(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 366 631 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
31.10.2012 Bulletin 2012/44

(51) Int Cl.:
B65B 47/06 *(2006.01)* ***B65B 7/28*** *(2006.01)*
B65B 11/50 *(2006.01)* ***A23G 3/02*** *(2006.01)*

(21) Application number: **11158196.3**

(22) Date of filing: **15.03.2011**

(54) **Device apparatus and process for wrapping an item in a casing of sheet material**

Gerätevorrichtung und Verfahren zum Verpacken eines Elements in einer Blattmaterialhülle

Dispositif, appareil et procédé pour conditionner un article dans un boîtier de matériaux en feuille

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **16.03.2010 IT TO20100200**

(43) Date of publication of application:
21.09.2011 Bulletin 2011/38

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Description

[0001] This invention refers to a packaging device and apparatus for wrapping an item, typically a food product, in a casing formed by a pair of half-shells made from sheeted material with a shape matching a respective portion of the surface of the item, and associated packaging process.

[0002] In known procedures, the two preformed half-shells are coupled one to the other around the item and connected together by means of an operation known as caulking which implies folding and/or upsetting flanges surrounding the mouth contour of each half-shell.

[0003] The term "caulking", which is used in mechanical technologies to indicate the operation of upsetting the edge of riveted sheets, is used in this description in a broad sense to indicate a deformation operation that folds and/or upsets the flange edges of each half-shell in such a way that such flange edges are connected to one another.

[0004] A packaging process and apparatus of the type mentioned above are described in DE 17 84 647 U. The procedure described there contemplates an initial stage in which little aluminium sheets are drawn in respective shaped moulds in such a way as to form the two half-shells of the casing; a food product is then inserted into one of the two half-shells, supported by the respective mould, and the second half-shell, inserted in a respective mould, is applied on the part of the product protruding from the first half-shell, thereby positioning the flange edges of the two half-shells in a face-to-face relationship.

[0005] When the two moulds have been closed, the flange edges are trimmed or punched; then the flange edges of the two half-shells are joined together by hot-bonding, gluing or folding; this last operation is not described in detail, however.

[0006] GB 952 925 and DE 12 60 949 B describe a procedure and a caulking device in the framework of a process that uses two half-shells of sheet aluminium shaped as a mould for forming a hollow chocolate body; the caulking operation is carried out by arranging the items inserted one by one between the two sheet aluminium half-shells in a first press which, with the aid of a ring-type shaping element, provokes an initial folding of the flange edges in a direction orthogonal to the general plane of the flanges.

[0007] The items are then transferred to a second press, associated with which is a ring-type shaping element which, in turn, causes the flanges to curl.

[0008] FR 1 343 517 A describes a caulking process with the use of punching tools with radial horizontal movement and vertical movement.

[0009] DE 227 127 C describes a caulking process in the production of a cartoon container.

[0010] One object of this invention is to supply a device that makes it possible to carry out the caulking operation simultaneously on a plurality of items.

[0011] Another object of the invention is to provide a procedure and an apparatus that permit in-line packaging, operating continuously or step by step, thereby making it possible to package a plurality of items in half-shells of sheeted material with high productivity.

[0012] In the light of these objects, a caulking device, an apparatus comprising it, and a process as defined in the claims that follow constitute the subject of the invention.

[0013] Further characteristics and advantages of the invention will be evident from the following detailed description, which is purely exemplificative and not limitative, and which is made with reference to the attached drawings, in which:

- figs. 1-15 are schematic representations that illustrate consecutive stages of the packaging procedure of a preferred embodiment;
- figs. 7a and 7b illustrate two consecutive positions of the operation carried out in fig. 7;
- fig. 16 is a perspective view of a caulking tool used in the framework of the process; and
- fig. 17 is a plan view of the tool in fig. 16, depicted in an operating position along with the item on which the tool works for the caulking operation.

[0014] The apparatus according to the invention carries out the in-line packaging of a given item starting from an initial sheeted material drawing stage in order to obtain the half-shells that constitute the casing, and goes on to discharge the completely packaged item.

[0015] As will be evident from the description that follows, some of the operating stages described below with reference to the attached drawings are purely optional.

[0016] Fig. 1 shows a drawing stage for forming a first and second half-shell 2, 4 in a respective honeycomb mould 6 and 8. The half-shells 2, 4 are obtained from a sheet of plastically deformable material. This is typically a sheet of aluminium, for example from 10 μm to 40 μm thick, and can optionally be coated on at least one face with a lacquer or other hot-melt or hot-bonding coating. The moulds 6 and 8 have a shaped moulding cavity 9, 11 (fig. 2) with a form that matches a respective portion of the external surface of the item to package.

[0017] The item to package is illustrated in the drawings supplied along with this description, and in figs. 1 to 15 in particular, with a circular cross section, so that the two half-shells 2, 4 are equal to one another in the sections that are the subject of the figures.

[0018] It is evident that this is a purely exemplificative choice taken for illustrative simplicity, as the invention should not be understood in any way to be limited to packaging items with circular cross sections or with rotational symmetry; on the contrary, the procedure is particularly advantageous for packaging shaped items with complex and asymmetrical forms, of the type illustrated in fig. 17, for example.

[0019] The two half-shells made from sheeted material in which the item is packaged can in this way have forms

that differ from one another, it being understood that in any case the mouth profile of the half-shells corresponds to the profile of the item's maximum longitudinal section.

[0020] In this way the item to wrap can, for example, be a body of food material, chocolate for example, optionally hollow, such as a chocolate egg (which constitutes a typical example of a body with rotational symmetry) for example, or a body with a complex form, such as a body representing a toy, a character or an animal.

[0021] It is also intended that, although each mould is depicted in the attached drawings with a single seat for drawing the respective half-shell, in industrial practice each mould can comprise a plurality of seats, arranged in a matrix for example, in order to make it possible to draw a plurality of half-shells in a single stage.

[0022] A continuous band of sheeted material unwound from a reel is cut to obtain a sheet which is positioned on each mould; in the case in which each mould has a plurality of seats, after having positioned the sheet so that it covers the seats, a first cutting operation is generally carried out in order to subdivide the sheet into small individual sheets, each of which covers a respective seat.

[0023] The drawing operation is carried out in a way that is known per se, for example with the use of a plug 10 (or a plurality of plugs 10) with a form that is complementary to the surface of each mould seat or cavity.

[0024] The drawing operation is carried out without constraining, or by only constraining slightly, the peripheral edges of each sheet subjected to drawing. The half-shells of sheeted material 2, 4 obtained in this way have a hollow surface portion 2a, 4a and a peripheral surface portion 2b, 4b surrounding the mouth contour of the hollow portion, the external profile of which corresponds to the perimeter of each sheet fed to the respective mould.

[0025] It should be specified, however, that the procedure described also applies to packaging an item that has a surface with a flat base, and in which case one of the half-shells consists of an undrawn sheet, i.e. a flat sheet; therefore, the fact that the two portions of casing are defined as half-shells in this description is to be intended as inclusive of the case in which one of said portions is a flat sheet.

[0026] Figs. 2 and 3 illustrate stages (optional moreover) in which the drawn half-shells 2, 4 are transferred into auxiliary supports 12, 14, each having at least one respective seat 16, 18 for receiving and/or supporting the respective half-shell and a portion of general flat surface 20, 22, surrounding the mouth of the respective seat, suitable for supporting the peripheral portion 2b, 4b of the respective half-shell.

[0027] As illustrated in fig. 3, one of said supports has an annular slot or groove 24 surrounding the mouth profile of the seat 16, the function of which is illustrated below. As indicated, the stages in fig. 2 and fig. 3 are optional, as the drawing operation could be carried out in a mould with characteristics in conformity with the support 12.

[0028] The item P is then positioned in the half-shell 2, using means of transfer known per se, for example of the suction cup type, and the half-shell 4 is coupled to the half-shell 2 in a position superimposed on the surface portion of the item P which emerges from the seat 16; a configuration is obtained in which the two half-shells 2, 4 are arranged with their peripheral surface portions 2b, 4b that surround the mouth contours of the half-shells in a face-to-face and essentially coplanar relationship, as illustrated in fig. 6.

[0029] In order to obtain this configuration, the support 14 can be overturned 180° onto the support 12, as illustrated in fig. 5; for this purpose, the supports 12, 14 can be articulated with one another in book form; however this solution is purely exemplificative as it is intended that the configuration in fig. 6 can be obtained with other operating means which effect the transfer of the half-shells 4, optionally drawn in a separate line, onto the half-shells 2.

[0030] The procedure then envisages an operation for cutting the peripheral edges 2b, 4b of the half-shells for the purpose of obtaining, in each half-shell, a flange, indicated as a whole by 5, 7, which surrounds the mouth contour of the half-shells 2, 4, preferably at a uniform distance.

[0031] This cutting operation illustrated in figs. 7, 7a and 7b, is preferably carried out by provoking, simultaneously with cutting, the folding of a portion 5a, 7a of the flanges 5, 7 distal from said item P in an angled position, preferably orthogonal, with respect to the plane on which the flange portions 5b, 7b, proximal to the item P, lie.

[0032] This operation can be carried out by means of a device of the type illustrated in fig. 7 which cooperates with the support 12, provided with the annular groove 24.

[0033] This cutting device comprises a vertically mobile support 26, with associated an annular cutting means or punch 28 and presser means 30, 32, preferably elastically constrained to the support 26, that surround the annular cutting means 28 internally and externally.

[0034] The cutting device is positioned by the presser means 30, 32 in contact with the peripheral portion 4b and with the cutting means 28 which is capable of penetrating the groove 24. The cutting end 28a of the cutting means 28 is capable of penetrating the groove 24 at a slight radial distance from the radially internal wall 24a of the groove 24, this distance being dimensioned in such a way as to be able to receive the flange edges 7a and 5a.

