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(54) **PACKAGE AND METHOD FOR PRODUCING SAID PACKAGE**

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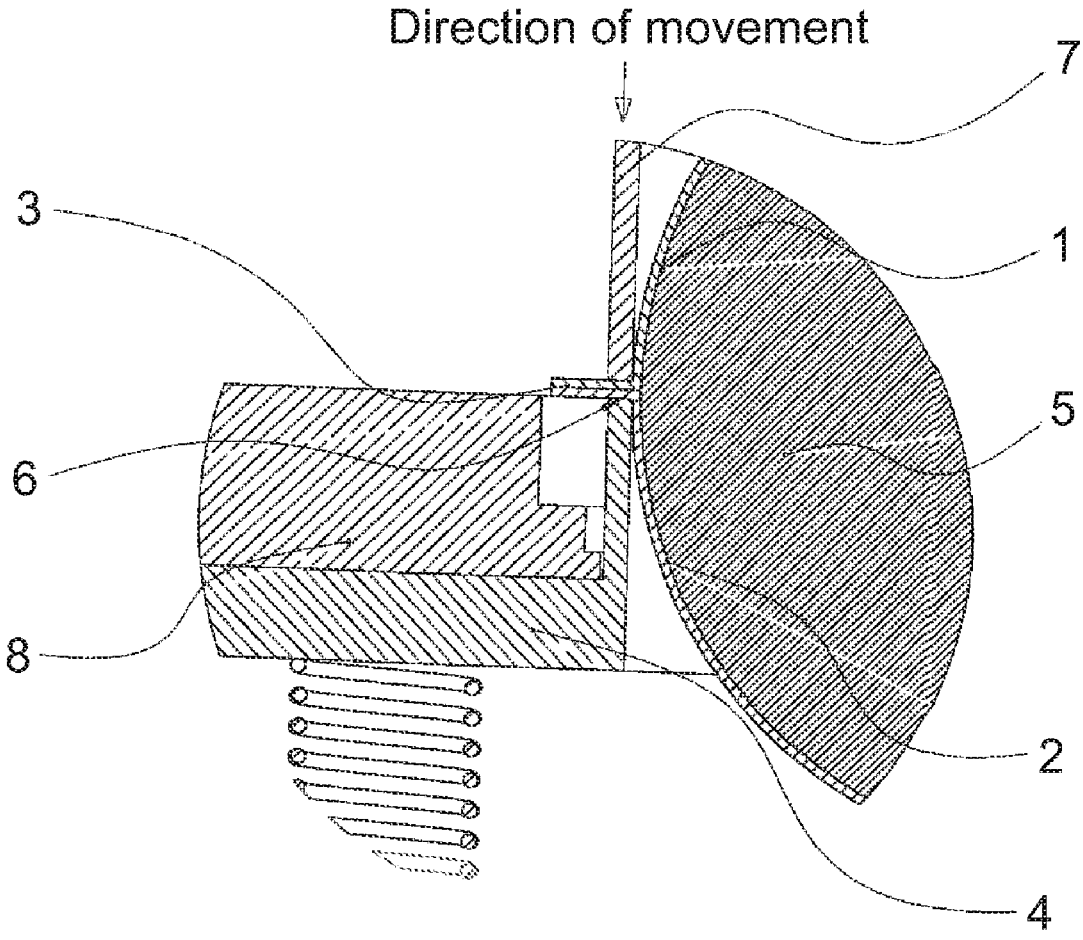
(57) **ABSTRACT**

The invention relates to a method for mechanically closing, in particular beading, a package for, in particular, food products, which package is made up of at least two foil half-shells which are mechanically closed at their encircling edge sections in contact with one another by means of a closing unit, wherein the closing unit comprises: a package carrier with an outer ring and a package receiving ring, and also at least two closing tools, specifically: a positioning tool for positioning the edge sections, which bear against one another, of the foil half-shells to be closed, and also an attachment tool for attaching the edge sections, wherein the method comprises the following steps: inserting the foil half-shells into the packaging receiving ring, wherein the foil half-shells bear against one another by way of their encircling edge sections, positioning the edge sections, which bear against one another, by means of the positioning tool, attaching the edge sections by means of the attachment tool, characterized in that the package carrier carries the package to be closed during the entire process.



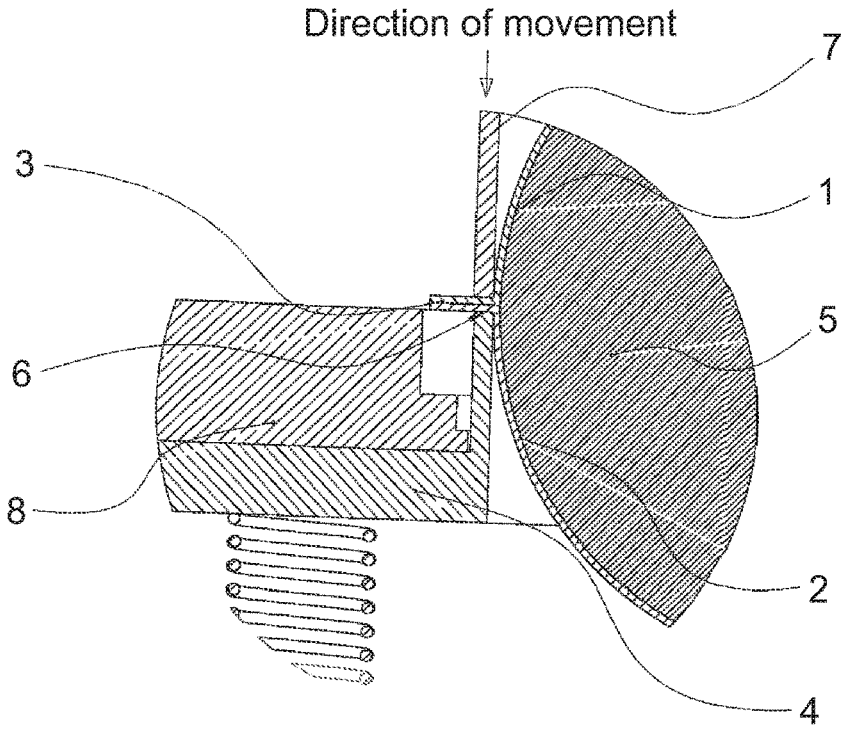

Direction of movement
7
3
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Fig. 1a

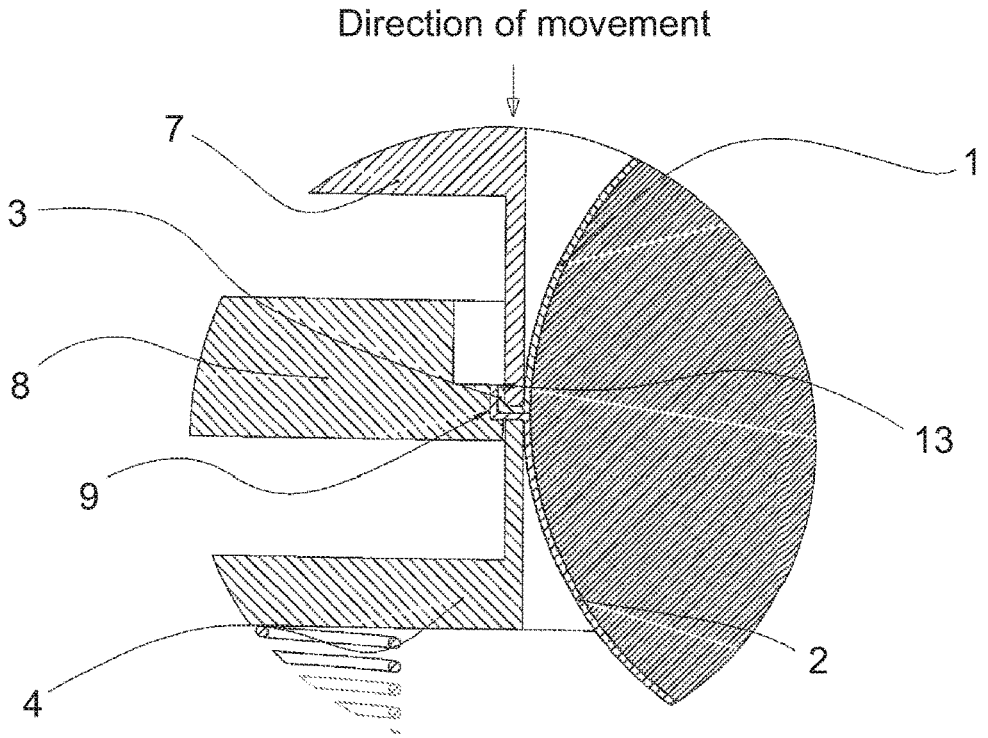
Direction of movement
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Fig. 1b

