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(54) **A DEVICE FOR MANUFACTURING FROM A SHEET OF PACKAGING MATERIAL MEMBRANES FOR CAPSULES OF A BEVERAGE, SUCH CAPSULES ADAPTED TO CONTAIN AN ANHYDROUS MATERIAL**

(57) The invention refers to a device (1, 1') for manufacturing membranes (2) for capsules (3) adapted to contain an anhydrous material for the production of a beverage starting from a sheet (4) of packaging material, the device (1, 1') comprises: a base body (8) having a first longitudinal axis (B) and including a supporting base (10) and a raised portion (11) extending coaxially from the supporting base (10) up to an axial end surface (12) thereof and configured to receive on said axial surface (12) the sheet (4); a cutting body (13) including a main portion (14) having a second longitudinal axis (C) and a peripheral portion (15) extending coaxially from the main portion (14); a cutting tooth (16, 16') having a closed-line endless profile and carried coaxially by one of said raised portion (11) and main portion (14); and a groove (17, 17') having a closed-line endless profile and carried coaxially

by the other of said raised portion (11) and main portion (14); the cutting body (13) can be coupled, releasably, to said base body (8) so that the peripheral portion (15) at least partially accommodates the raised portion (11) and so that the cutting tooth (16, 16') engages the groove (17, 17') to determine a cut of the packaging material; the raised portion (11) comprises a first frustoconical portion (18) extending from the supporting base (10) coaxially to the first axis (B); the peripheral portion (15) comprises a second frustoconical portion (19) extending from the main portion (14) coaxially to the second axis (C); the first (18) and second (19) frustoconical portions are configured to slidably cooperate with one another during the coupling to determine a centring of the first axis (B) with the second axis (C).

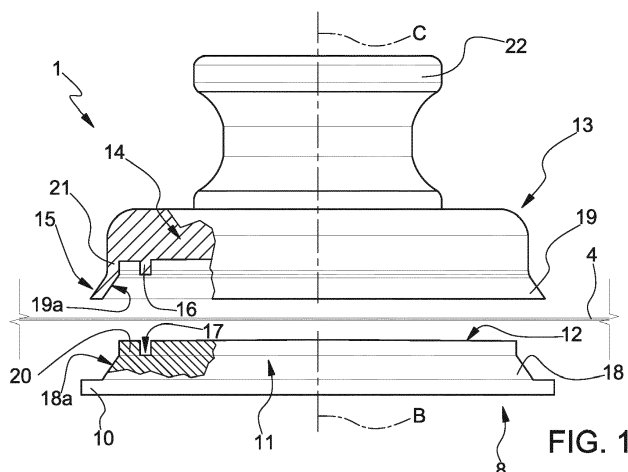


FIG. 1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 10202000001174 filed on 22/01/2020.

TECHNICAL FIELD

[0002] The present invention relates to a device for manufacturing membranes for capsules adapted to contain an anhydrous material for the production of a beverage, in particular anhydrous material in the form of powder, grains or leaves, such as coffee, tea, barley, cocoa, or the like, starting from a sheet of packaging material, in particular a sheet of malleable material, for example aluminium.

PRIOR ART

[0003] In the food sector, it is known to produce beverages by infusion or solution in water, usually heated, of an anhydrous material contained in a capsule, in particular an anhydrous material in the form of powder, grains or leaves, for example coffee, tea, barley, or the like.

[0004] In particular, the capsules intended to contain the above-mentioned anhydrous material are produced in generally automated, manufacturing and assembly plants and comprise a hollow cup-shaped body, which is open at the top and has a substantially frustoconical shape.

[0005] The cup-shaped body generally has an axis of symmetry and comprises a base, arranged at a lower axial end of the cup-shaped body, and a flange, which extends radially outwards from an upper axial end of the cup-shaped body.

[0006] Typically, the upper end has a larger diameter than the lower end, whereas the flange has a substantially annular shape and is formed integrally with the cup-shaped body at the upper end.

[0007] The cup-shaped body defines, coaxially inside it, a cavity which is open at the top and is intended to house, in use, the anhydrous material, which is pressed for optimum use of the internal space of the cavity itself.

[0008] In particular, the cavity has such dimensions that the cup-shaped body can be considered a thin-walled body.

[0009] Capsules of the type described above also comprise a membrane made starting from a sheet of packaging material, in particular a sheet of malleable material, for example aluminium, and configured to close the cup-shaped body at the top. The membrane is typically circular in shape and is attached to the cup-shaped body at the upper end thereof.

[0010] In detail, once the anhydrous material is inserted, the aforesaid cavity is closed by applying the mem-

brane on the upper surface of the annular flange.

[0011] The capsules of the type described above, once assembled, are intended to be used in extractor machines that produce a generally single-serve beverage, starting from a single capsule, according to a known method that is not described in detail.

[0012] In some known configurations, the membrane is applied to the annular flange in an automated manner in the aforesaid manufacturing and assembly plants, by using specific glues or adhesive materials or by welding, so that it adheres to the upper surface of the annular flange.

[0013] According to an alternative solution illustrated in IT102018000007826, on behalf of the same Applicant and still confidential as of the priority date of this application, the membrane is manually applied to the annular flange using a portable manual capsule assembly device starting from a cup-shaped body and a membrane made of packaging material.

[0014] Systems for manufacturing said membranes starting from a sheet of packaging material are known. For example, a known system involves the use of a die.

[0015] However, using a die to manufacture membranes involves the use of a cutting edge (or blade), which makes the operation somewhat dangerous. In addition, the known dies are bulky and not portable.