[0035] In this way, in the course of the cutting operation, the presser means 30 and 32 constrain the peripheral portions 2b and 4b of each half-shell and the descent of the cutting means inside the groove 24 provokes simultaneous folding downwards of the distal flange portions 5a and 7a (figs. 7a and 7b) at the same time as the cutting of said peripheral portions with a flange profile that conforms with the mouth contour of the half-shells.

[0036] The portions of scrap, indicated as a whole by 13, can be removed following cutting, for example by extraction in a later stage of the procedure.

[0037] The procedure then preferably envisages an

operation for overturning the item P by 180° with the associated half-shells 2, 4, in such a way as to position the folded flange edges 5a, 7a upwards.

[0038] This operation can, for example, be carried out in accordance with the operating stages in figs. 8, 9, 10 and 11 that comprise the overturning of the support 14 onto the support 12 to obtain the configuration in fig. 9, in which the two half-shells are constrained between the respective supports 12, 14, the overturning by 180° of the two associated supports 12, 14 (fig. 10) and the subsequent opening of the top support 14 to obtain the configuration in fig. 11.

[0039] In this configuration, the two half-shells 2 and 4 are not constrained to one another, so that it is necessary to carry out the caulking operation with folding and the possible upsetting of the folded flange edges.

[0040] According to the invention, this operation can be carried out by means of a caulking device, having the characteristics defined in the attached claims, described with reference to figs. 12 and 17, which is set up to operate starting from an item wrapped by the two half shells in the configuration in fig. 11.

[0041] It is intended, however, that the configuration in fig. 11 which makes it possible to operate by means of the device described below can be obtained independently with working stages that do not necessarily correspond with those described previously.

[0042] Such a device, however, which can constitute a station in a packaging apparatus that carries out one or more of the operations previously described in line, or which can constitute a standalone device to which the items with the associated half-shells 2, 4 can be fed, generally comprises means of support such as, for example, the support 12 in fig. 11 comprising at least one seat 16 suitable for supporting the item P inserted between the two half-shells of sheeted material, or a plurality of seats, each for a respective item; the means of support comprise a substantially flat surface 34 which surrounds the aforesaid seat 16 and which is suitable for supporting the flanges 5, 7 of the two half-shells arranged in a relationship of superimposition one on the other.

[0043] The device comprises means of caulking arranged to cause the folding and/or upsetting of the flange portions 5a, 7a distal to the item P, starting from a configuration of said flanges in which their distal portions 5a and 7a are already folded in an angled position, generally virtually orthogonal to the surface 34 of the support.

[0044] The aforesaid caulking means comprise a caulking tool, indicated by 36, which can be a body in the shape of a plate with an opening 38 (fig. 16) (or a plurality of openings, one for each item to caulk), having a perimeter profile 40 homologous and widened with respect to the perimeter profile defined by the ends of the flanges 5, 7.

[0045] In this way the caulking tool 36 is capable of being positioned in contact with the surface 34 of the support 12, with the opening 38 in a position surrounding the distal flange portions 5a, 7a at a distance, namely in the configuration shown in fig. 17, visible in which is the top half-shell 2, the perimeter profile defined by the distal portions 5a, 7a and the profile 40 of the opening 38 which is positioned at a virtually uniform distance from the flange edges.

[0046] The caulking tool is vertically mobile with respect to the means of support between a raised position and a lowered position, in which it is in contact with the surface 34. The caulking tool 36 is also mobile on a horizontal plane. Motor means 42 are arranged for operating the vertical and horizontal movements of the caulking tool.

[0047] In particular, the motor means 42 are arranged to bring consecutive or non-consecutive sections of the profile 40 of the opening 38 into contact with a homologous section of the profile defined by the previously folded distal flange portions 7a, 5a. This operation can be carried out in the position in which the bottom end of the caulking tool is in contact with the surface 34 and is also useful for obtaining, where necessary, correct positioning of said distal flange portions 5a, 7a in a position orthogonal to the surface 34 (fig. 12).

[0048] The caulking tool is then subject to a vertical movement for a distance d greater than the thickness of the two superimposed proximal flange portions 5b, 7b and such that the bottom end of the profile 40 of the opening 38 is still capable of interfering, following a horizontal displacement, with the top end of the distal flange portions 7a, 5a (fig. 13).

[0049] Consecutively, the caulking tool 36 is subject to a horizontal movement of approach to the item P, in such a way as to cause further folding towards the inside of the distal flange portions 7a, 5a (fig. 14), superimposed on the proximal portions 5b, 7b.

[0050] Optionally, and in any case preferably, the caulking tool 36 is then subject to a vertical movement of approach towards the surface 34 of the support 12, to cause upsetting (fig. 15).

[0051] The aforesaid operations, namely the operations in figs. 12, 13 and 14, and optionally also the operations in fig. 16 (upsetting), are carried out for further consecutive or non-consecutive sections of the profile of the flanges. For example, when the item has a generally quadrangular profile, the aforesaid operations are carried out for each of the sides that define the profile; it is intended however that carrying out the caulking operation along the whole flange profile does not constitute an essential and imperative aspect of the procedure as - in certain applications - it may be desirable to maintain an uncaulked portion of the flange profile, or keep a section of the flange profile in which the flanges are in a superimposed position and are not folded on themselves; this solution can, for example, be applied in the case in which the connection of one section of the flanges is made by applying an adhesive label. In this way the procedure according to the invention has the further advantage that it makes it possible to carry out the caulking operation only on one portion of the perimeter profile of the flanges

or on specific portions, even on portions that are not adjacent to one another.

[0052] In particular, in the case of a profile of the type illustrated in figs. 16 and 17, the caulking tool can carry out the complete (or partial) caulking operation, being put in motion with a translational movement in two directions orthogonal to one another.

[0053] In the case of an item with a body having a profile with curvilinear sections, an ovoid profile for example, the caulking tool can be arranged for a rotary and eccentric movement on the horizontal plane, so as to bring consecutive or non-consecutive sections of the profile 40 of the opening 38 into contact once again with the flange edges and carry out the subsequent operations illustrated.

[0054] As indicated above, the final upsetting operation is optional, because in the case of particular configurations of the item to caulk, such as, for example, in the case of an ovoid body, the caulking operation (if necessary) can be carried out at a later stage with an auxiliary tool 36b (fig. 15), vertically mobile under the action of motor means 42a, and provided with an opening the internal profile of which substantially corresponds with the mouth profile of the two half-shells. The aforesaid auxiliary tool 36b can be driven in a vertical movement until contact with flange edges folded on themselves, so as to effect upsetting along the entire contour of the flange edges in a single upsetting operation.

[0055] The procedure and the caulking device described make it possible in this way to package the items that have a complex or mixtilinear profile, just like bodies with a regular profile or with rectilinear and curvilinear sections.

[0056] As already indicated, it is intended that the procedure and the device can be set up to operate simultaneously on a plurality of items.

[0057] As indicated, it is possible to carry out the caulking operation along the entire flange contour, by envisaging the possibility of movement of the caulking tool 36 even only in two orthogonal directions in a horizontal plane; in this way the caulking device is particularly simple and advantageous, as it makes it possible to operate on items with different forms, simply by changing the profile 40 of the opening or openings 38.

[0058] Naturally, without prejudice to the principle of the invention, the forms of actuation and the embodiment details can be varied compared with what has been described and illustrated for non-limiting exemplificative purposes only, without leaving the framework of the claims that follow.

Claims

1. Device for wrapping an item (P) in a casing formed from a pair of half-shells (2, 4) made from sheeted material with a shape matching respective portions of the outer surface of said item (P), wherein said half-shells (2, 4) are provided with a respective flange (5, 7) surrounding the respective mouth contour and said flanges (5, 7) are connected together by folding and/or upsetting so as to jointly define said casing, comprising:

   - support means (12) suitable for supporting said item (P) inserted between said half-shells (2, 4) of sheeted material, with the respective flanges (5, 7) arranged in a face-to-face relationship;
   - caulking means (36) arranged to carry out the folding of said flanges upon themselves and optionally the upsetting of said folded flanges, from a configuration in which an end portion (5a, 7a) of said flanges (5, 7) distal from said item (P) is arranged in an angled position with respect to the flange portion (5b, 7b) proximal to said item (P), **characterised in that** said caulking means (36) comprise a tool comprising an opening (38) having a profile (40) that is homologous and widened with respect to the perimeter profile defined by the distal end (5a, 7a) of said flanges (5, 7), said tool (36) being mobile in the direction perpendicular to the plane in which the proximal portion (5b, 7b) of said flanges (5, 7) lies and also being mobile parallel to the plane of said proximal portion of the flanges, wherein motor means (42) are provided arranged to position said caulking tool (36) with the profile (40) of said opening (38) in an arrangement surrounding said angled distal portion (5a, 7a) of said flange (5, 7) and to bring a section of the profile (40) of said opening (38) into contact with a homologous section of the perimeter profile defined by said angled distal portion of said flanges (5, 7) and to cause an approach movement towards said item (P) by said section of the profile of said opening (38) in contact with said distal portion (7a) to cause further folding thereof on said proximal portion (5b, 7b) and to repeat the aforementioned operations on further sections of the profile of the distal portion (5a, 7a) of said flanges (5, 7).

2. Device according to claim 1, **characterised in that**, following said approach movement of the profile of said opening (38) that causes the further folding of said distal portion (5a, 7a) on said proximal portion (5b, 7b), the motor means are arranged to generate a movement of said tool (36) perpendicular to the plane of said proximal portion (5b, 7b), to cause the upsetting of said distal portions (5a, 7a) folded on said proximal portions (5b, 7b).