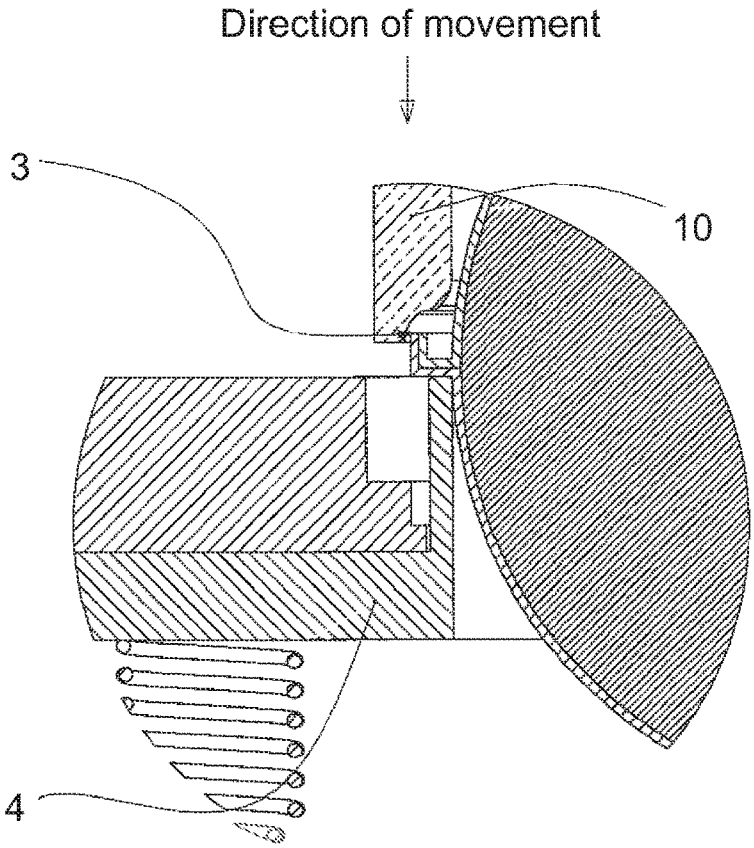

Fig. 1c

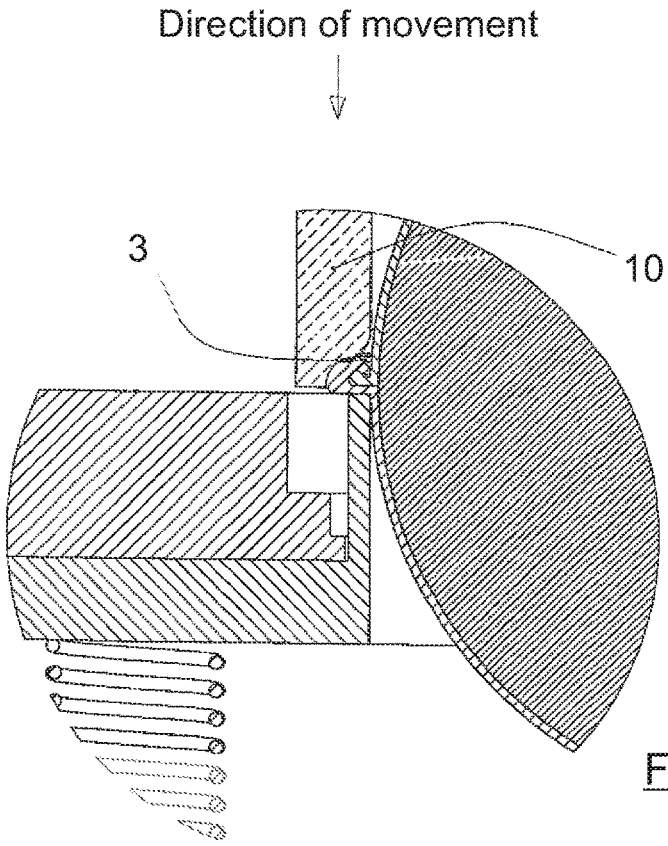

Fig. 1d

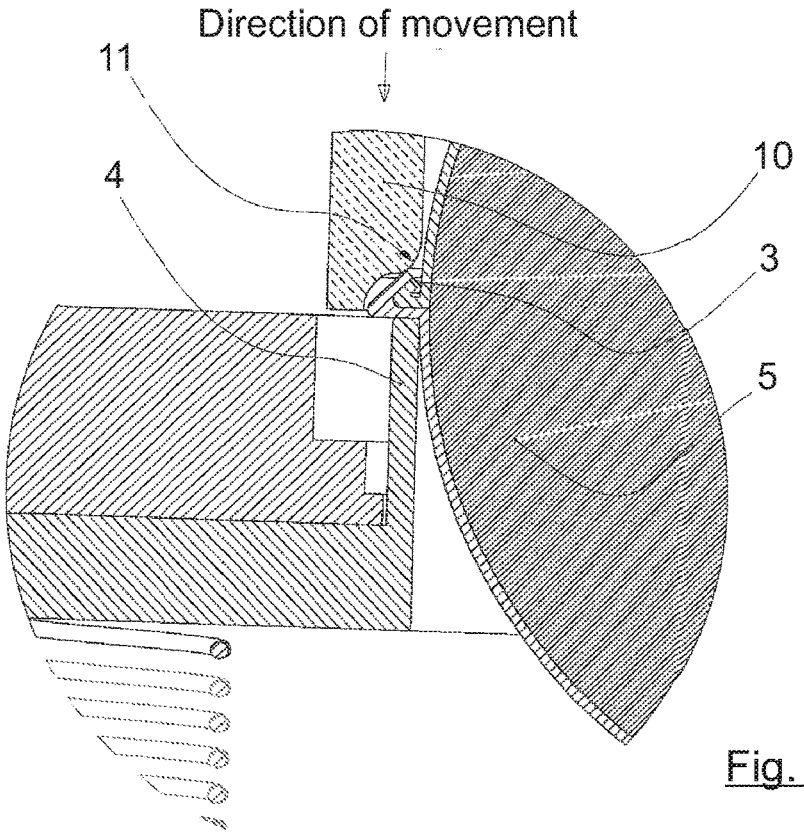

Fig. 1e

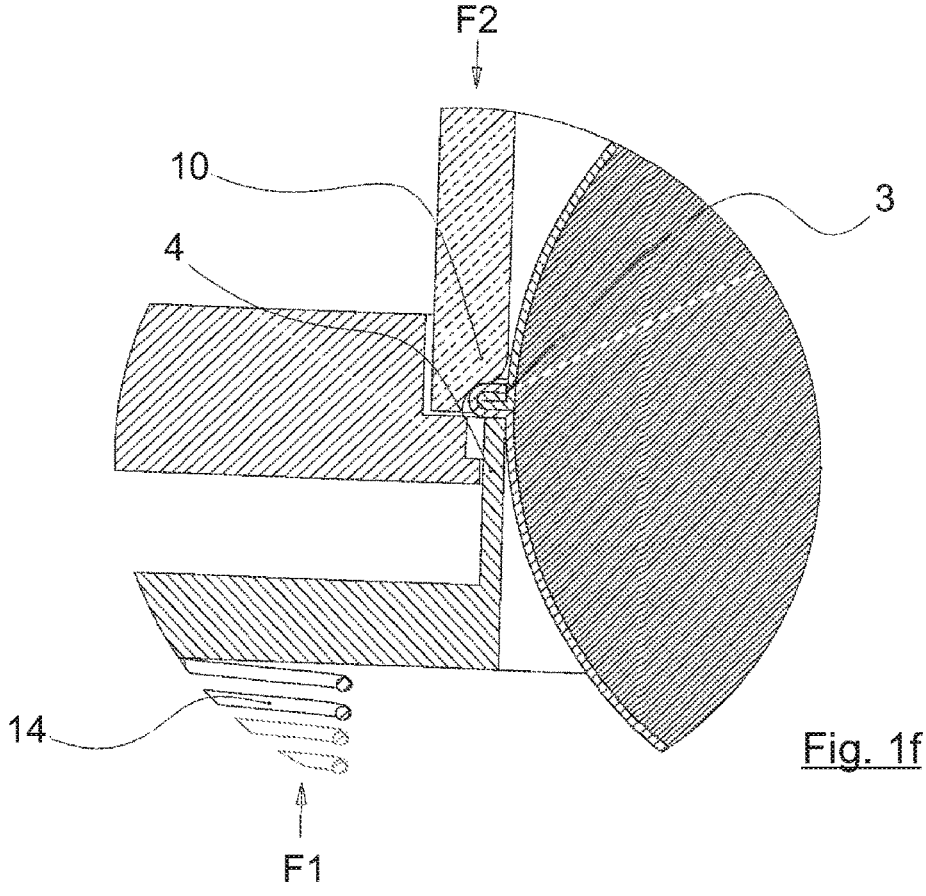

Fig. 1f

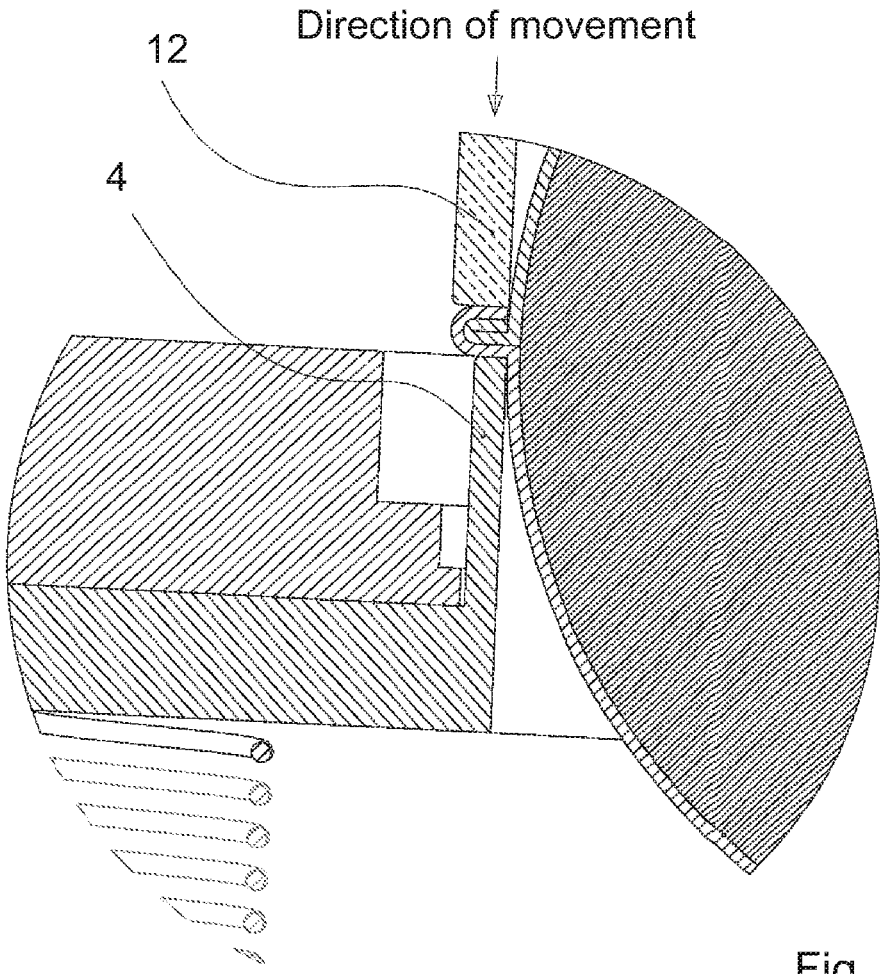

Fig. 2

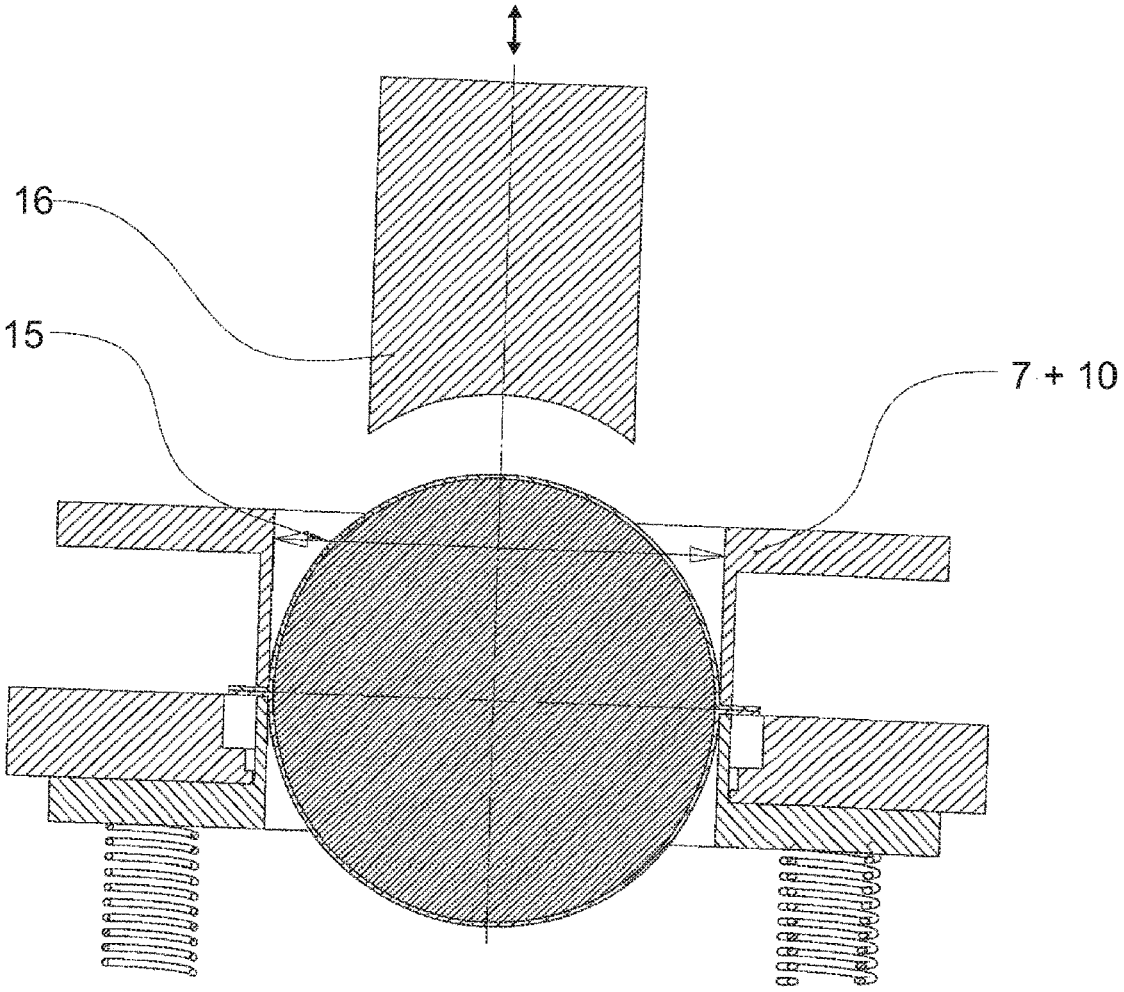

Fig. 3

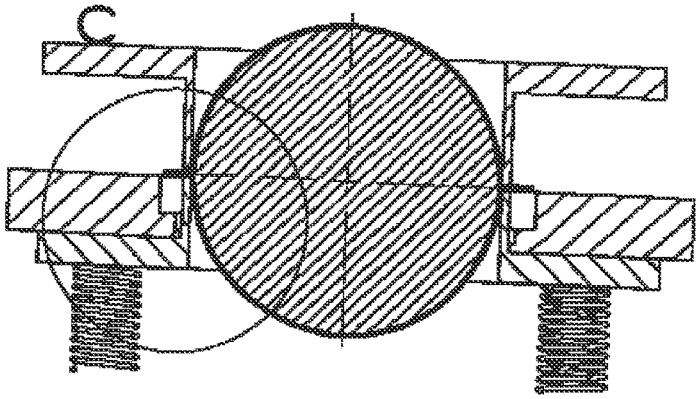

Fig. 4

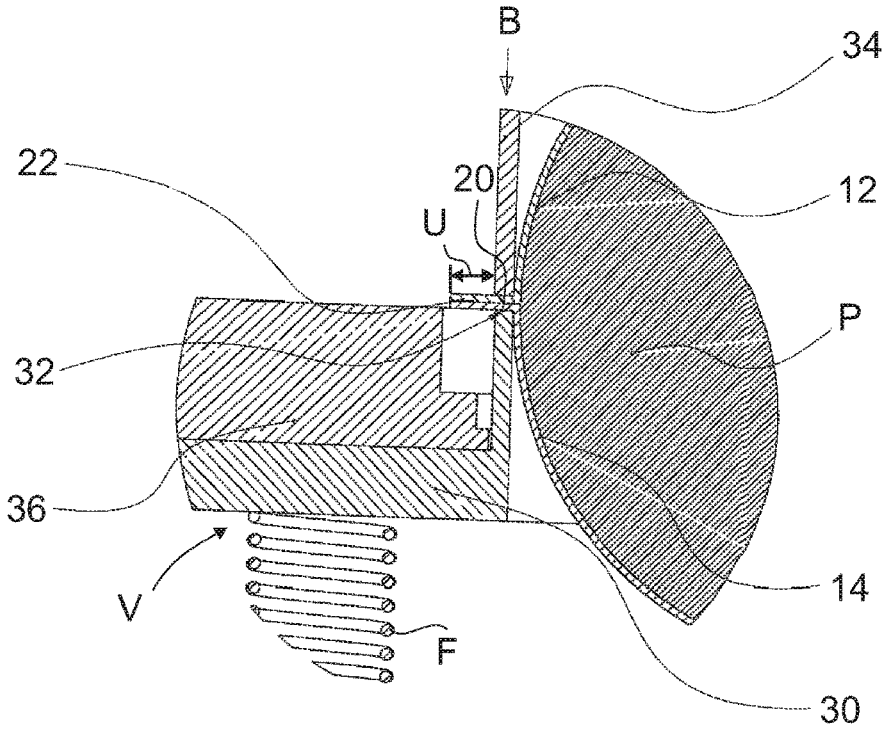

Fig. 5a

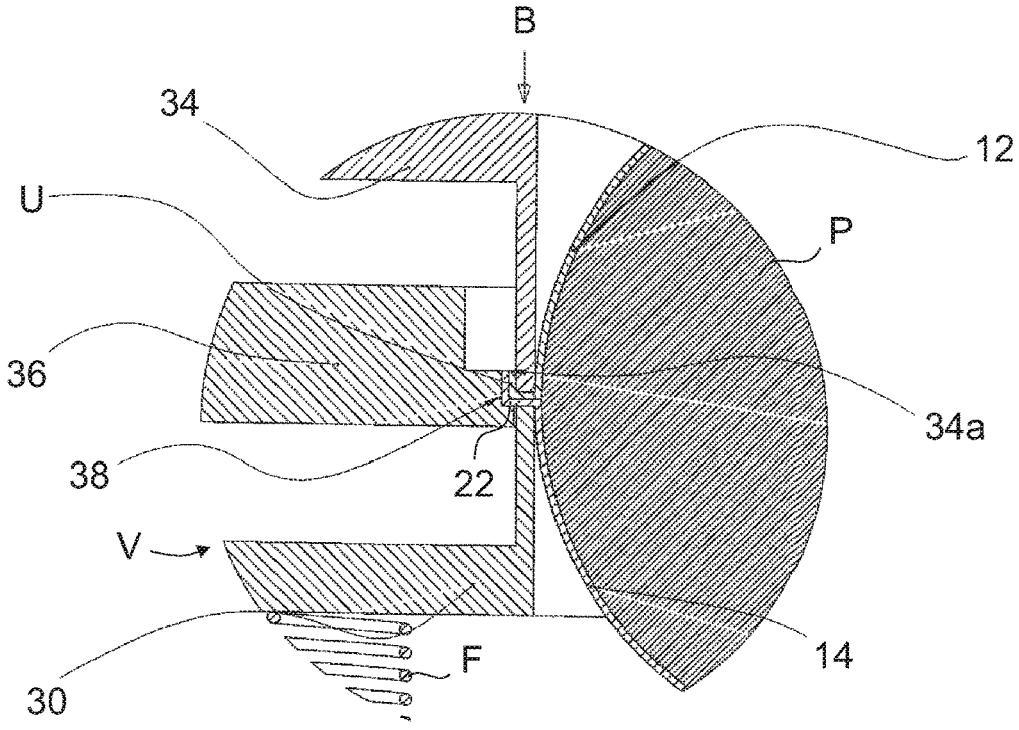

Fig. 5b

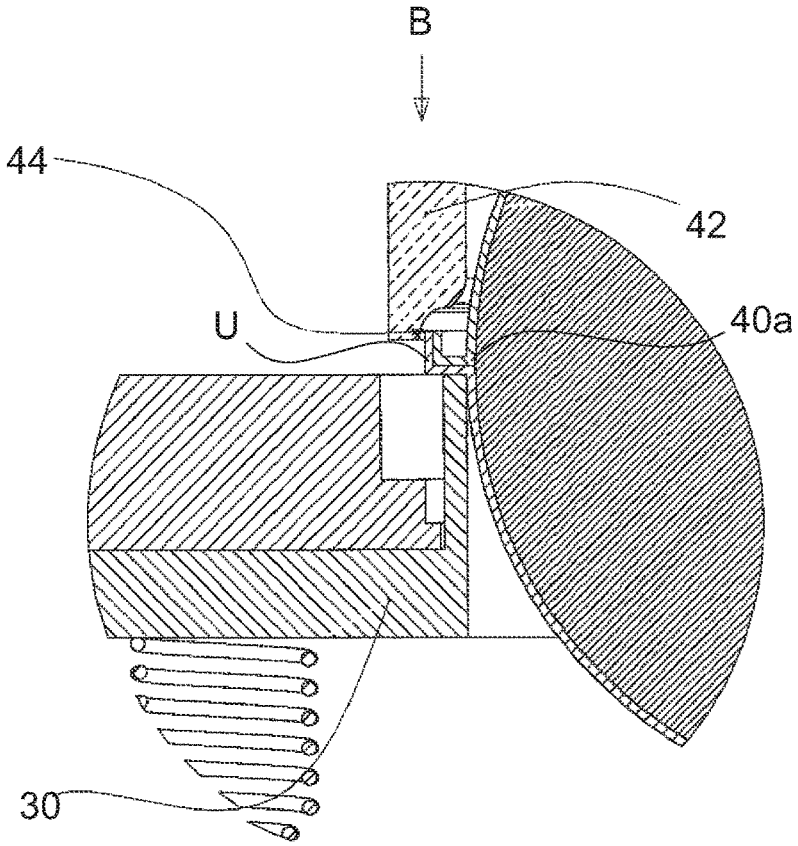

Fig. 5c

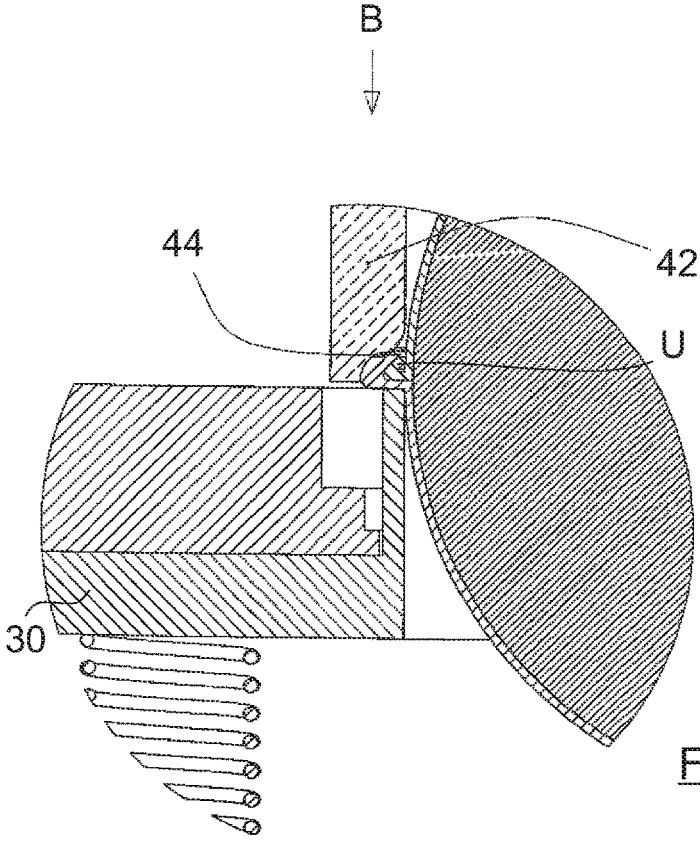

Fig. 5d

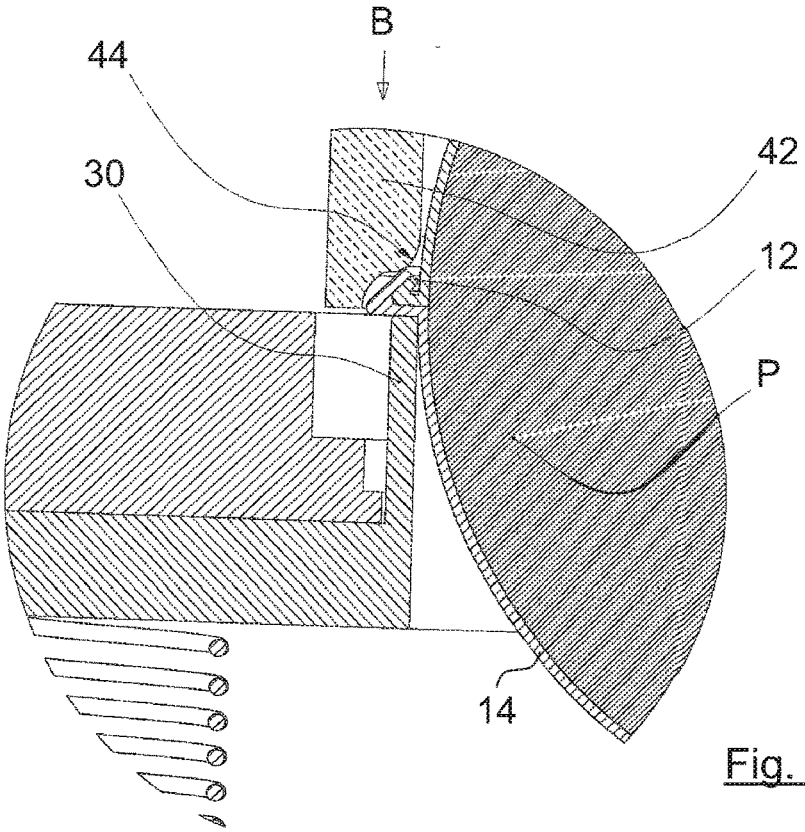

Fig. 5e

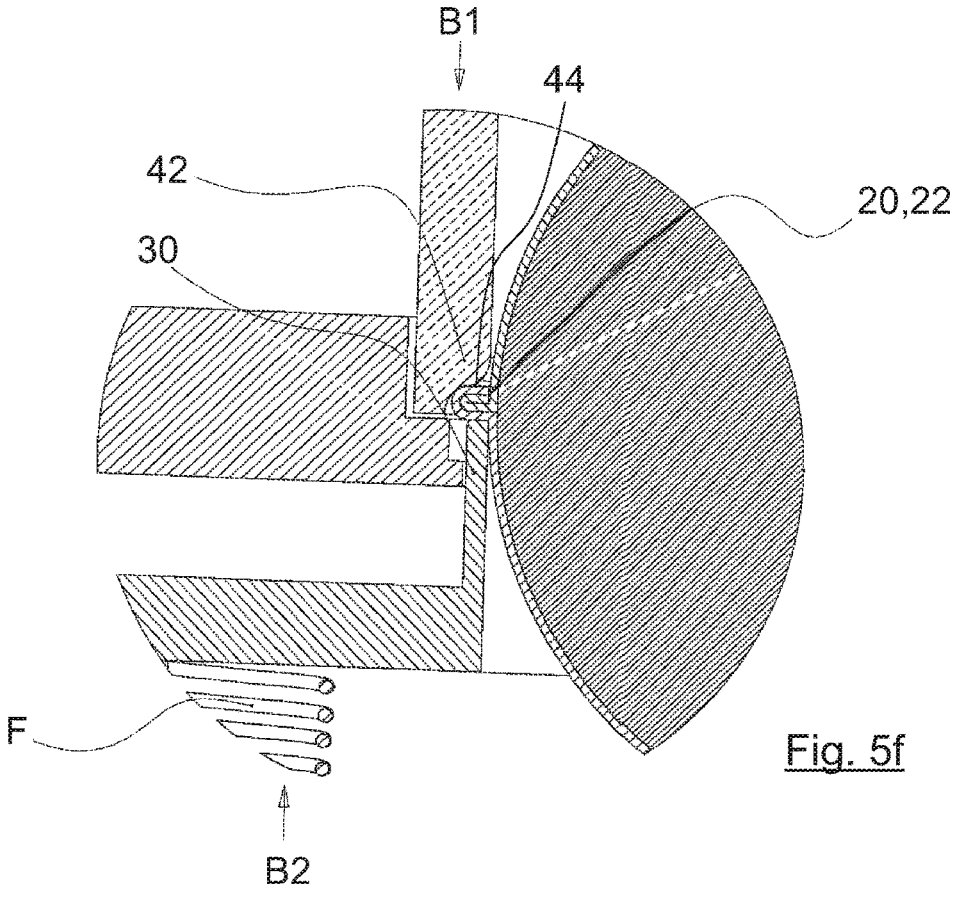

Fig. 5f

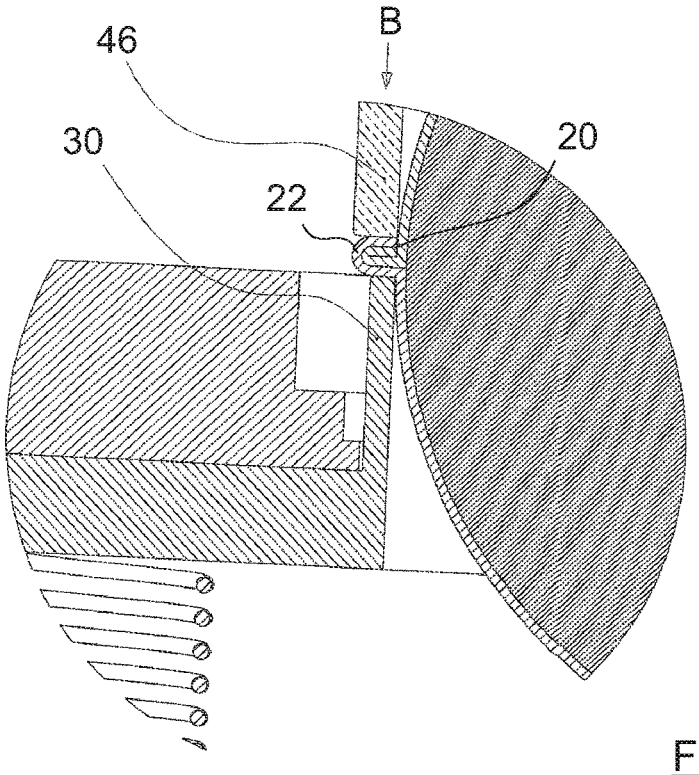

Fig. 6

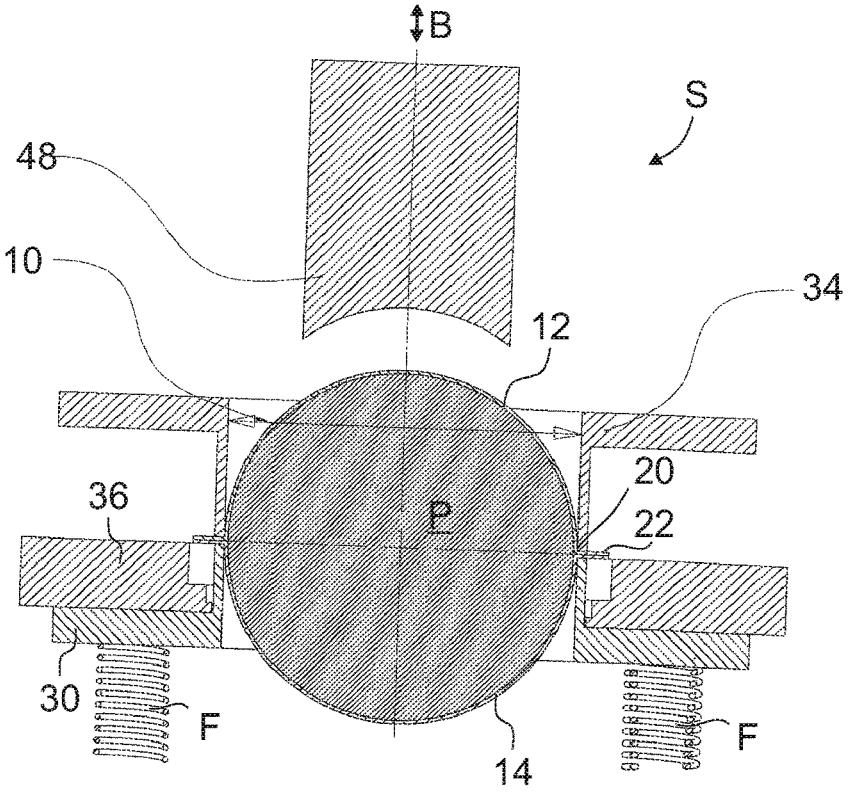

Fig. 7

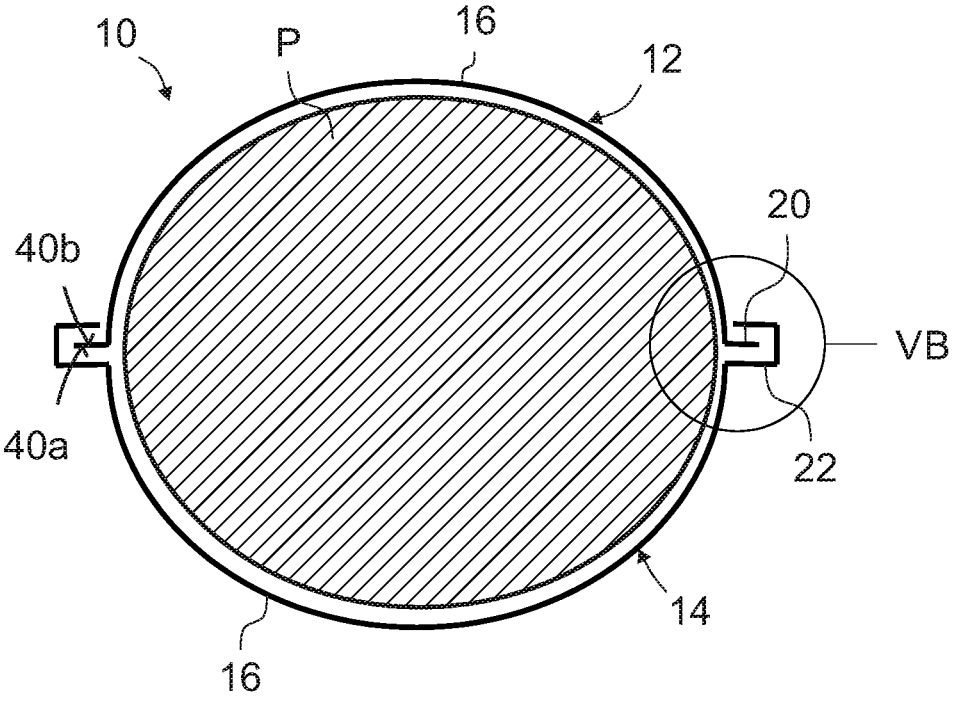

Fig. 8

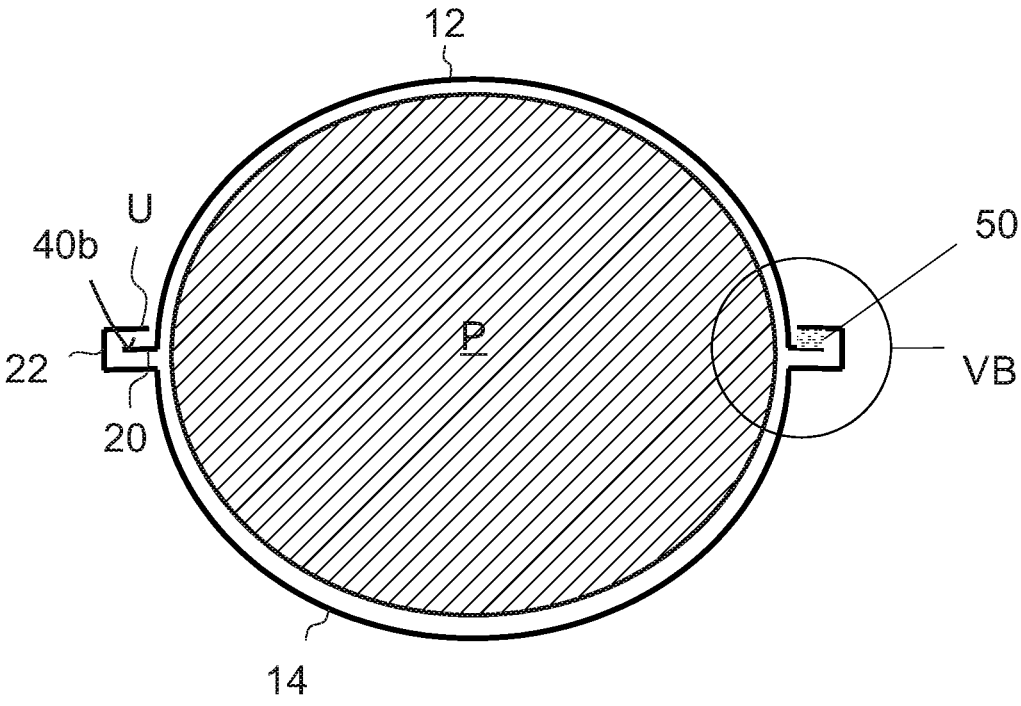

Fig. 9a

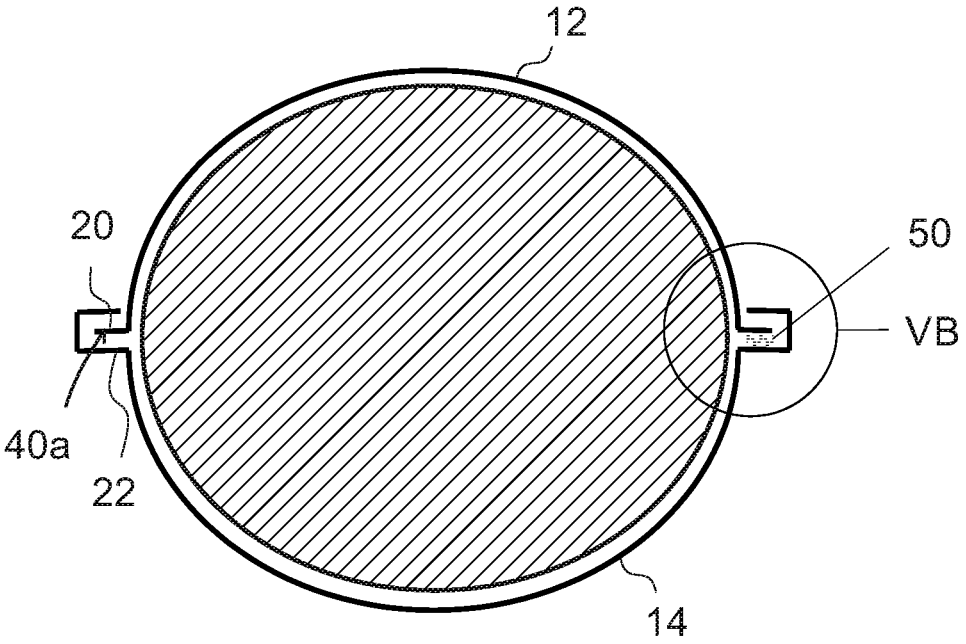

Fig. 9b

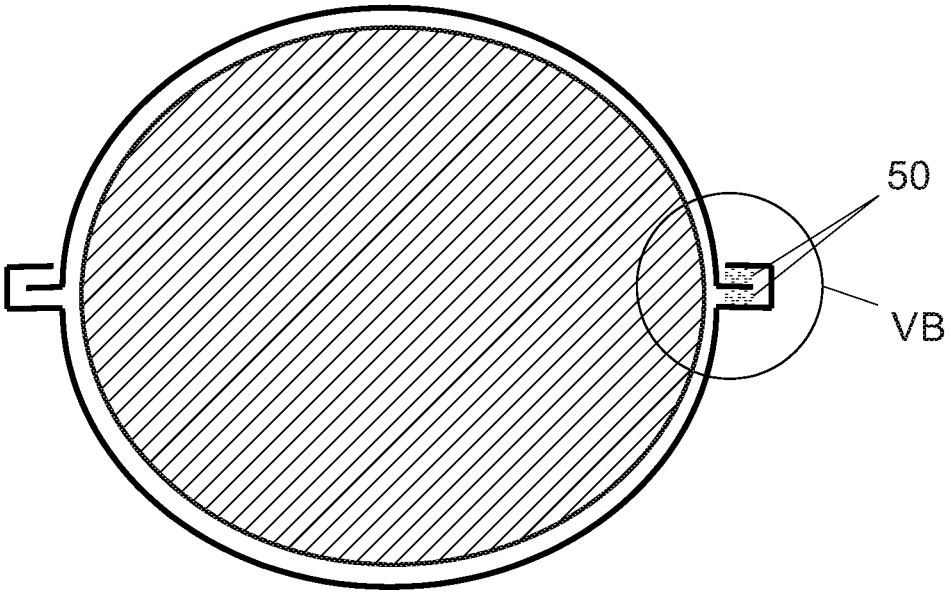

Fig. 9c

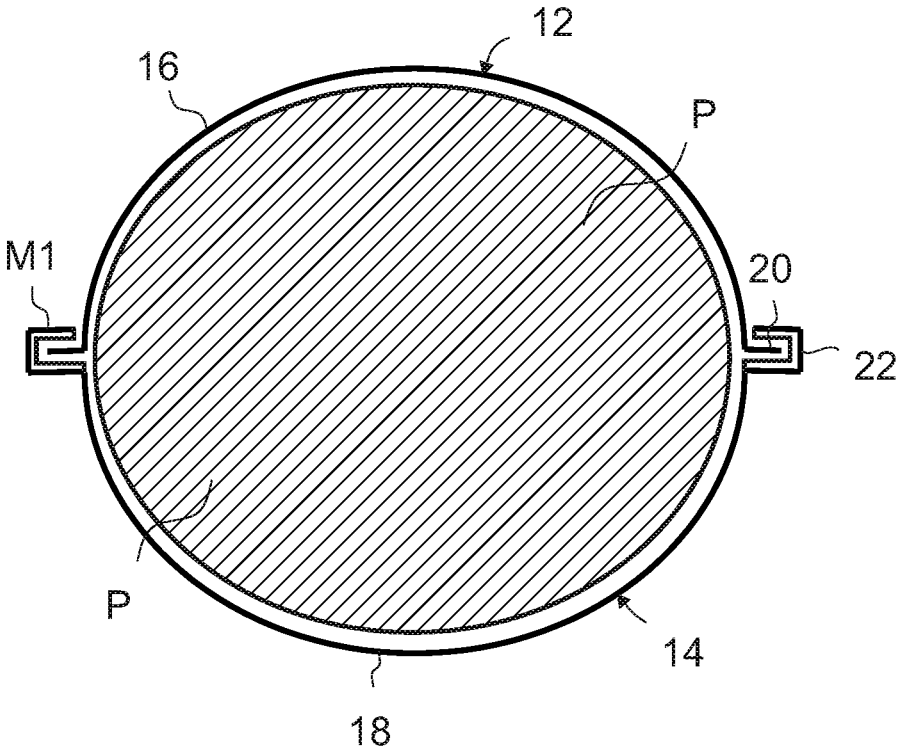

Fig. 10

PACKAGE AND METHOD FOR PRODUCING SAID PACKAGE

[0001] The present invention relates to a method and an apparatus for mechanically closing, in particular beading, foil packages. Furthermore, the present invention relates to a package, in particular for food products, and a method for producing a corresponding package.

[0002] In the following, the prior art will be described by using three different methods and apparatuses which operate according to the beading method.