[0016] While these systems are functionally sound, there is a need in the industry to provide manufacturing systems that are easier and more versatile to use and that are portable.

OBJECT AND SUMMARY OF THE INVENTION

[0017] The object of this invention is thus to obtain a device for manufacturing membranes for capsules adapted to contain an anhydrous material starting from a sheet of packaging material, which is very reliable and inexpensive and which satisfies the above-specified requirement related to capsule membrane manufacturing devices of a known type.

[0018] According to the invention, this purpose is achieved with a device for manufacturing membranes as claimed in claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] For a better understanding of this invention, two preferred, non-limiting embodiments thereof will be described below purely by way of example and with the aid of the accompanying drawings, wherein:

- Figure 1 is an exploded side view, in partial cross-section and with parts removed for clarity, of a device for manufacturing membranes made according to this invention;
- Figure 2 is a side view, in partial cross-section, with parts removed for clarity, of the manufacturing device in Figure 1 in a first operating condition;

- Figure 3a is a side view, in partial cross-section, with parts removed for clarity, of the manufacturing device in Figure 1 in a subsequent operating condition;
- Figure 3b illustrates, on an enlarged scale, a detail of Figure 3a;
- Figure 4a illustrates in side view and on an enlarged scale, a capsule intended to contain an anhydrous material for the production of a beverage and obtained starting from a membrane and a cup-shaped body, in an unassembled condition;
- Figure 4b shows the capsule in Figure 4a in an assembled condition; and
- Figure 5 is an exploded side view, in partial cross-section and with parts removed for clarity, of a device for manufacturing membranes starting from a starting sheet of packaging material made according to an alternative embodiment of this invention.

DETAILED DESCRIPTION

[0020] With reference to the attached figures, the reference number 1 represents, as a whole, a device for manufacturing membranes 2 for capsules 3 adapted to contain an anhydrous material for the production of a beverage, in particular anhydrous material in the form of powder, grains or leaves, such as coffee, tea, barley, cocoa, or the like, starting from a sheet 4 of packaging material, in particular a sheet 4 of malleable material, for example aluminium.

[0021] In particular, the capsules 3 are intended for use in extractor machines for producing a generally single-serve beverage, starting from a single capsule, according to a known method not described in detail.

[0022] According to this preferred and non-limiting embodiment, the device 1 is a manually operated device intended to be used and manually operated by a user for the purpose of making (fabricating) a membrane 2 starting from the sheet 4 of packaging material. The user subsequently uses the membrane 2 to assemble a capsule 3 from a hollow, cup-shaped body 5 open at the top and the membrane 2, which is configured to close the cup-shaped body 5 at the top, as can be seen in Figures 4a and 4b.

[0023] For example, the portable manual device described in IT102018000007826, in the name of the same Applicant and still confidential as of the priority date of this application, by which the membrane 2 is applied to the cup-shaped body 5 in the manner described below, may be used to assemble the membrane 2 and the cup-shaped body 5.

[0024] Specifically, as can be seen in Figures 4a and 4b, the cup-shaped body 5 has an axis of symmetry A and comprises a supporting base 5a, arranged at a lower axial end of the cup-shaped body 5, and an annular flange 6, which extends radially outwards from an upper axial end of the cup-shaped body 5.

[0025] In greater detail, the flange 6 extends integrally from the cup-shaped body 5 and has an upper axial an-

nular surface 6a and a lower axial annular surface 6b.

[0026] The cup-shaped body 5 has a substantially frustoconical flanged shape, with the upper end having a diameter greater than the diameter of the lower end.

5 **[0027]** Moreover, the cup-shaped body 5 defines, coaxially inside it, a cavity 7 that is open at the top at the upper end of the cup-shaped body 5 and is intended to house, in use, the aforesaid anhydrous material.

10 **[0028]** Preferably, the cavity 7 has such dimensions that the cup-shaped body 5 can be considered a thin-walled body.

15 **[0029]** The cavity 7 is intended to be closed at the top by the membrane 2, which for this purpose is applied, in use, to the cup-shaped body 5 at the upper end thereof, i.e. at the flange 6.

20 **[0030]** More specifically, the membrane 2 comprises an annular peripheral portion 2a having a diameter greater than the diameter of the flange 6. In particular, the membrane 2, in a first step of assembling the capsule 3, overlaps - is, in particular, supported by - the upper surface 6a of the flange 6.

25 **[0031]** When the membrane overlaps - is, in particular, supported by - the upper surface 6a, the peripheral portion 2a protrudes radially from the outer rim of the flange 6.

30 **[0032]** The assembly of the capsule 3 is borne out as described in IT102018000007826, i.e., the peripheral portion 2a is bent in a "U" shape around the flange 6 using the portable manual assembly device described therein.

[0033] As can be seen in Figure 1, the device 1 comprises:

- a base body 8 having a longitudinal axis B, preferably straight, and including a supporting base 10 and a raised portion 11 extending coaxially from the supporting base 10 to an end axial surface 12 thereof; and
- a cutting body 13 including a main portion 14 having a longitudinal axis C, preferably straight, and a peripheral portion 15 extending coaxially from the main portion 14, in particular from a peripheral edge of the main portion 14.

45 **[0034]** Specifically, the axial surface 12 defines an end axial free surface of the raised portion 11, which is configured to receive the sheet 4 on the axial surface 12.

[0035] Thus, the axial surface 12 defines a support surface for the sheet 4 of packaging material.

50 **[0036]** According to this preferred and non-limiting embodiment, the device 1 has a substantially circular shape.