3. Device according to claim 1 or 2, **characterised in that** said support means (12) comprise a substantially flat surface (34) surrounding said seat (16) suitable for supporting the proximal portions (5b, 7b) of

said flanges (5, 7) and said motor means are arranged to:

- actuate said caulking tool (36) between a position away from said surface (34) to a position in which said tool (36) is in contact with said surface (34) and said profile (40) of the opening (38) and surrounds the angled distal portions (5a, 7a) of said flanges (5, 7) at a distance,
- actuate said tool (36) parallel to said surface (34) until a section of the profile (40) of said opening (38) is brought into contact with a homologous section of the angled distal portion (7a) of said flange,
- actuate said tool (36) in the direction perpendicular to said surface (34) up to a distance (d) from said surface (34), such that the profile (40) of said opening (38) is able to interfere with the end of the distal portion (5a, 7a) of said flanges (5, 7) and not interfere with the overlapping proximal portions (5b, 7b) of said flanges (5, 7),
- actuate said tool (36) according to a movement parallel to said surface (34) according to an approach movement towards said item (P) to cause the folding of said distal portion (5a, 7a) of said flanges (5, 7) on said proximal portion (5b, 7b), and
- optionally, actuate said tool (36) in the direction perpendicular to said surface (34) to cause the upsetting of said distal end portion (5a, 7a) on said proximal portion (5b, 7b).

4. Device according to claim 3, **characterised in that** it comprises an auxiliary upsetting member (36b) of said flanges (5, 7) comprising a tool (36b) provided with an opening with a perimeter profile (40b) substantially matching the mouth profile of said half-shells (2, 4), said auxiliary tool (36b) being mobile in the direction perpendicular to the plane of the proximal portion of said flanges (5, 7) and being mobile between a position away from said flanges (5, 7) and a lowered position in contact with the distal portion (5a, 7a) of said flanges (5, 7) folded on said proximal portion (5b, 7b) to carry out its upsetting.

5. Device according to any one of claims 1 to 4, **characterised in that** said caulking tool (36) is mobile parallel to the plane of said proximal portion (5b, 7b) of said flanges (5, 7) according to two perpendicular directions.

6. Device according to any one of claims 1 to 5, **characterised in that** said tool (36) is mobile parallel to the plane of said proximal portions (5b, 7b) of said flanges (5, 7) according to a rotary or eccentric movement.

7. Apparatus for packaging an item (P) in a casing formed from a pair of half-shells (2, 4) made from sheeted material, comprising a device according to any one of claims 1 to 6.

8. Apparatus according to claim 7, **characterised in that** it comprises:

- first and second drawing means (6, 8, 10) suitable for providing a first (2) and second (4) half-shell of sheeted material, each having a surface portion (2a, 4a) with a matching shape to a respective surface portion of said item (P) and a surface portion (2b, 4b) surrounding said first portion (2a, 4a);
- means for coupling said first and second sheet with respective surface portions (2a, 4a) of said item (P) with said peripheral surface portions (2b, 4b) in overlapping relationship; and
- means for cutting said first and second sheet according to a profile surrounding said item (P), so as to form a pair of peripheral flanges (5, 7), said cutting means (26, 28, 30, 32) being arranged to cause, simultaneously to the cutting, the folding of a distal portion (5a, 7a) with respect to the item (P) of said flange (5, 7) in an angled position with respect to the general plane of said flanges (5, 7).

9. Process for wrapping an item (P) in a casing formed from a pair of half-shells (2, 4) made from sheeted material having a shape matching respective outer side portions (2a, 4a) of said item (P), wherein said half-shells (2, 4) are provided with a respective flange (5, 7) surrounding the respective mouth outline and said flanges (5, 7) are connected together through a caulking operation comprising the folding and optionally the upsetting of said flanges (5, 7) so as to jointly define said casing, **characterised in that** it comprises the operations of:

- supporting said item (P) inserted between a pair of half-shells (2, 4) provided with respective flanges (5, 7) in a face-to-face relationship, with portions of said flanges (5a, 7a) distal with respect to the item arranged in an angled position with respect to the plane in which the flange portions (5b, 7b) proximal to said item lie,
- providing a mobile caulking tool (36) comprising an opening (38) having a profile (40) that is homologous and widened with respect to the perimeter profile defined by the distal end of said flanges,
- positioning said tool (36) with the profile of said opening (38) in a relationship surrounding said angled distal portion (5a, 7a) of said flanges,
- actuating said tool to bring a section of said profile (40) of said opening into contact with a homologous section of the perimeter profile de-

fined by said angled distal portions (5a, 7a) of said flanges,

- causing an approach movement towards said item (P) of said section of the profile of said opening (38) in contact with said distal portion (7a) to cause its further folding on said proximal portion (5b, 7b), and
- repeating the aforementioned operations for further sections of the profile of the distal portion (5a, 7a) of said flanges (5, 7).

10. Process according to claim 9, **characterised in that**, following said approach movement of the profile of said opening (38) that causes the further folding of said distal portion (5a, 7a) on said proximal portion (5b, 7b), it comprises the operation of generating a movement of said tool perpendicular to the plane of said proximal portion (5b, 7b), to cause the upsetting of said distal portions (5a, 7a) folded on said proximal portions (5b, 7b).

11. Process according to claim 9 or 10, **characterised in that** it comprises the operations of:

- providing a first and second sheet, each having a surface portion (2a, 4a) shaped to match a respective outer surface portion of said item (P) and a peripheral surface portion (2b, 4b) surrounding said shaped portion,
- coupling said first and second sheet with respective surface portions of said item (P) with said peripheral surface portions (2b, 4b) in an overlapping relationship,
- carrying out a cutting operation on said first and second sheet according to a profile surrounding said item (P) so as to form a pair of peripheral flanges (5, 7), and further **characterised in that** said cutting operation is carried out so as to cause, simultaneously to the cutting, the folding of the portion (5a, 7a) of said flanges (5, 7) distal from said item (P) in an angled configuration with respect to the general plane of said flanges (5, 7).

12. Process according to claim 9, comprising, following said cutting operation, an operation of inverting said item (P) by 180° with said half-shells (2, 4) coupled.

13. Process according to any one of claims 9 to 11, **characterised in that** said caulking operation is carried out through a caulking device as defined in any one of claims 1 to 6.

Patentansprüche

1. Einrichtung zum Umhüllen eines Gegenstands (P) in einer aus einem Paar Halbschalen (2, 4) gebildeten Ummantelung, die aus einem Folienmaterial mit einer Form hergestellt sind, die jeweils mit Abschnitten der Außenfläche des Gegenstands (P) übereinstimmt, wobei die Halbschalen (2, 4) jeweils mit einem Flansch (5, 7) bereitgestellt sind, der jeweils den Mündungsumriss umgibt und die Flansche (5, 7) durch Falten und/oder Stauchen miteinander verbunden sind, um zusammen die Ummantelung zu definieren, mit:

- einem Unterstützungsmittel (12), das zum Unterstützen des Gegenstands (P), der zwischen den Halbschalen (2, 4) aus Folienmaterial eingeführt ist, geeignet ist, und zwar jeweils mit den Flanschen (5, 7) in einem gegenüberstehenden Verhältnis angeordnet;
- einem Verstemmungsmittel (36), das eingerichtet ist, das Falten der Flansche über sich selbst und wahlweise das Stauchen der gefalteten Flansche auszuführen, und zwar von einer Anordnung aus, in der ein zu dem Gegenstand (P) distaler Endabschnitt (5a, 7a) der Flansche (5, 7) in Bezug zu dem Flanschabschnitt (5b, 7b) proximal zu dem Gegenstand (P) in einer angewinkelten Position angeordnet ist, **dadurch gekennzeichnet, dass** das Verstemmungsmittel (36) ein Werkzeug mit einer Öffnung (38) aufweist, die ein Profil (40) aufweist, das in Bezug zu dem Umfangsprofil, das durch das distale Ende (5a, 7a) der Flansche (5, 7) definiert ist, homolog und geweitet ist, wobei das Werkzeug (36) in der Richtung, die senkrecht zu der Ebene, in der der proximale Abschnitt (5b, 7b) der Flansche (5, 7) liegt, beweglich ist und auch parallel zu der Ebene des proximalen Abschnitts der Flansche beweglich ist, wobei ein Motormittel (42) bereitgestellt ist, das eingerichtet ist, das Verstemmungsmittel (36) mit dem Profil (40) der Öffnung (38) in einer Anordnung zu positionieren, die den angewinkelten distalen Abschnitt (5a, 7a) des Flansches (5, 7) umgibt, und einen Abschnitt des Profils (40) der Öffnung (38) mit einem homologen Abschnitt des Umfangsprofils in Kontakt zu bringen, das durch den winkeligen distalen Abschnitt der Flansche (5, 7) definiert ist, um eine Annäherungsbewegung in Richtung des Gegenstands (P) durch den Abschnitt des Profils der Öffnung (38), die mit dem distalen Abschnitt (7a) in Kontakt ist, zu bewirken und dessen weitere Faltung an dem proximalen Abschnitt (5b, 7b) zu bewirken und die zuvor genannten Arbeitsschritte an weiteren Abschnitten des Profils des distalen Abschnitts (5a, 7a) der Flansche (5, 7) zu wiederholen.

2. Einrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** auf die Annäherungsbewegung des Profils der Öffnung (38) folgend, die das weitere Fal-

ten des distalen Abschnitts (5a, 7a) auf den proximalen Abschnitt (5b, 7b) bewirkt, das Motormittel eingerichtet ist, eine Bewegung des Werkzeugs (36) zu erzeugen, die senkrecht zu der Ebene des proximalen Abschnitts (5b, 7b) ist, um das Stauchen der distalen Abschnitte (5a, 7a), die auf die proximalen Abschnitte (5b, 7b) gefaltet sind, zu bewirken.

3. Einrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Unterstützungsmittel (12) eine im Wesentlichen plane Fläche (34) aufweist, die den Sitz (16) umgibt, der zum Unterstützen der proximalen Abschnitte (5b, 7b) der Flansche (5, 7) geeignet ist, und das Motormittel eingerichtet ist, um:

- das Verstemmungswerkzeug (36) zwischen einer von der Fläche (34) entfernten Position zu einer Fläche zu bewegen, in der das Werkzeug (36) mit der Fläche (34) und dem Profil (40) der Öffnung (38) in Kontakt ist und die winkligen distalen Abschnitte (5a, 7a) der Flansche (5, 7) in einem Abstand umgibt,
- das Werkzeug (36) parallel zu der Fläche (34) zu bewegen, bis ein Abschnitt des Profils (40) der Öffnung (38) mit einem homologen Abschnitt des winkeligen distalen Abschnitts (7a) des Flansches in Kontakt gebracht ist,
- das Werkzeug (36) in der zu der Fläche (34) senkrechten Richtung bis zu einem Abstand (d) zu der Fläche (34) zu bewegen, sodass das Profil (40) der Öffnung (38) imstande ist, in das Ende des distalen Abschnitts (5a, 7a) der Flansche (5, 7) einzugreifen und nicht in die überlappenden proximalen Abschnitte (5b, 7b) der Flansche (5, 7) einzugreifen,
- das Werkzeug (36) gemäß einer Bewegung parallel zu der Fläche (34) zu bewegen, und zwar gemäß einer Annäherungsbewegung in Richtung des Gegenstands (P), um das Falten des distalen Abschnitts (5a, 7a) der Flansche (5, 7) auf den proximalen Abschnitt (5b, 7b) zu bewirken, und
- wahlweise das Werkzeug (36) in der zu der Fläche (34) senkrechten Richtung zu bewegen, um das Stauchen des distalen Endabschnitts (5a, 7a) auf den proximalen Abschnitt (5b, 7b) zu bewirken.

4. Einrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** sie ein Hilfsstauchelement (36b) der Flansche (5, 7) aufweist, und zwar mit einem Werkzeug (36b), das mit einer Öffnung mit einem Umfangsprofil (40b) bereitgestellt ist, das im Wesentlichen mit dem Mündungsprofil der Halbschalen (2, 4) übereinstimmt, wobei das Hilfswerkzeug (36b) in der Richtung senkrecht zu der Ebene des proximalen Abschnitts der Flansche (5, 7) beweglich ist und zwischen einer von den Flanschen (5, 7) entfernten Position und einer abgesenkten Position in Kontakt mit dem distalen Abschnitt (5a, 7a) der Flansche (5, 7), die auf den proximalen Abschnitt (5b, 7b) gefaltet sind, beweglich ist, um dessen Stauchung auszuführen.

5. Einrichtung nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Verstemmungswerkzeug (36) parallel zu der Ebene des proximalen Abschnitts (5b, 7b) der Flansche (5, 7) gemäß zwei senkrechter Richtungen beweglich ist.

6. Einrichtung nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** das Werkzeug (36) parallel zu der Ebene der proximalen Abschnitte (5b, 7b) der Flansche (5, 7) gemäß einer Drehbewegung oder exzentrischen Bewegung beweglich ist.

7. Vorrichtung zum Verpacken eines Gegenstands (P) in einer Ummantelung, die aus einem Paar aus Folienmaterial hergestellten Halbschalen (2, 4) ausgebildet ist, mit einer Vorrichtung nach einem der Ansprüche 1 bis 6.

8. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** sie aufweist:

- ein erstes und ein zweites Tiefziehmittel (6, 8, 10), das zum Bereitstellen einer ersten (2) und einer zweiten (4) Halbschale aus Folienmaterial geeignet ist, wobei jede einen Flächenabschnitt (2a, 4a) übereinstimmender Form mit einem entsprechenden Flächenabschnitt des Gegenstands (P) und einen den ersten Abschnitt (2a, 4a) umgebenden Flächenabschnitt (2b, 4b) aufweist;
- ein Mittel zum Koppeln der ersten und zweiten Folie mit jeweiligen Flächenabschnitten (2a, 4a) des Gegenstands (P), und zwar mit den Umfangsflächenabschnitten (2b, 4b) in einem überlappenden Verhältnis; und
- ein Mittel zum Schneiden der ersten und zweiten Folie entsprechend eines den Gegenstand (P) umgebenden Profils, um ein Paar Umfangsflansche (5, 7) auszubilden, wobei das Schneidmittel (26, 28, 30, 32) eingerichtet ist, gleichzeitig mit dem Schneiden das Falten eines distalen Abschnitts (5a, 7a) in Bezug zu dem Gegenstand (P) des Flansches (5, 7) in eine angewinkelte Position in Bezug zu der Hauptebene der Flansche (5, 7) zu bewirken.

9. Verfahren zum Verpacken eines Gegenstands (P) in einer Ummantelung, die aus einem Paar Halbschalen (2, 4) hergestellt aus Folienmaterial ausgebildet ist, das eine Form aufweist, die jeweils mit äußeren Seitenabschnitten (2a, 4a) des Gegenstands (P) übereinstimmt, wobei die Halbschalen (2, 4) je-

weils mit einem Flansch (5, 7) bereitgestellt sind, der die jeweilige Mündungskontur umgibt und die Flansche (5, 7) über einen Verstemmungsarbeitsschritt miteinander verbunden sind, der das Falten und wahlweise das Stauchen der Flansche (5, 7) umfasst, um verbunden die Ummantelung zu definieren, **dadurch gekennzeichnet, dass** es die Arbeitsschritte aufweist:

- Unterstützen des Gegenstands (P), der zwischen einem Paar Halbschalen (2, 4) eingeführt ist, die jeweils mit einem Flansch (5, 7) bereitgestellt sind, in einem gegenüberstehenden Verhältnis, und zwar mit Abschnitten der Flansche (5a, 7a) distal in Bezug zu dem Gegenstand, der in einer angewinkelten Position in Bezug zu der Ebene angeordnet ist, in der die Flanschabschnitte (5b, 7b) proximal zu dem Gegenstand liegen,
- Bereitstellen eines beweglichen Verstemmungswerkzeugs (36) mit einer Öffnung (38), die ein Profil (40) aufweist, das in Bezug zu dem Umfangsprofil homolog und geweitet ist, das durch das distale Ende der Flansche definiert wird,
- Positionieren des Werkzeugs (36) zu dem Profil der Öffnung (38) in einem den angewinkelten distalen Abschnitt (5a, 7a) der Flansche umgebenden Verhältnis,
- Bewegen des Werkzeugs, um einen Abschnitt des Profils (40) der Öffnung mit einem homologen Abschnitt des Umfangsprofils, das durch die angewinkelten distalen Abschnitte (5a, 7a) der Flansche definiert wird, in Kontakt zu bringen,
- Bewirken einer Annäherungsbewegung in Richtung des Gegenstands (P) des Abschnitts des Profils der Öffnung (38), die mit dem distalen Abschnitt (7a) in Kontakt ist, um seine weitere Faltung auf den proximalen Abschnitt (5b, 7b) zu bewirken, und
- Wiederholen der zuvor genannten Arbeitsschritte bei weiteren Abschnitten von dem Profil des distalen Abschnitts (5a, 7a) der Flansche (5, 7).

10. Verfahren nach Anspruch 9, **dadurch gekennzeichnet, dass** auf die Annäherungsbewegung des Profils der Öffnung (38) folgend, die das weitere Falten des distalen Abschnitts (5a, 7a) auf den proximalen Abschnitt (5b, 7b) bewirkt, es den Arbeitsschritt des Erzeugens einer Bewegung des Werkzeugs senkrecht zu der Ebene des proximalen Abschnitts (5b, 7b) umfasst, um das Stauchen der distalen Abschnitte (5a, 7a), die auf die proximalen Abschnitte (5b, 7b) gefaltet sind, zu bewirken.

11. Verfahren nach Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** es die Arbeitsschritte umfasst:

- Bereitstellen einer ersten und zweiten Folie, die jeweils einen Flächenabschnitt (2a, 4a) aufweisen, der geformt ist, um mit einem entsprechenden Außenflächenabschnitt des Gegenstands (P) und einem den geformten Abschnitt umgebenden Umfangsflächenabschnitt (2b, 4b) übereinzustimmen,
- Koppeln der ersten und zweiten Folie mit entsprechenden Flächenabschnitten des Gegenstands (P), und zwar mit Umfangsflächenabschnitten (2b, 4b) in einem überlappenden Verhältnis,
- Ausführen eines Schneidearbeitsschritts an der ersten und zweiten Folie entsprechend eines Profils, das den Gegenstand (P) umgibt, um ein Paar Umfangsflansche (5, 7) auszubilden, und

weiterhin **dadurch gekennzeichnet, dass** der Schneidearbeitsschritt ausgeführt wird, um gleichzeitig mit dem Schneiden das Falten des Abschnitts (5a, 7a) der Flansche (5, 7) distal zu dem Gegenstand (P) in einer angewinkelten Anordnung in Bezug zu der Hauptebene der Flansche (5, 7) zu bewirken.

12. Verfahren nach Anspruch 9, das auf den Schneidearbeitsschritt folgend einen Arbeitsschritt des Umdrehens des Gegenstands (P) um 180° umfasst, und zwar mit den gekoppelten Halbschalen (2, 4).