[0003] EP 2 765 081 A1 describes a method and an apparatus by means of which a package for a food product, consisting of two part shells or consisting of two sheets of winding material, which are preformed in a way corresponding to two foil half shells, can be produced. The food products can be, for example, hollow chocolate body figures such as Easter bunnies, Christmas figures or surprise eggs. The part shells consist of aluminum foil or another plastically deformable foil material, which is coated on one side with a sealable layer. During the molding process, a receiving region is produced for the flange surrounding the food product, via which part shells are connected to one another in the following process steps after the food product has been inserted. The connection is produced by sealing and subsequently turning over the edges or two flanges resting on one another, what is known as beading, in the direction toward the receiving region. A projecting edge is produced by this packaging process. A similar method is also known from EP 3 145 814 A1.

[0004] WO 2016/193447 A1 describes a method for beading an at least two-layer material. In particular, by using this method, a cell pocket of a pouch cell or a temperature control unit is produced. The at least two-layer material is folded over in such a way that at least one layer, in particular the metal foil layer, encompasses the other layer mechanically. The at least two-layer material is fixed between upper and lower mold cavities. The flange to be turned over and to be beaded projects beyond said mold cavities. In a first step, the projecting flange is then guided against a bending element by means of a relative movement, so that the flange is turned over through 90°. In the next beading step, the flange turned up by 90° is then to be turned over by a further 90°. To this end, an upper tool part which consists of two parts is proposed. One part of the upper tool part turns over the turned up edge with the aid of a so-called molding plunger by about 45°-60° onto the package. The second part of the tool then presses the foils through the angular amount which is then still lacking into the horizontal.

[0005] AT 221 906 B describes a method for producing hollow chocolate figures with subsequent packaging. The liquid chocolate mass is put into a shaped package shell made of tin foil. A further package part shell is placed on this package part shell with product put in and is fixed, for example in a frame. This package, filled with liquid chocolate mass, is then thrown, that is to say rotated in all spatial dimensions, in such a way that the liquid chocolate mass is distributed uniformly in the package part shells.

[0006] The package part shells form projecting edges at their contact surfaces. Said edges are fixed to one another, which is done by beading. To this end, the tinfoiled hollow figures are removed from their fixing and inserted into a first closing tool (raising tool). The latter consisting of an upper tool with a molding plunger, which corresponds to the geometry of the package. The lower part consisting of a rigid frame and a sprung mold insert, which likewise corresponds to the geometry of the package.

[0007] A relative movement toward the rigid frame is produced by pressing the upper part onto the sprung mold insert of the lower part. In this way, the projecting edge is raised through 90°. In the next packaging step, the raised edge is turned over in a further tool (beading tool). In this tool, too, upper and lower parts are machined out in such a way that the geometry of the package fits in accurately. As the upper part is lowered onto the lower part, a frame which surrounds the upper mold part turns over the raised edge. To this end, the frame includes a so-called flute, on which the package edges are turned over inward during the downward movement. The package has then been finally beaded.

[0008] EP 2 252 528 B1 describes a package for hollow food bodies, which has two half shells which, in the region of the flange surrounding the receiving region for the food hollow bodies, rest on one another. The half shells are connected by a mutual engagement seat of the flanges, which is made by jointly bending over and beading the flanges in the direction of the receiving region. This packaging process produces a projecting edge.