55 **[0037]** More specifically, the base body 8 and the cutting body 13 are configured as two distinct and separate bodies that can be releasably coupled to each other and have a substantially circular profile around their respective axes B and C, in order to make circular membranes 2 for assembly with respective cup-shaped bodies 5 of the type illustrated in Figures 4a and 4b.

[0038] Alternatively, the device 1 may have a different shape, for example substantially square, square with rounded corners, rectangular, polygonal, or oval, etc.

[0039] It should be noted that, in this description, the term "substantially" is intended to take into account the normal geometric tolerances necessarily present in and between the device 1 components.

[0040] In view of what has been described above, the support base 10 is substantially circular in shape about the axis B, the main portion 14 is substantially circular in shape about the axis C, and the peripheral portion 15 is defined by an annular protuberance extending, in particular extending integrally, from the annular end edge of the main portion 14.

[0041] The device 1 also comprises:

- a cutting tooth 16 having a closed-line endless profile and borne by the cutting body 13 coaxially to the axis B, in particular extending axially, more particularly extending integrally, from the main portion 14 to a position radially more inward than the peripheral portion 15; and
- a groove 17 having a closed-line endless profile and coaxially borne by the base body 8, in particular being defined by a recess extending axially in the raised portion 11 coaxially to the axis B and open at the axial surface 12.

[0042] In use, the cutting body 13 can be releasably coupled to the base body 8 so that the peripheral portion 15 accommodates, at least partially, the raised portion 11 and so that the cutting tooth 16 engages the groove 17 to determine a cut of the sheet 4 and the production of a membrane 2 for separating a piece of the sheet 4 by said cut.

[0043] In particular, the peripheral portion 15 has an axial extension from the main portion 14 that is less than the axial extension of the raised portion 11 from the supporting base 10, so that the raised portion 11 is partially, and not totally, accommodated within the peripheral portion 15 during said coupling.

[0044] In the described example, the cutting tooth 16 is annular, in particular circular, about the axis C and the groove 17 is annular, in particular circular, about the axis B.

[0045] Alternatively, the cutting tooth 16 and the groove 17 could have a profile defined by any closed-line endless profile around the respective axis C, B, for example a profile that is square with rounded corners, square, rectangular, polygonal, etc. In this case, the resulting membrane 2 will have a perimeter tracing the profile of the cutting tooth 16 and the groove 17.

[0046] Clearly, for the purpose of the above-mentioned engagement, the cutting tooth 16 and the groove 17 have the same profile, so that one engages the other as a result of the coupling between the cutting body 13 and the base body 8.

[0047] The cutting tooth 16 and the groove 17 are con-

veniently arranged at the same radial distance from the respective axes C and B, so that the cutting tooth 16 engages the groove 17 during the above-mentioned coupling.

[0048] Advantageously, the raised portion 11 comprises a frustoconical portion 18 extending from the supporting base 10 coaxially to the axis B and the peripheral portion 15 comprises a frustoconical portion 19 extending from the main portion coaxially to the axis C. The one frustoconical portion 18 and the other frustoconical portion 19 are configured to slidably cooperate with each other during the coupling of the cutting body 13 with the base body 8 to determine the centring of the axis B with the axis C.

[0049] Specifically, the frustoconical portion 18 comprises an external frustoconical lateral surface 18a and the frustoconical portion 19 comprises an inner frustoconical lateral surface 19a configured to slidably cooperate with the surface 18a during the above-mentioned coupling, so as to determine the centring of the axis B with the axis C.

[0050] Thus, the one surface 18a and the other surface 19a face each other when the cutting tooth 16 engages the groove 17. In particular, the one surface 18a and the other surface 19a are parallel to each other when the cutting tooth 16 engages the groove 17.

[0051] Thanks to the above-described configuration, the user is able to perform the above-mentioned centring easily and without having to worry about precisely coupling the base body 8 and the cutting body 13, and without the aid of axial guiding elements for the cutting body 13. This centring will cause, in use, the correct alignment between cutting body 13 and base body 8 and, thus, between cutting tooth 16 and groove 18, thus determining a cut in the sheet 4 under rating conditions.

[0052] Suitably, the frustoconical portion 18 is tapered toward the axial surface 12 and the frustoconical portion 19 is tapered toward the main portion 14.

[0053] In use, the device 1 is configured to be used with the base body 8 arranged on a support surface (not shown) so that the axis B is perpendicular to the support surface (vertical, if the support surface is horizontal) and the axis C is perpendicular to the support surface (vertical, if the support surface is horizontal) after centring and coupling has been completed. Preferably, the support surface may be defined by a user's hand.

[0054] If the support plane is horizontal, it can be said that the one frustoconical portion 18 and the other frustoconical portion 19 are tapered upwards.

[0055] The above-described configuration not only allows centring of the axis B with the axis C, but also causes a tensioning of the sheet 4 radially outwards, prior to the cutting of the sheet 4 itself.

[0056] More specifically, during coupling of the cutting body 13 to the base body 8, the one frustoconical portion 19 slides from top to bottom along the other frustoconical portion 18. This movement, in addition to determining the centring of the axes B and C, causes a substantially,

axially symmetric tensioning of the sheet 4 in an outward radial direction.

[0057] Thus, the sheet 4 is well stretched and the cutting tooth 16 can easily penetrate it, compared to cases where the sheet 4 is not well stretched, and can therefore easily cut it cleanly and neatly.

[0058] The frustoconical portion 18 is preferably tilted in relation to a direction orthogonal to the axis B by an angle α between 40° and 70° , preferably between 50° and 60° , even more preferably 55° (Figure 3b). In addition, the frustoconical portion 19 is inclined with respect to a direction orthogonal to the axis C by an angle β between 110° and 140° , preferably between 120° and 130° , even more preferably 125° (Figure 3b).

