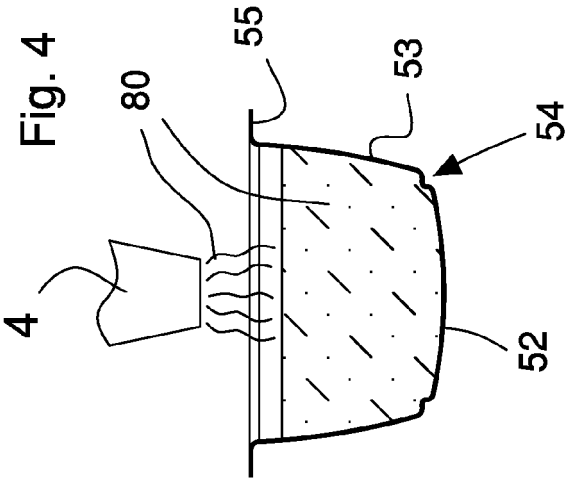


Fig. 6

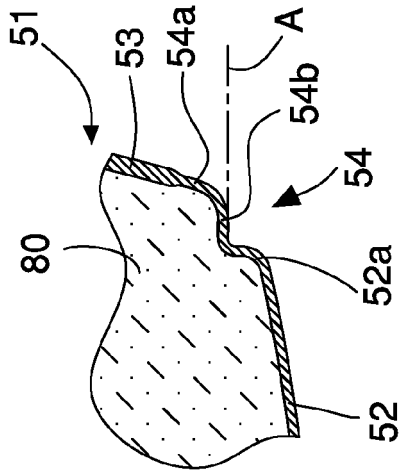


Fig. 3A

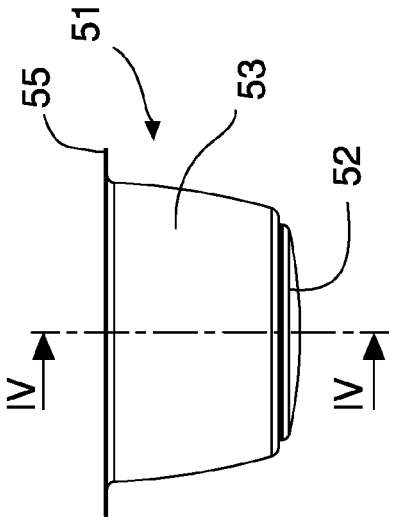


Fig. 5B

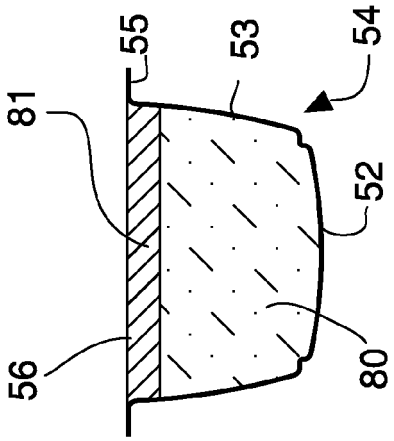


Fig. 3B

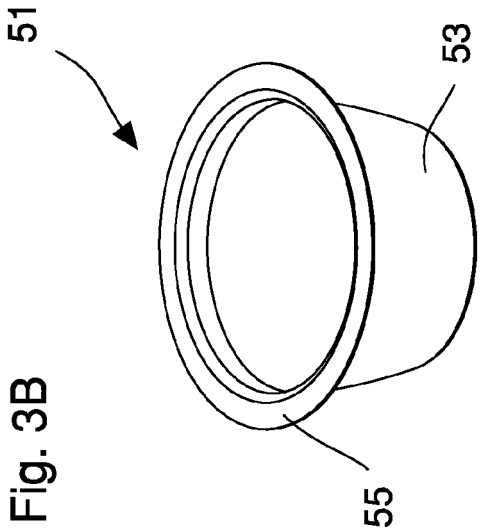
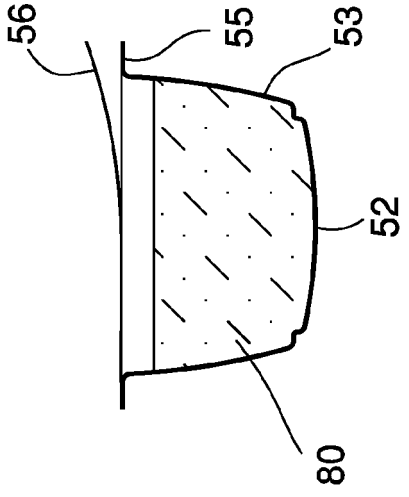