[0009] DE 10 2015 217 593 A1 discloses a method for producing a package, in which an edge which is formed by two overlaid flanges of corresponding package half shells and which projects laterally from the package is at least partially attached to at least one half shell during a relative movement of a die and the package.

[0010] DE 10 2015 101 417 B4, finally, describes a method for producing a package, in which a sealing layer is provided between the edges of two part shells resting on one another, and the edges are connected to one another by sealing and folding, wherein the sealing is carried out together with the folding or after the folding of the edges. During the folding, the edges are bent over jointly in the direction of the receiving region of the package and again form a projecting edge.

[0011] DE 82 23 988 U1 describes a package for product pairs which can also be used individually, consisting of a cardboard panel and a transparent covering, wherein the products forming the pairs are accommodated on both cardboard sides, under a first and a second transparent covering.

[0012] U.S. Pat. No. 3,226,236 A discloses a further method for packaging a food product.

[0013] DE 60 2005 003 213 T2 discloses a prefabricated food package, a method for its production and the use of polymer-coated paperboard in the prefabricated food package. The package is produced by the food being put in the raw state into a shell, in which the food is baked, and by the shell being closed with a lid following the baking.

[0014] A method for closing a filled container which consists of foil material and which is provided with an edge flange and with an upright border delimiting the flange, in which a covering foil is placed on the flange and the border is subsequently turned over onto the flange, clamping in the covering foil, is disclosed by DE 12 27 825 A. As the border is turned over, it is bent over downward together with the flange and the edge of the covering film placed thereon and is bent inward in the form of a groove along the bending point, after which the outer edge of the flange, which is still directed downward, is compressed against the flange part having the inward bend by means of beading and material concentration.

[0015] The invention described here has the object of implementing an improved closing method and tool for foil packages which operates on the beading method principle, and of devising an improved package and a method for simpler production of such a package.

[0016] This object is achieved by a method having the features of claim **1** and by a closing unit having the features of claim **11**. In this way, the projecting package edge caused by the method after the beading is to be kept as small as possible, in order thus to save material and at the same time to improve the appearance of the package.

[0017] Important characteristics of the mechanical closing method are at least two method steps. Firstly, raising a package edge, which is formed from two packaging flanges lying one above another or edge sections of the foil half shells of the package and, secondly, subsequently attaching the raised edge sections to the package body.

[0018] The packaging foils are preferably thin aluminum foils in thicknesses of 8 μm-30 μm. If the packaging foils are equipped with a sealing layer, a sealed package can also be produced in a further packaging step. To this end, a heated element can be introduced into the method.

[0019] According to the invention, the package carrier carries the package to be closed during the entire method. Repositioning or transport between two steps of the method is not necessary.

[0020] In addition, simultaneous additional processing of the package part shells or foil half shells of the package, for example by marking, is to be possible. Accordingly, the raising tool and the attachment tool contact the package during the respective method step of raising and attachment only in the region of their edge sections resting on one another, so that the remaining package simultaneously remains accessible for further processing steps by means of further processing tools.

[0021] The packaging material used can preferably be aluminum foil in the thicknesses 8 μm-30 μm. Likewise, it is possible to use coated aluminum foil, wherein one side is, for example, coated with a plastic layer which, in the course of the packaging process, can be used as a sealing layer. It is then possible to carry out sealing before or after the beading process.

[0022] In addition, the tool is to be implemented with as few components as possible, in order to devise a cost and reliability optimum. Accordingly, the invention also relates to a corresponding tool, in particular a closing unit.

[0023] The individual features of the invention can be gathered from the claims and the following figure description. As a further alternative refinement, counter to the explanations of claim **2**, it is also conceivable to design the closing tool to be closed at the top and to permit no accessibility to the package.

[0024] Furthermore, the outer ring can also be designed in such a way that the tool can dip into the same for edge attachment.

[0025] In claim **12**, a package for in particular food products is specified. In this way, the intention is to save packaging material and at the same time the advantages of known packages are to be provided.

[0026] Accordingly, the invention relates to a package for in particular food products, which is assembled from at least two preformed foil half shells, which are preformed in such a way that they each have a receiving space for a product to be received and a flange at least partially surrounding the receiving space, wherein the flanges are designed to be attached to one another, at least partially, to connect the foil half shells.

[0027] According to the invention, a first flange of a first foil half shell has a first radial extent, based on the receiving space, which is greater by a projection than the second radial extent of the second flange of the second foil half shell, in such a way that, when connected, the first flange is bent over in the region of its projection in the direction of the receiving space in such a way that it at least partially overlaps the second flange with its projection and the second flange is at least partially encompassed on both sides by the first flange.

[0028] In a manner differing from the known prior art, the second flange remains unbeaded in the closed state of the package with the connected foil half shells and, instead—at least partially—is encompassed by the first flange on its upper and lower side. However, the first flange is wider, that is to say longer in its radial extent (based on the receiving space) than the second flange, so that in the unbeaded state, it bears smoothly on the second flange only with its proximal region (based on the receiving space), while it projects with its distal region beyond the second flange (projection).

[0029] This projection is then bent over and beaded, i.e. in a first step is bent over in the direction of the second flange by about 90° and then, in a second step, is bent over the second flange by approximately a further 90° in the direction of the receiving space. In this way, the proximal section of the first flange in the beaded state continues to rest on the second flange (e.g. on its underside) from one side (first contact region), while the distal section of the first flange in the beaded state rests from the second side on the second flange (e.g. on its upper side) (second contact region). The second flange is, so to speak, encompassed by the proximal and distal section of the first flange—at least partially. The projection and the bending section can be chosen in such a way that the distal section of the first flange encompasses only an outer edge section of the second flange, or that it reaches almost as far as the transition region from flange to receiving space of the second foil half shell. Thus, the second contact region can be chosen to be virtually the same size as the first contact region or less than the latter.

[0030] The fact that only one flange has to be bent over means that the second flange can be designed more narrowly, i.e. have a smaller radial extent, which means that packaging material can be saved. This is advantageous both for reasons of cost and also while taking into account the lower environmental contamination arising as a result of the packaging. Thus, a material saving of about 10% is possible, which means that enormous savings can be achieved. At the same time, as a result of the two-fold bending of the first flange, a secure and sealed connection of the flanges of the two foil half shells, and therefore good protection of a product accommodated therein, can continue to be provided, which is advantageous in particular when a food product is involved.

[0031] Provision can also be made for at least one of the foil half shells, for example the first foil half shell, to have a sealing coating on at least one side, at least partially in the region of its flange. This can extend over the entire flange, covering the surface but does not have to; alternatively, the sealing coating can also be formed by local sealing points or regions.

[0032] In this way, once more particularly resource-conserving use of a sealing coating as compared with the prior

art can be achieved. At the same time, as a result of the additional sealing, improved tightness of the package is achieved, which in turn is of great relevance in the case of food products to be accommodated, since in this way the shelf life of the packaged product is prolonged.

[0033] For the case in which, for example, the first flange is to have a sealing coating on one side, i.e. that a sealing coating is to be provided only on one side (upper side or underside) of the flange, the sealing coating is expediently provided on that side of the first flange and at least in the regions of the flange which, in the connected state, come or comes into contact with the second flange.

[0034] A further advantage of this specific design is to be seen in the fact that the sealing coating can carry out the sealing in only one operation both in the first contact region of the first flange and second flange, in which the first flange rests with its proximal section on the second flange, and in the second contact region, in which the first flange rests with its distal section on the second flange.

[0035] A locally heat-sealing lacquer can be provided as a sealing coating. Alternatively, for example, polypropylene, polyethylene, ionomers (Surlyn) or ethylene vinyl acetate copolymers can be used, which are melted by the input of heat from both sides from the outside. Thus, for example, it is possible to use a coated aluminum foil, wherein one side is, for example, coated with a plastic layer which, in the course of the packaging process, can be used as a sealing layer.

[0036] Alternatively or additionally, provision can be made for at least the second foil half shell to have a sealing coating on one or both sides, at least partially in the region of the second flange.

[0037] As a rule, sealing always takes place against a sealing layer, i.e. two surfaces to be connected to one another are each provided with a sealing coating. Depending on the type of sealing material used, the sealing coating can, however, also be provided only on one side in the manner of an adhesive which, in the molten state, is suitable to enter into a connection with the respective other surface.

[0038] Alternatively or additionally to the sealing of the foil half shells, the latter can in principle also be adhesively bonded, i.e. instead of or in addition to a sealing coating, an adhesive coating can be provided on at least one of the foil half shells, at least partially, in the region of its flange.

[0039] For the case in which only the second foil half shell is to have a sealing coating, a coating on both sides, at least in the region of the second flange, may be expedient. Here, too, that stated above applies, that said coating does not have to extend over the entire area of the second flange or its upper and/or underside, but can also be formed by local sealing points or regions and, expediently, is provided at least in the regions of the flange which, in the connected state, come into contact with the first flange.

[0040] The question of the type and the extent of the sealing coating can also depend on the time at which sealing is to be carried out. Sealing can thus be carried out before or after the beading process. In the first case, the sealable region is restricted to the first contact region, in which the first flange rests with its proximal section on the second flange, while in the second case the sealing can also be carried out in the second contact region, in which the first flange rests with its distal section on the second flange.

[0041] Furthermore, irrespective of the aspect of a sealing coating, provision can be made for at least one of the foil half shells to have at least two sections which are produced from different materials.

[0042] Thus, for example, a first section of the at least one foil half shell, for example in the region of the first flange, can be produced from a plastically deformable, in particular metal-containing, material, and optionally a second section, for example in the region of the receiving region, can be produced from a biodegradable and/or transparent material.

[0043] In this way, it is possible to provide good deformability in the region of the first flange for a secure and sealing beaded connection and, at the same time, to provide a particularly environmentally friendly and/or visually appealing package which, for example in the case of production from transparent material, permits a view of the accommodated product

[0044] Alternatively or additionally, provision can be made for one section of the at least one foil half shell to have a plurality of material layers, for example a first layer of a plastically deformable, in particular metal-containing, material, and a second layer of a biodegradable and/or transparent material.

[0045] In this variant, a single film, for example a transparent film, can be laminated with a plastically deformable material, for example in the region in which the flange section is later to be formed.

[0046] Because of the inventive idea as claimed in claim **12**, according to which only one of the flanges of the two foil half shells is to be reshaped to produce the connection, it is also conceivable (independently of the considerations relating to material selection mentioned above) to provide foil shells of different materials since, in particular, the second foil shell does not have to have any pronounced reshaping properties in the region of its flange.

[0047] The present invention also relates to a method having the features of claim **18**. Accordingly, a method is proposed for mechanically closing, in particular beading, a package for in particular food products, having the aforementioned features of the invention, which is assembled from at least two foil half shells which are connected by means of a closing unit in the region of their flange. According to the invention, the method comprises the following steps: inserting the foil half shells into a package carrier of the closing unit, the foil half shells resting at least partially on one another with their flanges; raising the first flange in the region of its projection in the direction of the second flange; and attaching the raised projection of the first flange to the second flange.

[0048] To carry out the method, the closing unit can in particular comprise a package carrier with an outer ring and a package receiving ring and at least two closing tools, namely a raising tool for raising the first flange of the film half shells to be connected in the region of its projection, and an attachment tool for attaching the raised projection of the first flange to the second flange.

[0049] Provision can be made for the package carrier to carry the package to be closed during the entire method.