[0059] The Applicant noticed that these width values of the angles α and β define the optimal inclination that results in the frustoconical walls 18, 19 producing the best centring effects on the axis B with the axis C for the device 1 described above, at the same time favouring an optimal tensioning of the sheet 4.

[0060] The cutting tooth 16 and the groove 17 conveniently have the same axial extension. Thus, the cutting tooth 16 fully engages the groove 17 during coupling of the cutting body 13 with the base body 8. The device 1 is thus compact and sliding cooperation between the frustoconical portions 18, 19 is ensured.

[0061] Since the sheet 4 is well stretched due to the cooperation between the frustoconical portions 18, 19, it is not necessary to provide the cutting tooth 16 with a cutting edge or blade.

[0062] Accordingly, as shown in Figure 3b, the cutting tooth 16 comprises an axial cutting wall 16a, which is substantially flat and perpendicular to the axis C. More specifically, the cutting tooth 16 has, in axial cross-section, a substantially quadrangular, in particular rectangular, profile, wherein the cutting wall 16a defines the axial end surface of the axial prominence defining the cutting tooth 16.

[0063] Thus, the cutting tooth 16 is defined by a substantially cylindrical, hollow axial protuberance and is, moreover, free of a sharp axial cutting surface, i.e., a cutting edge or blade.

[0064] Appropriately, the groove 17 comprises an axial abutment wall 17a that is substantially flat and perpendicular to the axis B. More precisely, the groove 17 has, in axial cross-section, a substantially quadrangular, in particular rectangular, profile, wherein the abutment wall 17a defines the bottom axial surface of the axial recess defining the groove 17.

[0065] The cutting wall 16a is configured to abut against the abutment wall 17a when the cutting tooth 16 engages the groove 17, so as to determine the complete separation of the membrane 2 from the sheet 4.

[0066] The separation occurs, in particular, at the inner diameter of the cutting tooth 16 and of the groove 17.

[0067] According to this preferred and non-limiting embodiment, the raised portion 11 further comprises a cylindrical portion 20 coaxial to the axis B and extending

axially from the frustoconical portion 18 to the axial surface 12; and the peripheral portion 15 also comprises a cylindrical portion 21 coaxial to the axis C and axially interposed between the main portion 14 and the frustoconical portion 19.

[0068] Specifically, the raised portion 11 consists of the frustoconical portion 18 and the cylindrical portion 20 that overlies the frustoconical portion 18 and has the axial surface 12; and the peripheral portion 15 consists of the cylindrical portion 21 extending, in particular extending integrally, axially from the main portion 14 and the frustoconical portion 19, which in turn extends, in particular extends integrally, from the cylindrical portion 21.

[0069] In use, the one cylindrical portion 20 and the other cylindrical portion 21 radially face each other, in particular they are parallel to each other when the cutting tooth 16 engages the groove 17.

[0070] The cylindrical portion 20 conveniently has an axial extension corresponding to the axial extension of the groove 17 and the cylindrical portion 21 has an axial extension corresponding to the axial extension of the cutting tooth 16.

[0071] This configuration ensures that the centring of the axes B and C and the tensioning of the sheet 4 take place before the cutting tooth 16 completes its stroke inside the groove 17, and, in any case, prior to the cutting of the packaging material.

[0072] A nominal cut of the sheet 4 is, thus, ensured.

[0073] The cutting body 13 is preferably provided with a handle 22, in particular coaxial to the axis C and extending from the opposite side of the main portion 14 to the peripheral portion 15, which facilitates the user's manipulation thereof.

[0074] The operation of the device 1 according to this invention will be described below, with particular reference to an initial condition wherein the base body 8 is arranged on a support plane and the sheet 4 is supported on the axial surface 12.

[0075] In this condition, the user grasps the cutting body 13, initially separated from the base body 8, and overlaps it with the base body 8 itself, moving it towards the latter. As this movement continues, the frustoconical portions 18 and 19 slidably cooperate with each other, thereby determining the centring of the axes B and C and the tensioning of the sheet 4.

[0076] At this point, the cutting tooth 16 engages the groove 17, thereby determining the cutting of the sheet 4 and the creation of the membrane 2.

[0077] With reference to Figure 5, the reference number 1' represents a device for manufacturing membranes 2 according to an alternative embodiment of this invention.

[0078] Since the alternative device 1' is functionally and structurally similar to the device 1, only the distinctive features with respect to the latter will be described, using, where possible, the same references for the corresponding parts and components.

[0079] In particular, the alternative device 1' differs

from the device 1 in that the base body 8 comprises an additional groove 17' of the type described above and defining an additional recess in the raised portion 11 and arranged in a position radially distant from the groove 17.

[0080] In addition, the device 1' comprises a series of, in particular at least two, interchangeable elements 30' that can be alternatively, releasably coupled to the main portion 14 of the cutting body 13, coaxially to the axis C.

[0081] Specifically, each interchangeable element 30' is defined by a circular plate body bearing a respective cutting tooth 16, 16' of the type described above extending axially from the respective plate body.

[0082] More specifically, the cutting tooth 16 is arranged at a radial distance from the axis C different from the radial distance at which the cutting tooth 16' of the other interchangeable element 30' is arranged. These distances are measured when the interchangeable elements 30' are coaxially coupled to the cutting body 13; therefore, they refer to the axis C.

[0083] The cutting tooth 16 will be conveniently arranged at a radial distance such that it engages the corresponding groove 17 and the cutting tooth 16' will be arranged at a radial distance such that it engages the groove 17'.