13. Verfahren nach einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** der Verstemmungsarbeitsschritt durch eine Verstemmungsvorrichtung nach einem der Ansprüche 1 bis 6 ausgeführt wird.

Revendications

1. Dispositif pour envelopper un article (P) dans un logement formé à partir d'une paire de moitiés de coque (2, 4) faites d'un matériau en feuille ayant une forme épousant les parties respectives de la surface externe dudit article (P), lesdites moitiés de coque (2, 4) étant pourvues d'un rebord (5, 7) respectif entourant le contour d'embouchure respectif et lesdits rebords (5, 7) étant reliés l'un à l'autre par pliage et/ou refoulement afin de définir conjointement ledit logement, comprenant :

- un moyen de support (12) apte à supporter ledit article (P) inséré entre lesdites moitiés de coque (2, 4) de matériau en feuille, les rebords (5, 7) respectifs étant agencés en face à face ;
- un moyen de refoulement (36) agencé pour réaliser le pliage desdits rebords sur eux-mêmes et, éventuellement, le refoulement desdits rebords pliés, depuis une configuration dans laquelle une partie d'extrémité (5a, 7a) desdits re-

bords (5, 7) distante dudit article (P) est située en une position angulaire par rapport à la partie de rebord (5b, 7b) proche dudit article (P), **caractérisé en ce que** ledit moyen de refoulement (36) comprend un outil comprenant une ouverture (38) ayant un profil (40) qui est homologue et élargi par rapport au profil de périmètre défini par l'extrémité distale (5a, 7a) desdits rebords (5, 7), ledit outil (36) étant mobile dans la direction perpendiculaire au plan dans lequel se situe la partie proximale (5b, 7b) desdits rebords (5, 7) et étant également mobile parallèlement au plan de ladite partie proximale des rebords, un moyen formant moteur (42) étant agencé pour positionner ledit outil de refoulement (36) avec le profil (40) de ladite ouverture (38) en un agencement entourant ladite partie distale angulaire (5a, 7a) dudit rebord (5, 7) et amener une section du profil (40) de ladite ouverture (38) en contact avec une section homologue du profil de périmètre défini par ladite partie distale angulaire desdits rebords (5, 7) et provoquer un mouvement d'approche vers ledit article (P) par ladite section du profil de ladite ouverture (38) en contact avec ladite partie distale (7a) pour provoquer un nouveau pliage de cette partie sur ladite partie proximale (5b, 7b) et répéter les opérations précitées sur des sections supplémentaires du profil de la partie distale (5a, 7a) desdits rebords (5, 7).

2. Dispositif selon la revendication 1, **caractérisé en ce que**, après ledit mouvement d'approche du profil de ladite ouverture (38) qui provoque le pliage supplémentaire de ladite partie distale (5a, 7a) sur ladite partie proximale (5b, 7b), le moyen formant moteur est agencé pour produire un mouvement dudit outil (36) perpendiculairement au plan de ladite partie proximale (5b, 7b), pour provoquer le refoulement desdites parties distales (5a, 7a) pliées sur lesdites parties proximales (5b, 7b).

3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** ledit moyen de support (12) comprend une surface sensiblement plate (34) entourant ledit siège (16) apte à supporter les parties proximales (5b, 7b) desdits rebords (5, 7) et ledit moyen formant moteur est agencé pour :

- actionner ledit outil de refoulement (36) entre une position distante de ladite surface (34) et une position dans laquelle ledit outil (36) est en contact avec ladite surface (34) et ledit profil (40) de l'ouverture (38) et entoure les parties distales angulaires (5a, 7a) desdits rebords (5, 7) à une distance,
- actionner ledit outil (36) parallèlement à ladite surface (34) jusqu'à ce qu'une section du profil (40) de ladite ouverture (38) soit mise en contact avec une section homologue de la partie distale angulaire (7a) dudit rebord,
- actionner ledit outil (36) dans la direction perpendiculaire à ladite surface (34) jusqu'à une distance (d) depuis ladite surface (34), de manière que le profil (40) de ladite ouverture (38) soit apte à interférer avec l'extrémité de la partie distale (5a, 7a) desdits rebords (5, 7) et ne pas interférer avec les parties proximales en chevauchement (5b, 7b) desdits rebords (5, 7),
- actionner ledit outil (36) selon un mouvement parallèle à ladite surface (34) suivant un mouvement d'approche vers ledit article (P) pour amener le pliage de ladite partie distale (5a, 7a) desdits rebords (5, 7) sur ladite partie proximale (5b, 7b), et
- éventuellement, actionner ledit outil (36) dans la direction perpendiculaire à ladite surface (34) pour provoquer le refoulement de ladite partie d'extrémité distale (5a, 7a) sur ladite partie proximale (5b, 7b).

4. Dispositif selon la revendication 3, **caractérisé en ce qu'**il comprend un élément de refoulement auxiliaire (36b) desdits rebords (5, 7) comprenant un outil (36b) pourvu d'une ouverture ayant un profil de périmètre (40b) épousant sensiblement le profil d'embouchure desdites moitiés de coque (2, 4), ledit outil auxiliaire (36b) étant mobile dans la direction perpendiculaire au plan de la partie proximale desdits rebords (5, 7) et étant mobile entre une position distante desdits rebords (5, 7) et une position basse en contact avec la partie distale (5a, 7a) desdits rebords (5, 7) pliée sur ladite partie proximale (5b, 7b) pour réaliser son refoulement.

5. Dispositif selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** ledit outil de refoulement (36) est mobile parallèlement au plan de ladite partie proximale (5b, 7b) desdits rebords (5, 7) suivant deux directions perpendiculaires.

6. Dispositif selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** ledit outil (36) est mobile parallèlement au plan desdites parties proximales (5b, 7b) desdits rebords (5, 7) suivant un mouvement rotatif ou excentrique.

7. Appareil pour emballer un article (P) dans un logement formé à partir d'une paire de moitiés de coque (2, 4) faites d'un matériau en feuille, comprenant un dispositif selon l'une quelconque des revendications 1 à 6.

8. Appareil selon la revendication 7, **caractérisé en ce qu'**il comprend :

- des premier et second moyens d'emboutissage (6, 8, 10) aptes à former une première (2) et une seconde (4) moitié de coque de matériau en feuille, chacune comportant une partie de surface (2a, 4a) ayant une forme épousant une partie de surface respective dudit article (P) et une partie de surface (2b, 4b) entourant ladite première partie (2a, 4a) ;
- un moyen pour accoupler lesdites première et seconde feuilles à parties de surface (2a, 4a) respectives dudit article (P) avec lesdites parties de surface périphériques (2b, 4b) en une relation de chevauchement ; et
- un moyen pour couper lesdites première et seconde feuilles selon un profil entourant ledit article (P), afin de former une paire de rebords périphériques (5, 7), ledit moyen de coupe (26, 28, 30, 32) étant agencé pour provoquer, simultanément à la coupe, le pliage d'une partie distale (5a, 7a) par rapport à l'article (P) dudit rebord (5, 7) en une position angulaire par rapport au plan général desdits rebords (5, 7).

9. Procédé pour envelopper un article (P) dans un logement formé à partir d'une paire de moitiés de coque (2, 4) faites d'un matériau en feuille ayant une forme épousant les parties latérales externes respectives (2a, 4a) dudit article (P), lesdites moitiés de coque (2, 4) étant pourvues d'un rebord (5, 7) respectif entourant le contour d'embouchure respectif et lesdits rebords (5, 7) étant reliés par une opération de refoulement comprenant le pliage et, éventuellement, le refoulement desdits rebords (5, 7) afin de définir conjointement ledit logement, **caractérisé en ce que** le procédé comprend les étapes consistant à :

- supporter ledit article (P) inséré entre une paire de moitiés de coque (2, 4) pourvues de rebords (5, 7) respectifs agencés en face à face, des parties (5a, 7a) desdits rebords (5, 7) distantes de l'article étant situées en une position angulaire par rapport au plan dans lequel se trouvent les parties de rebords (5b, 7b) proches dudit article,
- prévoir un outil de refoulement mobile (36) comprenant une ouverture (38) ayant un profil (40) qui est homologue et élargi par rapport au profil de périmètre défini par l'extrémité distale desdits rebords,
- positionner ledit outil (36), le profil de ladite ouverture (38) entourant ladite partie distale angulaire (5a, 7a) desdits rebords,
- actionner ledit outil pour amener une section dudit profil (40) de ladite ouverture en contact avec une section homologue du profil de périmètre défini par lesdites parties distales angulaires (5a, 7a) desdits rebords,
- provoquer un mouvement d'approche vers ledit article (P) de ladite section du profil de ladite ouverture (38) en contact avec ladite partie distale (7a) pour la plier encore davantage sur ladite partie proximale (5b, 7b), et
- répéter les opérations précitées pour des sections supplémentaires du profil de la partie distale (5a, 7a) desdits rebords (5, 7).

10. Procédé selon la revendication 9, **caractérisé en ce que**, après ledit mouvement d'approche du profil de ladite ouverture (38) qui provoque le pliage supplémentaire de ladite partie distale (5a, 7a) sur ladite partie proximale (5b, 7b), le procédé comprend l'opération de production d'un mouvement dudit outil perpendiculairement au plan de ladite partie proximale (5b, 7b), pour provoquer le refoulement desdites parties distales (5a, 7a) pliées sur lesdites parties proximales (5b, 7b).