[0050] Alternatively or additionally, provision can be made that, during the respective method step of raising and attaching, the package is contacted by the processing tool of the closing unit only in the region of the flange, so that the remainder of the package simultaneously remains accessible for further processing steps by means of further processing

tools. Thus, simultaneous additional processing of the foil half shells, for example by marking, may be possible.

[0051] Alternatively or additionally, provision can be made for the package holder, formed by the package carrier, comprising the outer ring and the package receiving ring, to remain unchanged during the method steps as claimed in claim **18**.

[0052] In particular, provision can further be made for the package carrier to be arranged on a continuously moving conveying system, and for the processing tools of the closing unit to be moved together with the moving package carrier with the aid of a further drive shaft, so that no stoppage is required to carry out the method steps as claimed in claim **18**.

[0053] Alternatively or additionally, provision can be made for the attachment tool to consist of only one element and for the raised sections of the projection of the first flange to nestle against the contour of said element as said element is moved down onto the raised sections.

[0054] Alternatively or additionally, in a method step following the attachment of the projection of the first flange to the second flange, provision can be made for the section of the projection of the first flange that is attached to the second flange to be additionally compressed by an additional processing tool. In this connection, provision can be made for the package holder, formed from outer ring and package receiving ring, to remain unchanged starting from the preceding method steps.

[0055] Alternatively or additionally, in a method step following the attachment of the projection of the first flange to the second flange, provision can be made for the foil half shells to be sealed in the region of their flange resting on one another, wherein at least one of the foil half shells has at least one sealing coating on one side, at least partially in the region of the flange, for this purpose.

[0056] As already explained above, as a rule sealing is always carried out against a sealing layer, i.e. two surfaces to be connected to one another are each provided with a sealing coating. Depending on the type of sealing material used, the sealing coating can, however, also be provided only on one side in the manner of an adhesive which, in the molten state, is suitable to enter into a connection with the respective other surface.

[0057] Alternatively or additionally to sealing the foil half shells, these can in principle also be adhesively bonded, i.e. instead of or in addition to a sealing coating, an adhesive coating can be provided on at least one of the foil half shells, at least partially in the region of its flange.

[0058] In particular, provision can be made for this purpose for the sealing step (or the adhesive bonding step) to be carried out during the compression step, wherein the additional processing tool for the compression can comprise a heatable element for this purpose. Alternatively, the sealing step can, however, also be carried out before or after the compression step by means of the same processing tool or by means of a further processing tool. In addition, it is alternatively conceivable to carry out the sealing before the beading. In this case, sealing is carried out only in the first contact region, in which the proximal section of the first flange rests on the second flange.

[0059] Furthermore, in a further method step, provision can alternatively or additionally be made for the attached projection of the first flange and the second flange, which is at least partially encompassed on both sides by the first flange, to be attached jointly in the direction of one of the receiving regions. Thus, the reshaped edge, which is formed by the bent-over first flange, the encompassed second flange and possibly a seal and/or adhesive bond, can additionally be attached to the remainder of the package, as a result of which the entire package becomes more compact.

[0060] Finally, with respect to the package receiving ring, provision can be made for the latter to be displaceably mounted relative to the outer ring by means of an elastic element, in particular by means of a spring unit, wherein the elastic element can in particular be designed such that, during the deformation of the projection of the first flange by the attachment tool, it holds the package in the package receiving ring and is compressed only to such an extent that the method is not disrupted.

[0061] In general, reshaping thin foils (with or without coating), for example of aluminum or paper with a thickness of, for example, 8 μm to about 100 μm, is not a typical deep-drawing operation, such as is known, for example, from sheet metal forming in automobile construction. Instead, this is a folding operation, in which the foil is pressed into a die by a plunger. It is folded in the process and thus forms its final shape. Consequently, depending on the material, only slight flow processes of up to about 10% take place, but no flow processes such as are known, for example, from sheet metal forming.

[0062] In connection with the present invention, the term two pre-formed foil half shells is used throughout. The basic foil for this purpose can consist of plastic materials, such as PVC, metallic and metal-containing materials, such as aluminum, for example, or of composite materials. The foil must additionally be non-flexible in the initial state, i.e. at room temperature, but can have a certain stiffness and be heated continuously or once for improved processing.

[0063] The packaging foils are preferably thin aluminum foils in thicknesses of 8 μm-30 μm. If the packaging foils are equipped with a sealing layer, a sealed package can also be produced in a further packaging step. To this end, as explained above, a heated element can be introduced into the method, such as, for example, an element having an integrated incandescent filament or the like.

[0064] Furthermore, the tool is to be implemented with as few components as possible, in order to devise a cost and reliability optimum. Accordingly, the invention also relates to a corresponding tool, in particular a closing unit, as has been described above.

[0065] Further features and advantages of the invention can be gathered from the following description of an exemplary embodiment of the invention and from the dependent claims.

[0066] The present invention is not restricted to food products, instead can also be used in packaging apparatuses for packing products of all types.

[0067] In addition, it should be pointed out that terms such as "comprising", "having" or "with" do not rule out other features or steps. Furthermore, terms "a "or "the" which refer to a number of steps or features do not exclude a plurality of features or steps and vice versa.

[0068] The invention is described in more detail below with reference to the appended figures. The figures show a plurality of features of the invention in combination with one another. Of course, however, those skilled in the art are also able to consider these separately from one another and,

if appropriate, to combine the same to further expedient sub-combinations, without this involving any inventive activity.

[0069] In the drawing, schematically:

[0070] FIGS. **1***a*-**1***f* show the individual successive method steps of the closing method treated here in a detailed view according to the detailed section from FIG. **4**,

[0071] FIG. **2** shows the possibility of additional edge compression,

[0072] FIG. **3** shows the possibility of integrating a further processing step into the raising tool (item **7**) or into the attachment tool (item **10**),

[0073] FIG. **4** shows a partially sectioned view of the closing unit according to the invention,

[0074] FIGS. **5***a*-**5***f* show the individual method steps for mechanically closing a package according to the invention in a cut-out detailed view,

[0075] FIG. **6** shows the method step of compressing and/or sealing a package according to the invention,

[0076] FIG. **7** shows the structure of a closing unit for carrying out the method for mechanically closing a package according to the invention in an overall view,

[0077] FIG. **8** shows a package according to the invention in the connected state,

[0078] FIGS. **9***a*-**9***c* show the package according to the invention with different variants of a possible seal, and

[0079] FIG. **10** shows the package according to the invention with different material sections.

[0080] In FIG. **1***a* to FIG. **1***f* the individual successive method steps of the closing method treated here are illustrated. The directions of movement are symbolized by arrows in the sketches. Item **8** is a fixed element.

[0081] In FIG. **1***a* the upper package part shell is illustrated as item **1** and the lower package part shell as item **2**. Both package part shells rest with their flanges on one another (region illustrated at item **3**), wherein the lower package part shell has been inserted into the package receiving ring (item **4**). The upper package part shell is fixed in position and location by a product (item **5**) contained in the lower package part shell. The contact surface for the flanges (item **3**) of the two package part shells in the tool forms the surface section (item **6**) of the package receiving ring. Item **7** shows the raising tool. The raising tool (item **7**) is implemented as a ring running around the package. The ring for the raising tool (item **7**) is therefore matched to the package shape. The composite comprising upper package part shell (item **1**), lower package part shell (item **2**) and product (item **5**) will be designated as a package below.

[0082] In FIG. **1***b* the raising tool item **7** can be seen in a delivered position. During the delivery, it has pressed the upper and lower package part shell (item **1** and item **2**) downward with the spring-mounted package receiving ring (item **4**). The outer ring (item **8**) is fixed and does not move. During the relative movement of the package relative to item **8**, the projecting flanges (item **3**) are positioned on the sliding surface (item **9**) of the outer ring (item **8**). The raised edge is illustrated as item **13**.

[0083] The next method step includes the attachment of the raised flange. FIG. **1***c* shows the raised flange (item **3**) of the package which, during the entire packaging process, is located in the package receiving ring (item **4**). In this method step, the attachment tool (item **10**) attaches the raised flanges. Just like the raising tool (item **7**), the attachment tool (item **10**) is designed as a ring, which runs around the package. The attachment tool (item **10**) is designed geometrically at the contact surfaces to the flanges (item **3**) such that the raised flanges rest on this geometry (also in FIG. **1***e*, item **11**, "flute") during the downward movement.

[0084] FIG. **1***d* shows the attachment tool (item **10**) moved downward onto the flanges (item **3**) of the package. The spring force which supports the package receiving ring (item **4**) is chosen such that it holds the package receiving ring (item **4**) in an approximately fixed position during the flange attachment process. The package receiving ring (item **4**) is therefore not pressed downward or pressed only very little downward by the reshaping forces which are required for the flange attachment.

[0085] FIG. **1***e* shows the situation from FIG. **1***d* in an enlargement of the contact situation consisting of attachment tool (item **10**), flanges (item **3**) and package receiving ring (item **4**). The attachment tool (item **10**) is shortly before the end stop, which is predefined by the package receiving ring (item **4**) and the turned-over flange (item **3**). The previously raised flanges (item **3**) slide on the flute (item **11**) of the attachment tool and are turned over in the direction of the package with product (item **5**).

[0086] FIG. **1***f* shows the lowest position of the attachment tool (item **10**). The flange (item **3**) has now been turned over completely. The package receiving ring (item **4**) is spring mounted. The spring (item **14**) having the spring force F**1** should be designed such that it is stiff enough that, under the action of the force of the flange deformation process, it is compressed only when the flange has been turned over. Repeatedly lowering the attachment tool (item **10**) onto the turned-over flange (item **3**) has the effect that said flange is compressed still more intensively. The spring (item **14**) is compressed in this method step, which is intended to ensure that at least the spring forces act on the flange (item **3**) during the attachment process.

[0087] In the case of thicker packaging foils (above about 20 μm), these may have to be pressed once more or compressed in an additional processing step in the edge region following the edge attachment. This would result in a still more compressed package edge. This can be done following the method steps outlined, the package still resting on the package receiving ring item **4**. FIG. **2** shows the situation with a pressure plunger (item **12**), which performs the above-described task of compressing the edge.

[0088] The pressure plunger can also be designed as a heated element, which means that pressing on the package edge and sealing the package can be carried out at the same time.

[0089] FIG. **3** shows the possibility of the integration of a further processing step into the raising tool (FIG. **1**, item **7**) or into the attachment tool (FIG. **1**, item **10**). Since the tools act only on the edge of the package in this packaging method, they can be configured to be open in the middle. Through this opening, for example, it is possible to guide a marking device (FIG. **3**, item **16**), which marks the package, for example, with a batch number or with a minimum shelf life date. Instead of a marking device, however, it is also possible to guide a re-pressing plunger onto the package, which nestles the plastically deformable package which, for example, consists of aluminum foil, once more against the packaged product.

[0090] In FIGS. **5***a* to **5***f* and FIG. **6** the individual successive method steps of the closure method for mechanically closing a package according to the invention are illustrated.

The directions of movement of individual processing tools of a mechanical closing unit S are symbolized by arrows B in the sketches. The figures show an extract from the closing unit S; the entire closing unit is shown in FIG. **7**. The component bearing the designation **36** is a fixed element.