Fig. 5A



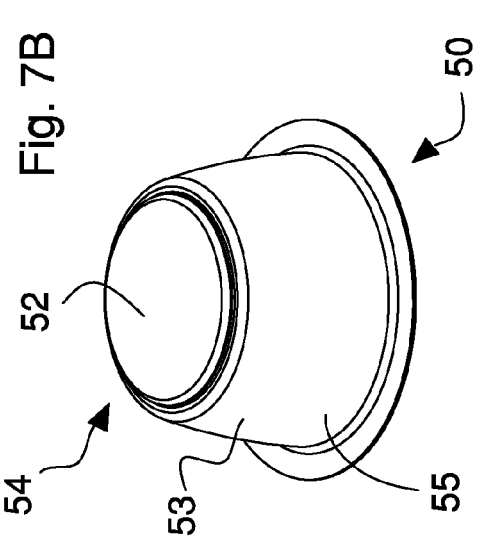


Fig. 7B

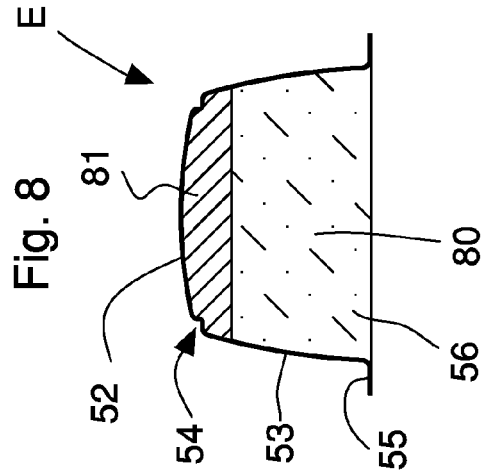


Fig. 8

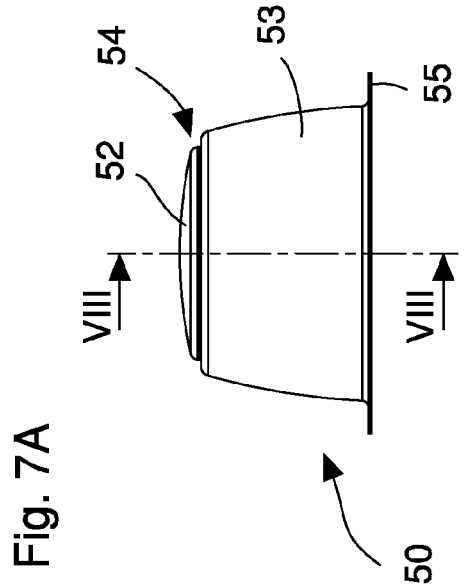


Fig. 7A

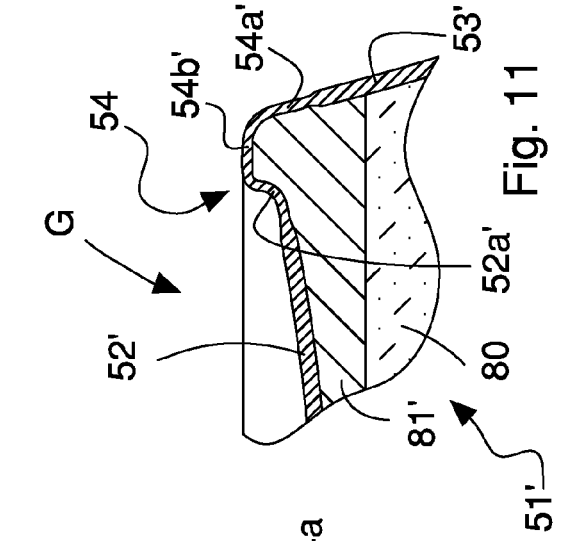


Fig. 11

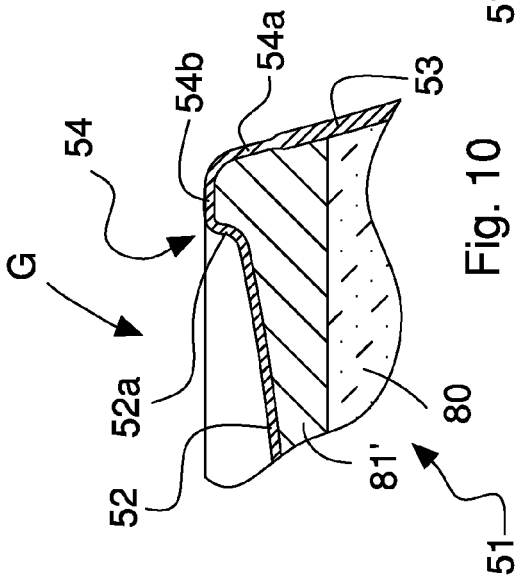


Fig. 10

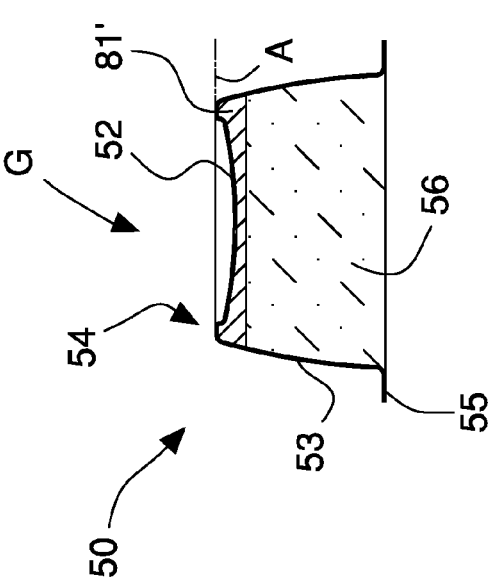


Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 13 15 1733

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 2004/144678 A1 (SCHWAB DOMINIQUE [FR]) 29 July 2004 (2004-07-29) * paragraph [0041]; figure 1 *	1	TECHNICAL FIELDS SEARCHED (IPC) B65B B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 February 2013	Lawder, M

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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