11. Procédé selon la revendication 9 ou 10, **caractérisé en ce qu'**il comprend les étapes consistant à :

- prévoir des première et seconde feuilles, chacune comportant une partie de surface (2a, 4a) façonnée pour épouser une partie de surface externe respective dudit article (P) et une partie de surface périphérique (2b, 4b) entourant ladite partie façonnée,
- accoupler lesdites première et seconde feuilles à parties de surface respectives dudit article (P) avec lesdites parties de surface périphériques (2b, 4b) en une relation de chevauchement,
- réaliser une opération de coupe sur lesdites première et seconde feuilles suivant un profil entourant ledit article (P) afin de former une paire de rebords périphériques (5, 7), et

caractérisé, en outre, en ce que ladite opération de coupe est réalisée pour provoquer, simultanément à la coupe, le pliage de la partie (5a, 7a) desdits rebords (5, 7) distante dudit article (P) en une configuration angulaire par rapport au plan général desdits rebords (5, 7).

12. Procédé selon la revendication 9, comprenant, après ladite opération de coupe, une opération de retournement dudit article (P) sur 180°, lesdites moitiés de coque (2, 4) étant accouplées.

13. Procédé selon l'une quelconque des revendications 9 à 11, **caractérisé en ce que** ladite opération de refoulement est réalisée au moyen d'un dispositif de refoulement tel que défini selon l'une quelconque des revendications 1 à 6.

FIG.1

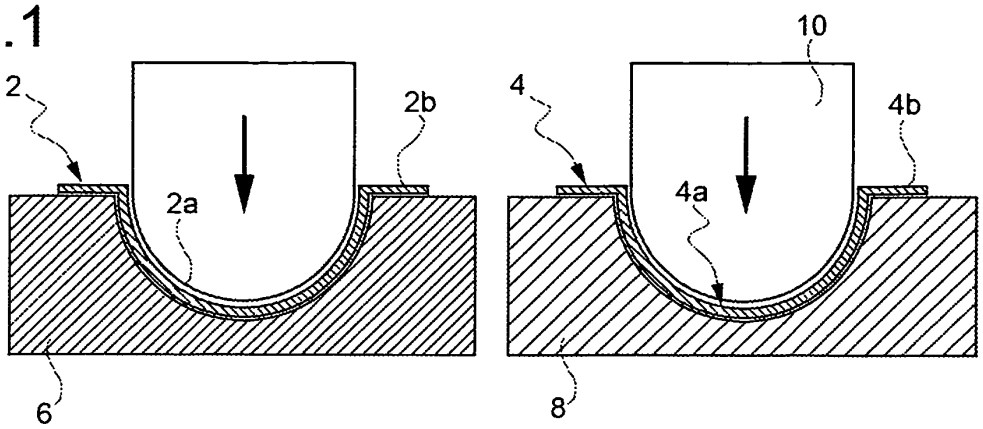


FIG.2

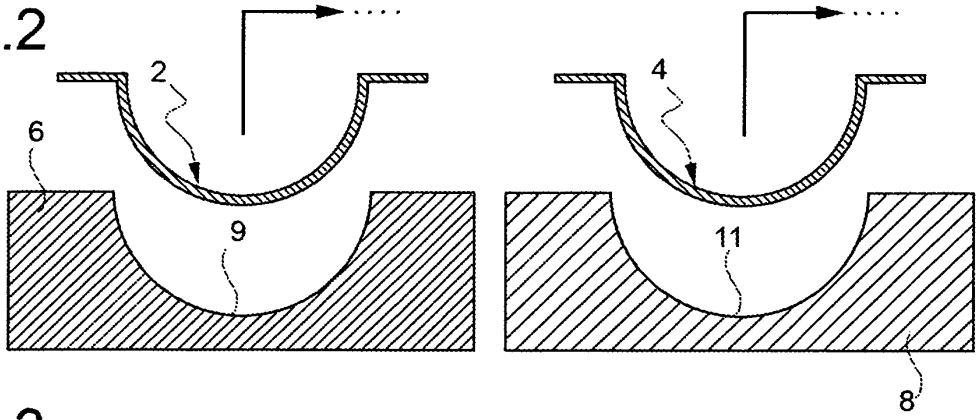


FIG.3

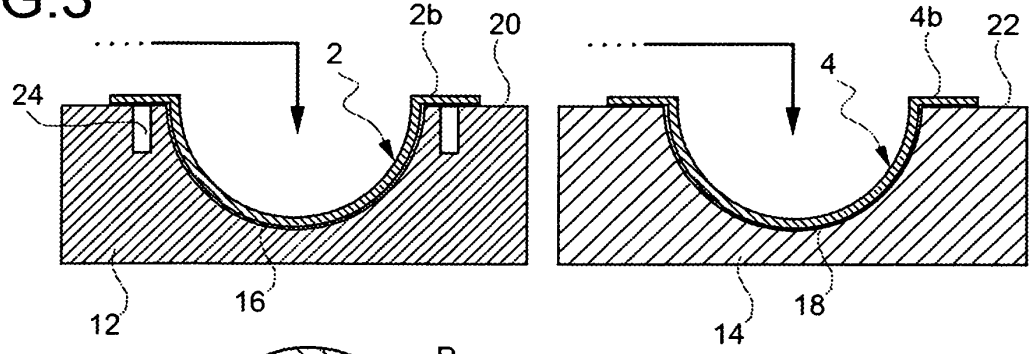


FIG.4

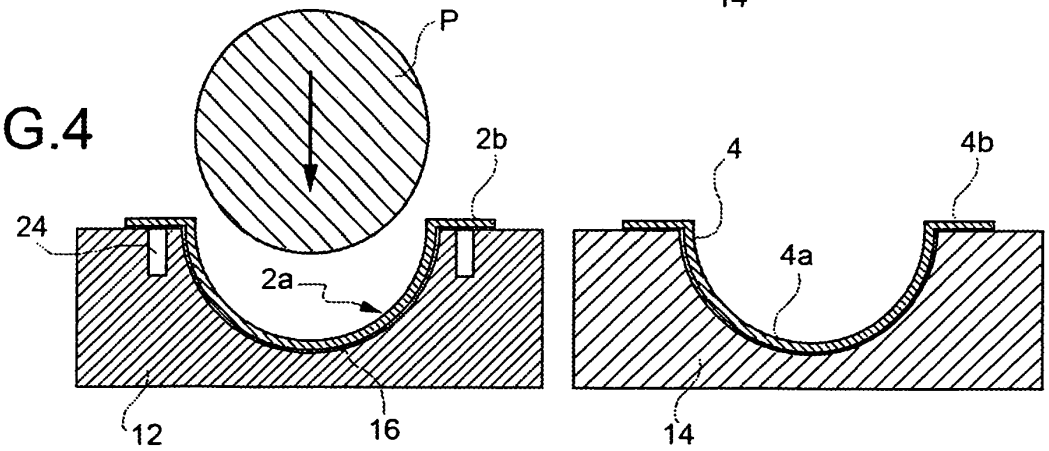
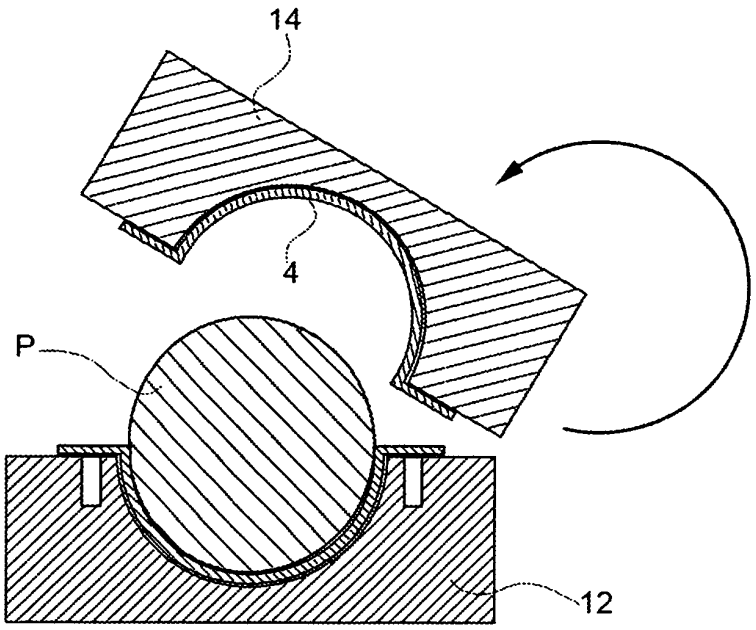