[0084] Thus, the radial distance from the axis C of the cutting teeth 16, 16' corresponds to the radial distance from the axis B of the grooves 17, 17', respectively.

[0085] In the light of what has been described above, it is possible to obtain membranes 2 of a different format, i.e. of a different diameter and, therefore, adapted for a different capsule format 3, by simply replacing the interchangeable element 30'.

[0086] The interchangeable elements 30' are preferably coupled to the cutting body 13 using clamping means, for example a screw 31'.

[0087] The advantages enabled by the device 1, 1' manufactured according to this invention will be apparent from an examination of the features thereof.

[0088] In particular, thanks to the presence of the frustoconical portions 18, 19, the user is able to carry out the above-mentioned centring of the axes B and C in a simple manner and without needing to worry about precisely coupling the base body 8 and the cutting body 13. Such centring will determine, in use, the correct alignment between cutting body 13 and base body 8 and, thus, between cutting tooth 16 and groove 18, thus resulting in a cut of the sheet 4 under rating conditions.

[0089] The frustoconical portions 18, 19 therefore make the presence of an axial guide for the cutting body 13 superfluous, further simplifying the architecture of the device 1 and favouring its portability.

[0090] The interaction of the frustoconical portions 18, 19 causes, in addition, a tensioning of the sheet 4 radially outwardly, prior to the cutting of the sheet 4 itself. The sheet 4 is, thus, tightly stretched and the cutting tooth 16 can penetrate it, and thus cut it, cleanly despite not having a cutting edge or blade. The device 1 is, thus, less dangerous and, therefore, more portable (and/or pocket-

sized).

[0091] Finally, in the case of the device 1', thanks to the presence of the interchangeable elements 30', each bearing a respective cutting tooth 16, 16' of different dimensions, it is possible to obtain membranes 2 of a different format, i.e., of a different diameter and, therefore, adapted for a different capsule format 3, by simply replacing the interchangeable element 30'.

[0092] It is clear that the device 1, 1' described and illustrated herein can be subject to modifications and variations without however departing from the scope of protection defined by the claims.

[0093] In particular, the cutting tooth 16 could be borne by the base body 8 and the groove 17 could be borne, i.e. made, in the cutting body 13, with appropriate structural modifications.

[0094] For example, in this case, the cylindrical portion 20 would have the same axial extension as the cutting tooth 16 and the cylindrical portion 21 would have the same axial extension as the groove 17.

Claims

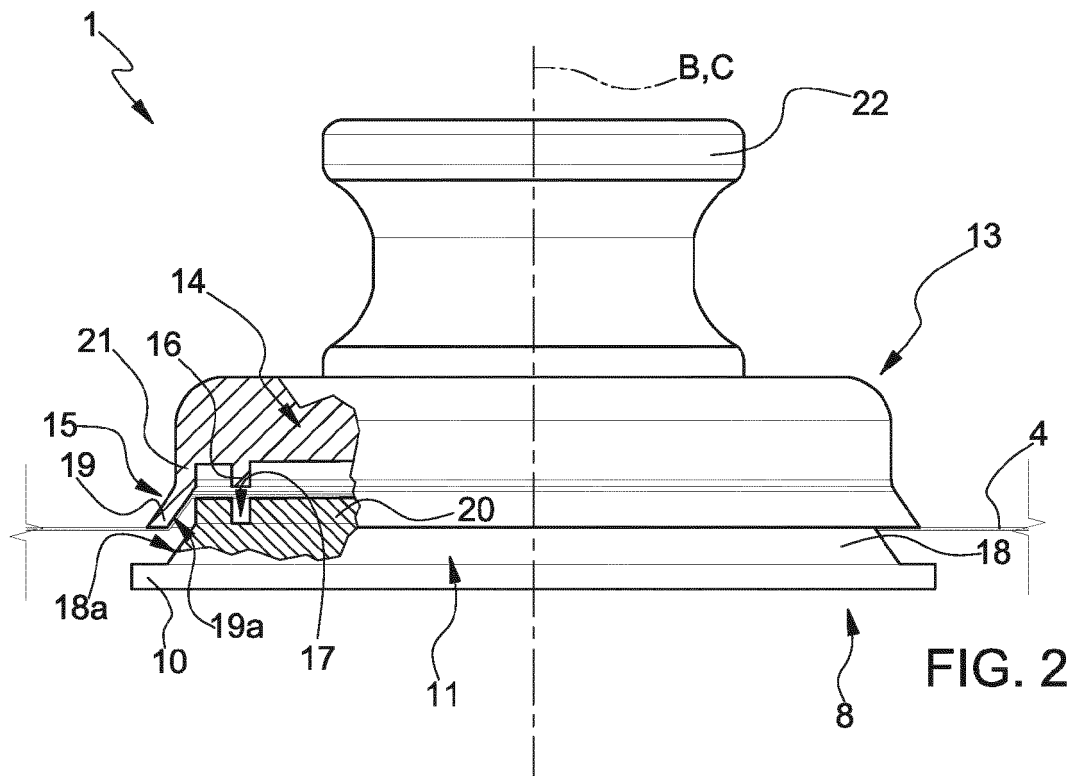
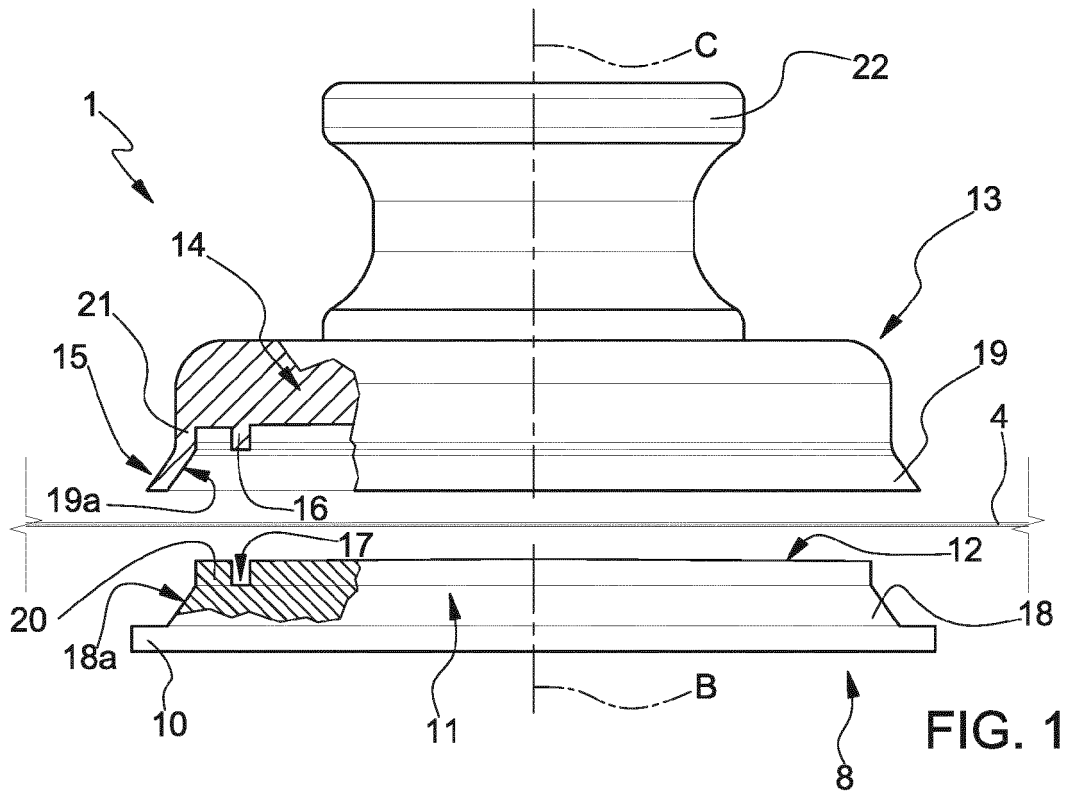
1. A device (1, 1') for manufacturing membranes (2) for capsules (3) adapted to contain an anhydrous material for the production of a beverage starting from a sheet (4) of packaging material, said device (1, 1') comprising:

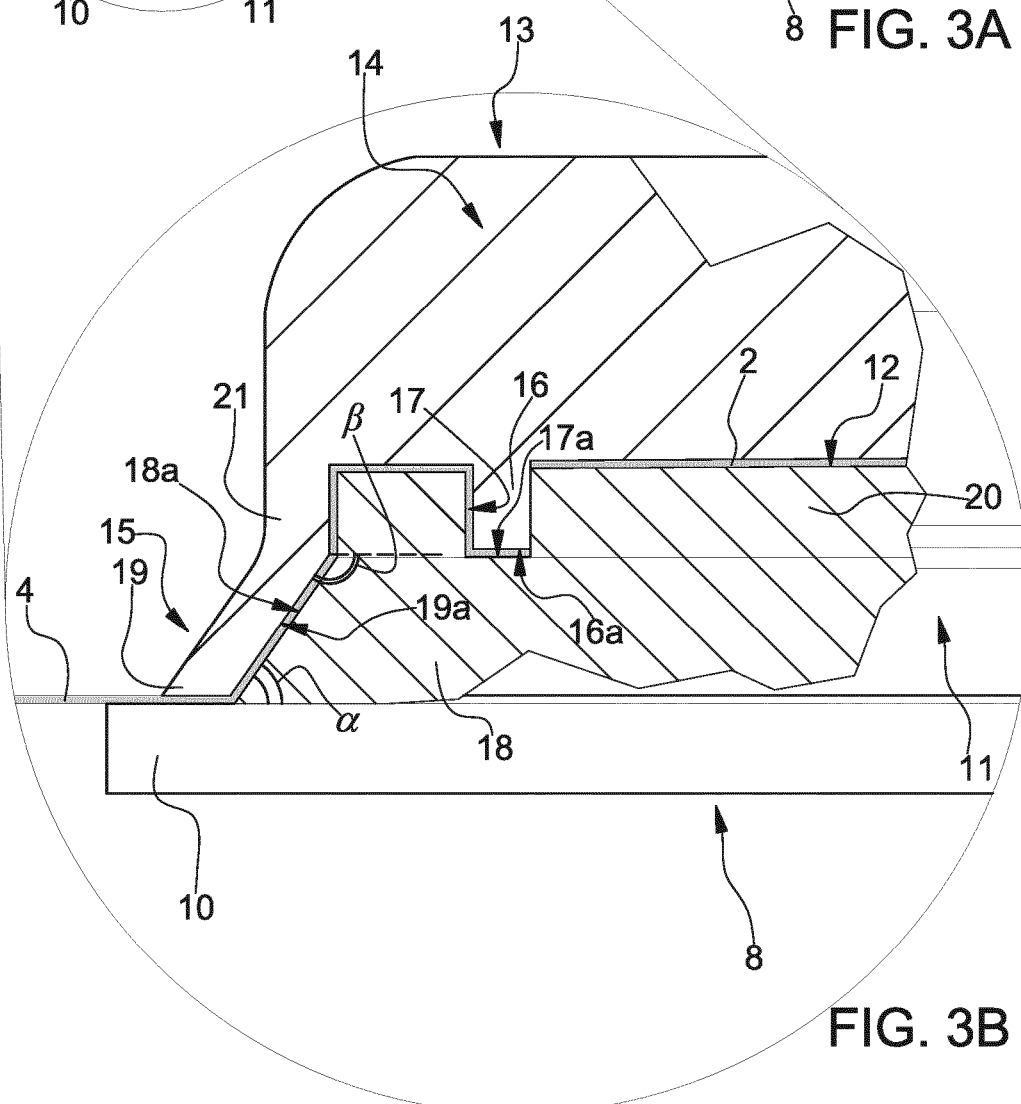
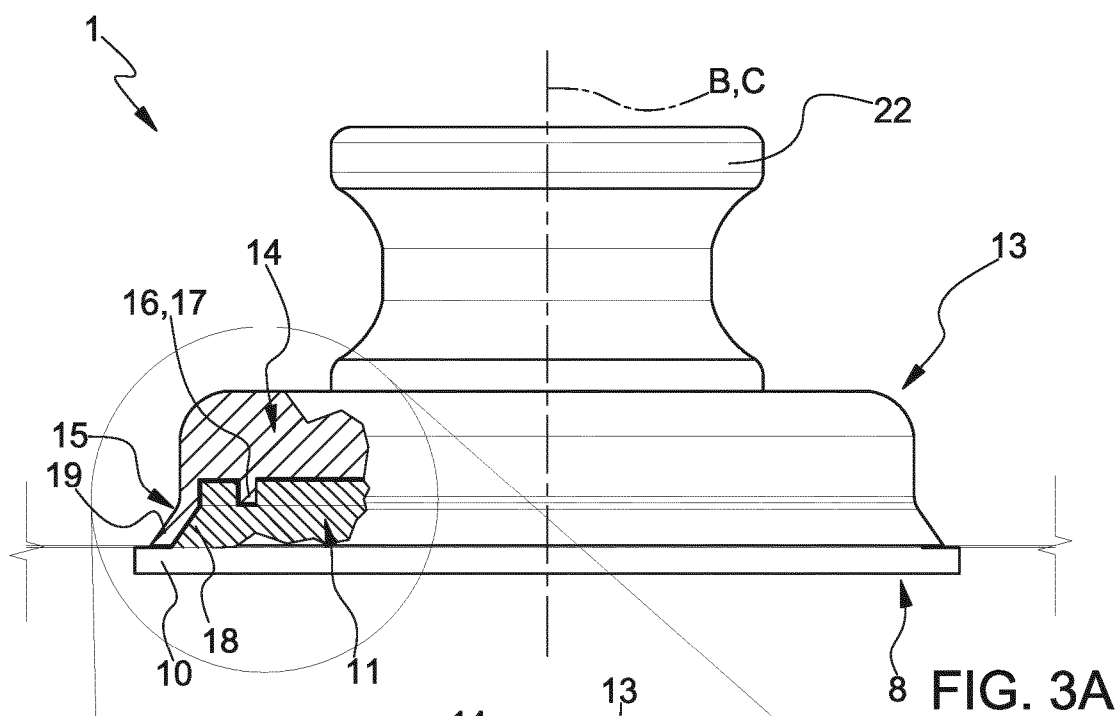
- a base body (8) having a first longitudinal axis (B) and including a supporting base (10) and a raised portion (11) extending coaxially from the supporting base (10) up to an axial end surface (12) thereof and configured to receive on said axial surface (12) said sheet (4) of packaging material;
- a cutting body (13) including a main portion (14) having a second longitudinal axis (C) and a peripheral portion (15) extending coaxially from the main portion (14);
- a cutting tooth (16, 16') having a closed-line endless profile and carried coaxially by one of said raised portion (11) and main portion (14); and
- a groove (17, 17') having a closed-line endless profile and carried coaxially by the other of said raised portion (11) and main portion (14);