[0091] FIGS. **8** and **9***a* to **9***c* show the package according to the invention, which is designated generally by the designation **10**. This is composed of two preformed foil half shells **12**, **14**, which each have a receiving space **16**, **18** and a flange **20**, **22** running around the receiving space **16**, **18**. The foil half shells **12**, **14** rest on one another in the region of their flanges **20**, **22** (cf. also connecting region VB) and jointly define a receptacle for a product P.

[0092] In FIG. **5***a* it can be seen that the lower, first flange **22** in the embodiment shown of the first foil half shell **14** inserted into a package receiving ring **30** of a package carrier V is longer in its radial extent than the upper, second flange **20**. The upper second foil half shell **12** is fixed in position and location by the product P contained in the lower first foil half shell **14**, while the lower foil half shell **14** is fixed in its position and location by the package receiving ring **30**. The contact surface for the flanges of the two foil half shells **12**, **14** in the tool is formed by the surface section **32** of the package receiving ring **30**.

[0093] The first flange **22** rests smoothly with its proximal section (based on the receiving space **18**) on the second flange **20** and, in its distal region (based on the receiving space **18**), has a projection Ü, which projects radially beyond the second flange **12** and, as explained below, is reshaped, in particular beaded, to produce a connection of the foil half shells **12**, **14**.

[0094] In a first step, a raising tool **34**, which is designed as a ring running around the package **10**, is used for this purpose. The circumferential plant contour **34***a* of said ring or the raising tool **34** is therefore matched to the package shape.

[0095] In FIG. **5***b* the raising tool **34** can accordingly be seen in a delivered position. During the delivery, it has pressed the upper and lower foil half shells **12**, **14** downward with the spring-mounted package receiving ring **30**. An outer ring **36** of the mechanical closing unit S is fixed and does not move. During the relative movement of the package **10** relative to the outer ring **36**, the projection Ü of the first flange **22** has been raised on the sliding surface **38** of the outer ring **36**.

[0096] The next method step includes the attachment of the raised projection Ü of the first flange **22**. FIG. **5***c* shows the raised projection Ü and the first contact region **40***a* (cf. also FIG. **8**), at which the proximal section of the first flange **22** is in contact with the second flange **20**. The first contact region **40***a* is located in contact with the surface section **32** of the package receiving ring **30** during the entire closing process.

[0097] In this method step according to FIG. **5***c*, the attachment tool **42** rests on the raised projection U of the first flange **22**, i.e. bends the latter over in the direction toward the receiving space **18**. Just like the raising tool **34**, the attachment tool **42** is designed as a ring, the contour of which is matched to the outer contour of the package **10** and surrounds the latter. The attachment tool **42** is designed geometrically at the contact surfaces **44** to the projection Ü such that the raised projection Ü rests on this geometry (also in FIG. **5***e*, **44** as "flute") during the downward movement.

[0098] FIG. **5***d* shows the attachment tool **42** moved down onto the flanges **20**, **22**. The spring force B_2 which, originating from spring element F, supports the package receiving ring **32**, is chosen such that, during the flange attachment process, it holds the package receiving ring **30** in an approximately fixed position. The package receiving ring **30** is therefore not pressed downward or pressed downward only very little by the reshaping forces B_1 which are required for the flange attachment.

[0099] FIG. **5***e* shows in an enlargement how, in the course of the attachment, the attachment tool **42** has arrived shortly in front of the end stop which is predefined by the package receiving ring **32** and the turned-over flanges **20**, **22**. The previously raised projection Ü of the first flange **22** slides along on the flute of the attachment contour **44** of the attachment tool **42** and is turned over onto the second flange **20** in the direction of the receiving space **18**.

[0100] FIG. **5***f* shows the lowest position of the attachment tool (item **10**). The projection Ü of the first flange **22** has now been bent over completely. The package receiving ring **30** is spring-mounted, as previously mentioned. The spring element or elements F having the spring force B_2 is or are designed such that it or they are stiff enough that, under the action of the force B_1 of the flange deformation process, they are compressed only when the first flange **22** has been turned over. Repeatedly lowering the attachment tool **42** onto the turned-over first flange **22** has the effect that said flange **22** is compressed still more intensively. The spring F is compressed according to the illustration of FIG. **5***f* in this method step, which is intended to ensure that at least the spring forces act on the first flange **22** or the turned-over projection Ü of the first flange **22** during the attachment process.

[0101] In the case of thicker packaging foils (above about 20 μm), these may have to be pressed or compressed once more in an additional processing step in the edge region following the edge attachment. This would result in a still more compressed package edge. This can be done following the method steps outlined, the package still resting on the package receiving ring **30**. FIG. **6** shows the situation with an additional processing tool in the form of a pressure plunger **46**, which performs the above-described task of compressing the edge.

[0102] The pressure plunger **46** can also comprise a heated element, which means that pressing on the package edge and sealing the package can be carried out at the same time. With respect to possible sealing of the package **10**, reference is also made to FIGS. **9***a* to **9***c*, which show different variations of a possible seal **50**.

[0103] In the first variant of FIG. **9***a*, a seal (sealing layer **50**) is provided in the second contact region **40***b*, i.e. in the region in which the projection Ü of the first flange **22** rests on the second flange **20** after the reshaping operation of the flange **22** has been carried out

[0104] In the second variant of FIG. **9***b*, a seal (sealing layer **50**) is provided in the first contact region **40***a*, i.e. in the region in which the proximal section of the first flange **22** rests on the second flange **20**, even before the reshaping operation of the flange **22** has been carried out. Consequently, said sealing can be carried out before or after the reshaping operation of the flange **22**.

[0105] The third variant of FIG. **9***c* finally shows a seal (sealing layers **50**, **50**) in the first contact region **40***a* and in the second contact region **40***b*. This sealing can be very advantageous because of particularly pronounced tightness,

in particular during the packing of foods. A further advantage of this specific shape can be seen in the fact that the sealing can be carried out in only one operation both in the first contact region **40***a* and in the second contact region **40***b*.

[0106] FIG. **7** shows the mechanical closing unit S as a whole and, in this connection, also the possibility of the integration of a further processing step into the raising tool **36** or into the attachment tool (cf. FIG. **5***c*). Since the tools in this mechanical closure method act only on the edge of the package, they can be configured to be open in the middle. Through this opening, it is possible to guide a further processing tool **48**, for example a marking device, which marks the package **10**, for example, with a batch number or with a minimum shelf life date. Instead of a marking device, however, it is also possible to guide a re-pressing plunger onto the package, which nestles the plastically deformable package which, for example, consists of aluminum foil, once more against the packaged product.

[0107] In connection with FIG. **10**, it is finally shown that the package V, in particular at least one of the foil half shells, can have at least two sections which are produced from different materials.

[0108] Thus, for example, a first section of the at least first foil half shell **14** can be produced from a plastically deformable, in particular metal-containing, material M**1**, for example in the region of the first flange **22**, and a second section, for example in the region of the receiving region **18**, can be produced from a biodegradable and/or transparent material M**2**.

[0109] In this way, it is possible to provide good deformability in the region of the first flange **22** for a secure and sealing beading connection and, at the same time, to provide a particularly environmentally friendly and/or visually appealing package **10** which, for example in the event of production from transparent material, permits a view of the accommodated product P.

[0110] Alternatively or additionally, provision can be made for a section of the at least one foil half shell to have a plurality of material layers, for example a first layer of a plastically deformable, in particular metal-containing, material M**1**, and a second layer of a biodegradable and/or transparent material M**2**. This is indicated in FIG. **10** by the thicker configuration of the flange **22**.

[0111] In this variant, a single foil, for example a transparent foil, can be laminated with a plastically deformable material, for example in the region in which the flange section is subsequently to be formed. Furthermore, a multilayer foil composite can be configured such that only one or more smaller regions appear to be transparent, which once more, similar to a window, permit the view of the accommodated product. The non-transparent material in these regions is cut out.

[0112] All the embodiments described herein can be combined with one another as desired unless obvious reasons oppose specific combinations.

1-11. (canceled)

12. A package for in particular food products, which is assembled from at least two preformed foil half shells, which are preformed in such a way that they each have a receiving space for a product to be received and a flange at least partially surrounding the receiving space, wherein the flanges are designed to be attached to one another, at least partially, to connect the foil half shells,

wherein a first flange of a first foil half shell has a first radial extent, based on the receiving space, which is greater by a projection than the second radial extent of the second flange of the second foil half shell, in such a way that, when connected, the first flange is bent over in the region of its projection in the direction of the receiving space in such a way that it at least partially encompasses the second flange with its projection and the second flange is at least partially encompassed on both sides by the first flange.

13. The package as claimed in claim **12**, characterized in that at least one of the foil half shells, for example the first foil half shell, has a sealing coating or adhesive coating, at least on one side, at least partially in the region of its flange.

14. The package as claimed in claim **12**, characterized in that at least the second foil half shell has a sealing coating on both sides, at least partially in the region of the second flange.

15. The package as claimed in claim **12**, characterized in that at least one of the foil half shells has at least two sections, which are produced from different materials.

16. The package as claimed in claim **15**, characterized in that a first section of the least first foil half shell is produced from a plastically deformable, in particular metal-containing, material for example in the region of the first flange and in that, optionally, a second section, for example in the region of the receiving region, is produced from a biodegradable and/or transparent material.

17. The package as claimed in claim **15**, characterized in that a section of the at least one foil half shell has a plurality of metal layers, for example a first layer of a plastically deformable, in particular metal-containing, material and a second layer of a biodegradable and/or transparent material.

18. A method for mechanically closing, in particular beading, a package for in particular food products, which is assembled from at least two foil half shells having the features of claim **12**, which are connected to one another in the region of the flange by means of a clamping unit,

the method comprising the following steps:

inserting the foil half shells into a package carrier of the closing unit, the foil half shells resting at least partially on one another with their flanges,

raising the first flange in the region of its projection,

attaching the projection of the first flange to the second flange in such a way that the second flange is at least partially encompassed on both sides by the first flange.

19. The method as claimed in claim **18**, characterized in that the package carrier carries the package to be closed during the entire method.

20. The method as claimed in claim **18**,

characterized in that during the respective method step of raising and attachment, the package is contacted by the processing tools of the closing unit only in the region of their flanges, so that the remainder of the package simultaneously remains accessible to further processing steps by means of further processing tools.

21. The method as claimed in claim **18**,

characterized in that the package carrier is arranged on a continuously moving conveying system, and in that the processing tools of the closing unit move together with the moving package carrier with the aid of a further drive shaft, so that no stoppage is required to carry out the method steps as claimed in claim **26**.

22. The method as claimed in claim **18**,
characterized in that in a method step following the attachment of the projection of the first flange to the second flange, the section of the projection of the first flange which is attached to the second flange is additionally compressed by an additional processing tool.

23. The method as claimed in claim **18**,
characterized in that in a method step following the attachment of the projection of the first flange to the second flange, the foil half shells are sealed or adhesively bonded in the region of their flanges resting on one another, wherein at least one of the foil half shells (**12**, **14**) has a sealing coating or adhesive coating, at least on one side, at least partially in the region of the flange, for this purpose.

24. The method as claimed in claim **18**,
characterized in that in a further method step, the attached projection of the first flange and the second flange which is at least partially encompassed on both sides by the first flange, are attached jointly in the direction of one of the receiving regions.

25. The method as claimed claim **18**, characterized in that at least one of the foil half shells has at least two sections, which are produced from different materials.

26. The package as claimed in claim **12**, characterized in that the second flange remains unbeaded in the closed state of the package with the connected foil half shells and at least partially is encompassed by the first flange on its upper and lower side.

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