FIG.5



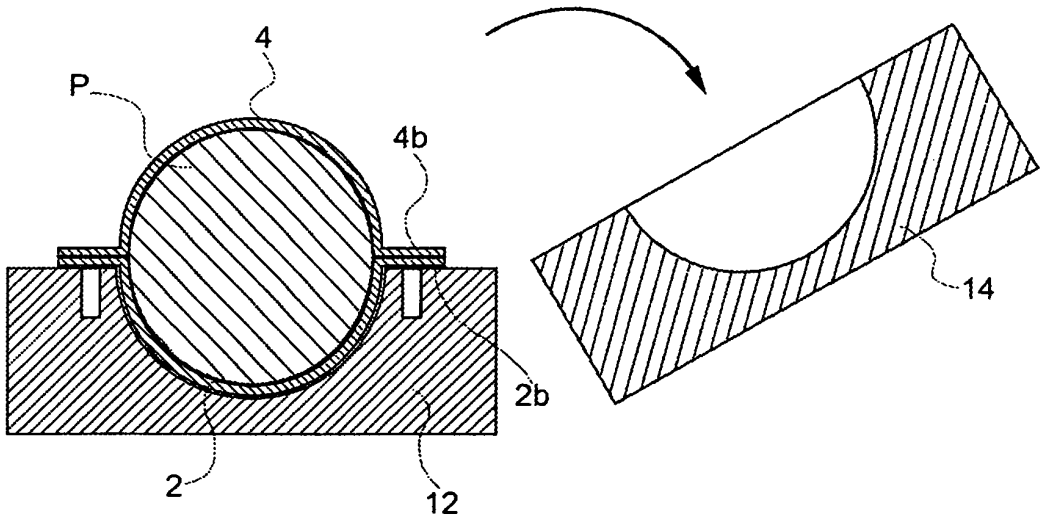
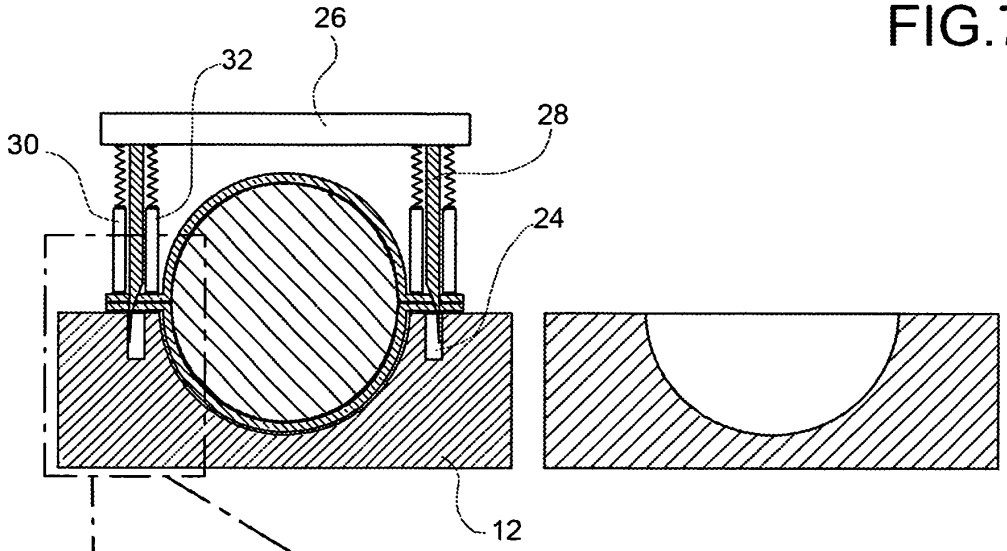