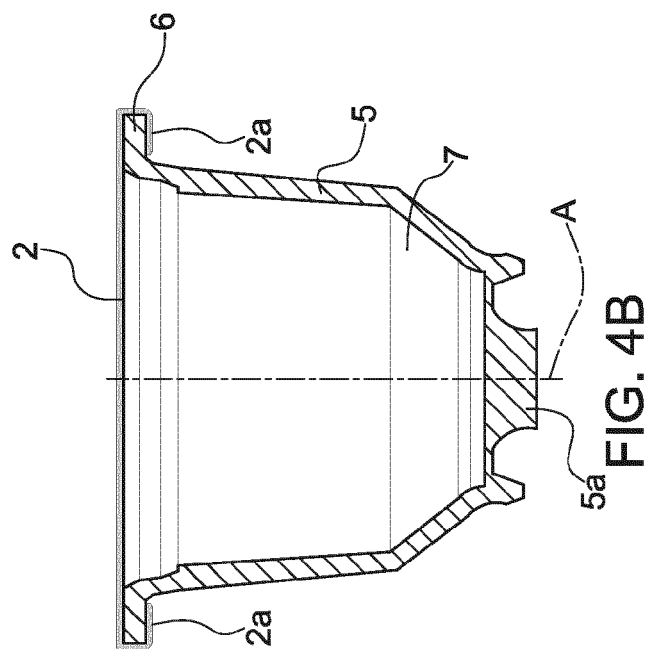
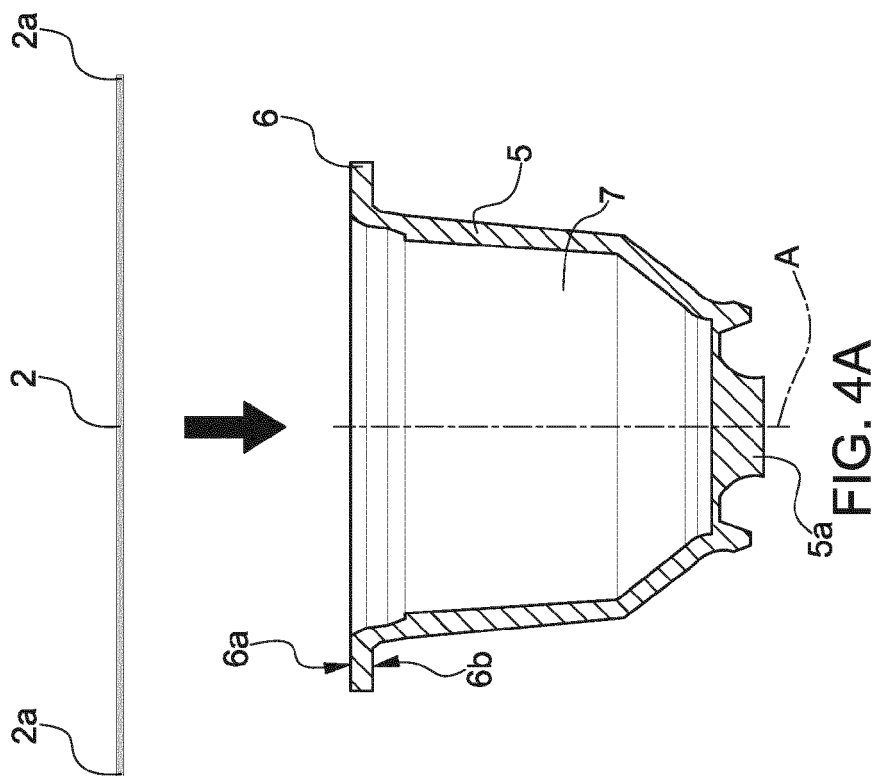
said cutting body (13) being releasably couplable to said base body (8) so that the peripheral portion (15) at least partially accomodates the raised portion (11) and so that the cutting tooth (16, 16') engages the groove (17, 17') to determine a cut of the packaging material and the production of one said membrane (2) from said sheet (4);