FIG.6

FIG.7



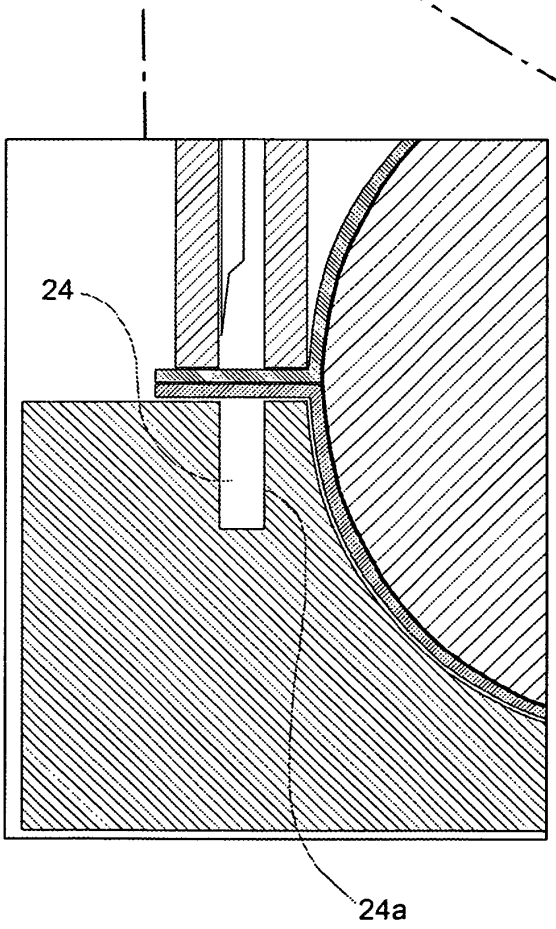


FIG.7a

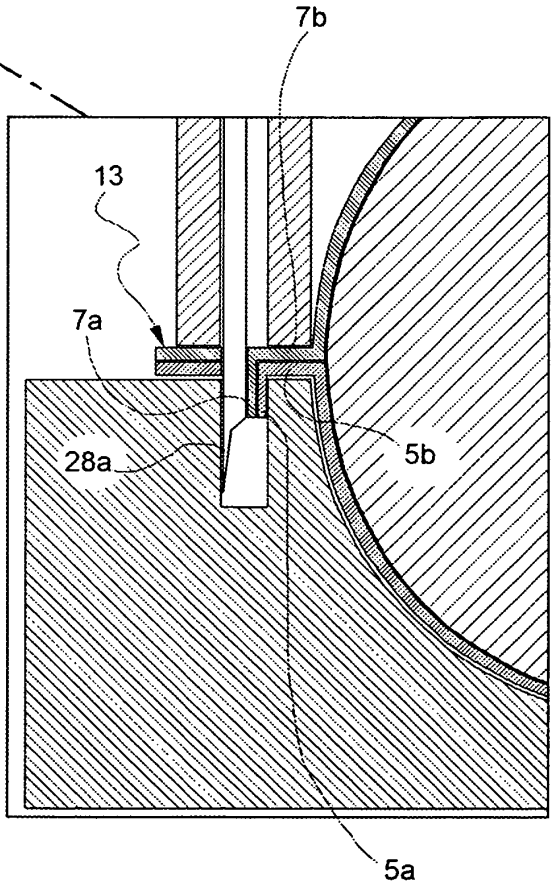


FIG.7b

FIG.8

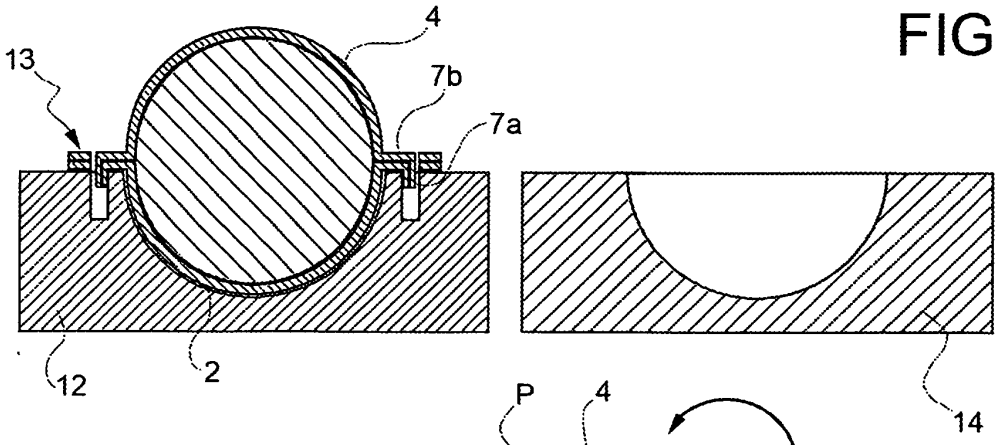


FIG.9

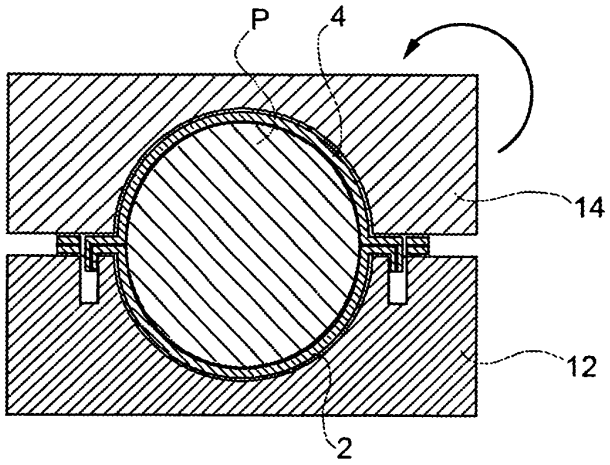


FIG.10

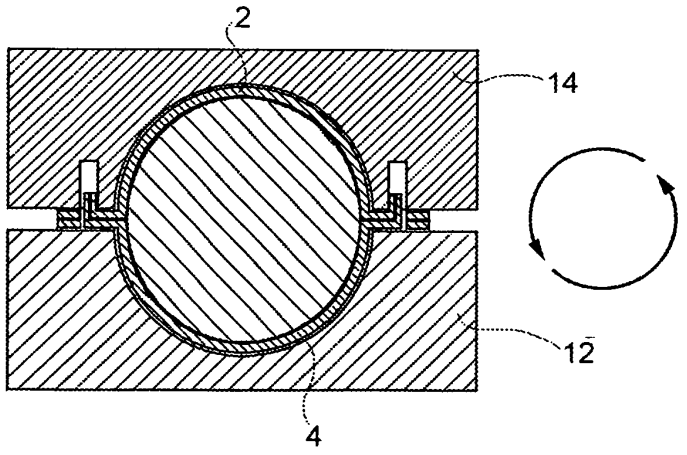


FIG.11

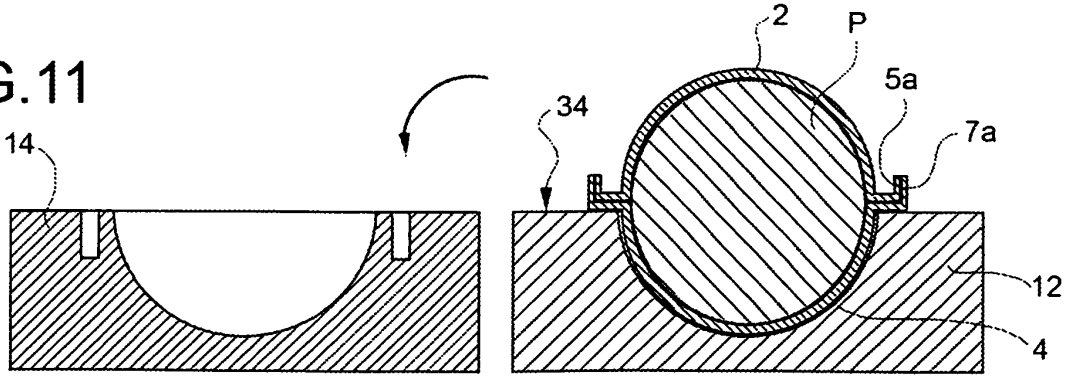


FIG.12

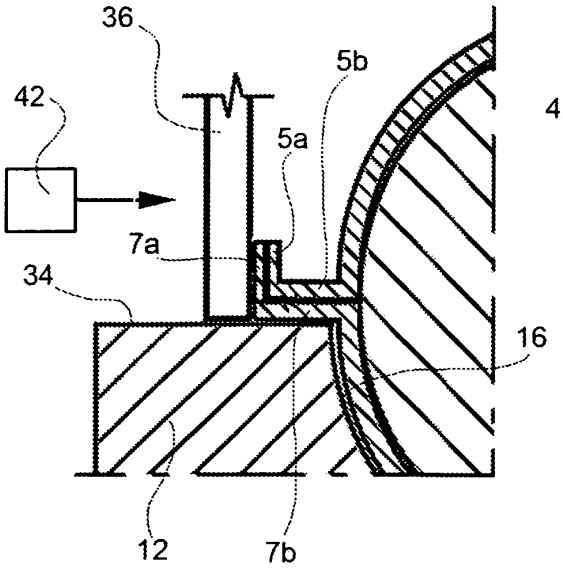
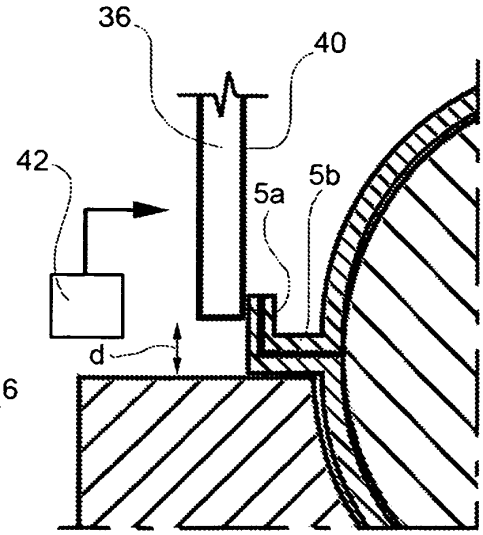


FIG.13



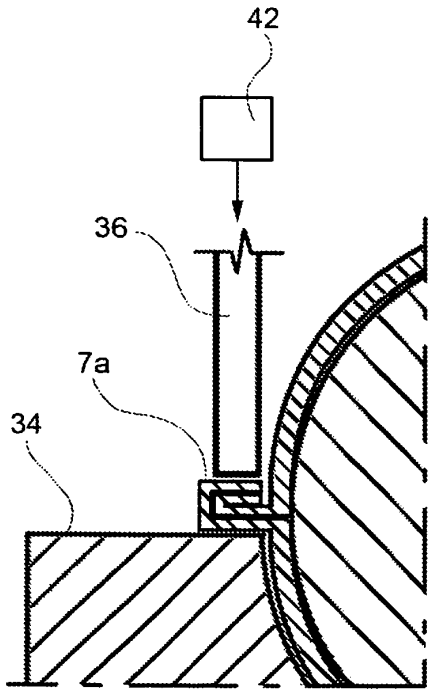


FIG.14

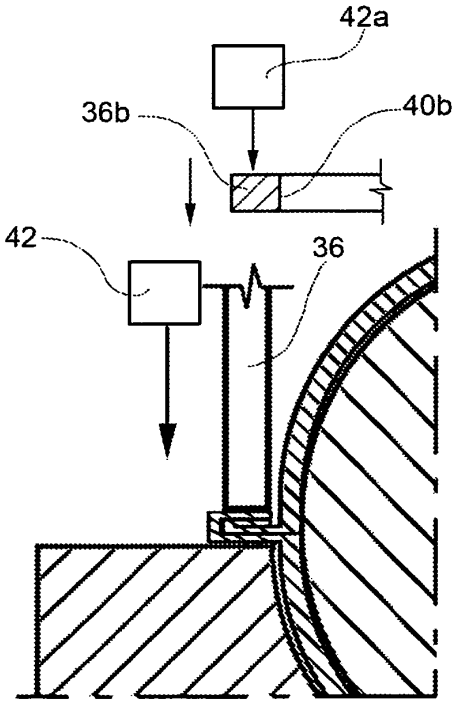
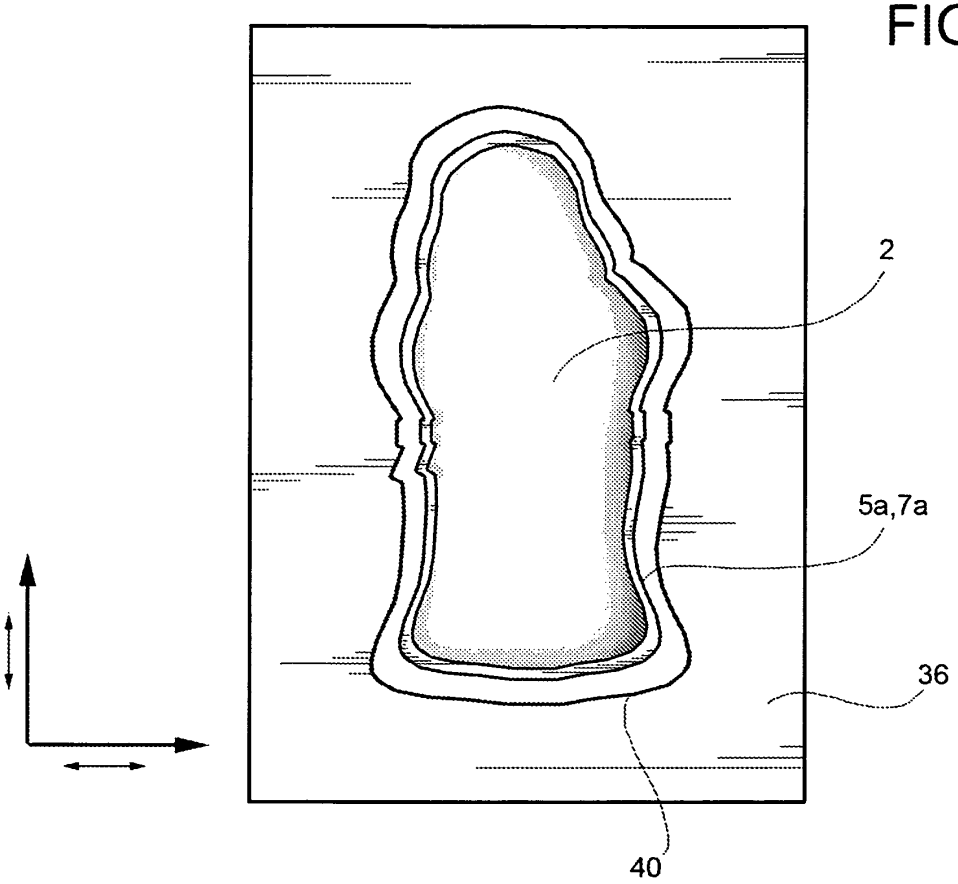


FIG.15

FIG.17



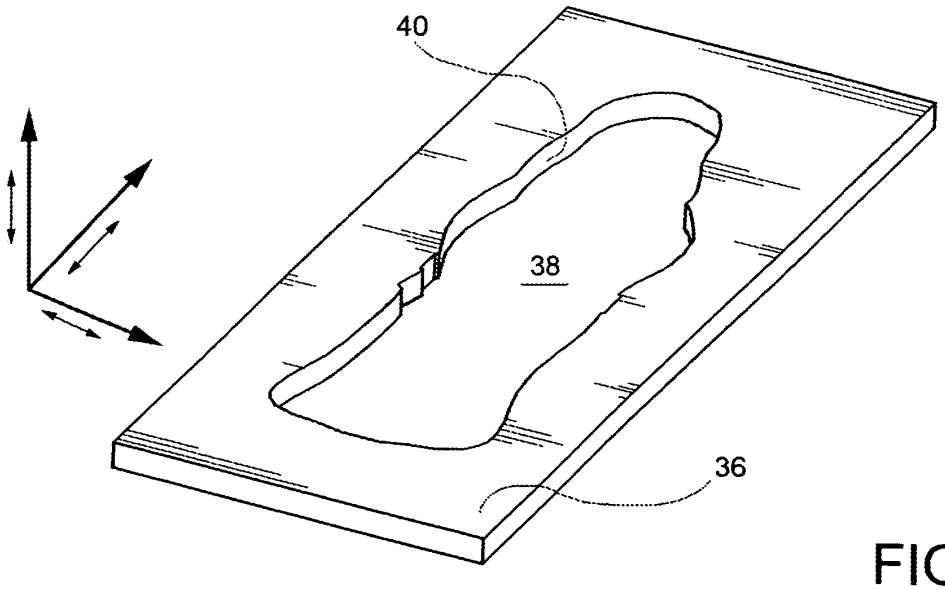


FIG.16

REFERENCES CITED IN THE DESCRIPTION

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