said raised portion (11) comprising a first frustoconical portion (18) extending from the supporting base

- (10) coaxially to the first axis (10);
said peripheral portion (15) comprising a second frustoconical portion (19) extending from the main portion (14) coaxially to the second axis (C);
said first (18) and second (19) frustoconical portions being configured to slidably cooperate with one another during said coupling to determine a centring of said first axis (B) with said second axis (C).
2. The device as claimed in claim 1, wherein said first frustoconical portion (18) comprises a first frustoconical lateral surface (18a) and wherein the second frustoconical portion (19) comprises a second frustoconical lateral surface (19a) configured to slidably cooperate with said first frustoconical lateral surface (18a) during said coupling;
said first frustoconical lateral surface (18a) and said second frustoconical lateral surface (19a) facing one other when said cutting tooth (16) engages said groove (17).
 3. The device as claimed in claim 1 or 2, wherein said first frustoconical portion (18) is axially tapered towards said axial surface (12) and wherein said second frustoconical portion (19) is axially tapered towards said main portion (14).
 4. The device as claimed in claim 3, wherein said first frustoconical portion (18) is tilted with respect to a direction orthogonal to the first axis (B) by an angle (α) between 40° and 70°, preferably between 50° and 60°, even more preferably 55°;
and wherein said second frustoconical portion (19) is tilted with respect to a direction orthogonal to the second axis (C) by an angle (β) between 110° and 140°, preferably between 120° and 130°, even more preferably 125°.
 5. The device as claimed in any one of the preceding claims, wherein said peripheral portion (15) has a smaller axial extension, calculated from said main portion (14), than the axial extension of the raised portion (11), calculated from said supporting base (10), so that said raised portion (11) is housed partially inside said peripheral portion (15) once said coupling has been performed.
 6. The device as claimed in any one of the preceding claims, wherein said cutting tooth (16) is annular coaxially to the axis (C) of said one of said raised portion (11) and main portion (14) and comprises an axial cutting wall (16a), substantially flat and perpendicular to the axis (C) of said one of said raised portion (11) and main portion (14);
said groove (17) being annular coaxially to the axis (B) of said other of said raised portion (11) and main portion (14) and comprising an axial abutment wall (17a), substantially flat and perpendicular to the axis (B) of said other of said raised portion (11) and main portion (14);
said cutting wall (16a) being configured to abut against said abutment wall (17a) when said cutting tooth (16) engages said groove (17).
 7. The device as claimed in any one of the preceding claims, wherein said cutting tooth (16) is carried by said cutting body (13) and extends axially from said main portion (14) at a position radially innermost with respect to said peripheral portion (15);
and wherein said groove (17) is obtained in said base body (8) and defines a recess of said raised portion (11) open at said axial surface (12).
 8. The device as claimed in any one of the preceding claims, wherein said raised portion (11) further comprises a first cylindrical portion (20) coaxial to the first axis (B), extending axially from said first frustoconical portion (18) up to said axial surface (12);
and wherein said peripheral portion (15) further comprises a second cylindrical portion (21) coaxial to the second axis (C) and axially interposed between said main portion (14) and said second frustoconical portion (19);
said first cylindrical portion (20) and said second cylindrical portion (21) radially facing one another when said cutting tooth (16) engages said groove (17).
 9. The device as claimed in claim 7 and 8, wherein said first cylindrical portion (20) has an axial extension, with respect to said first axis (B), corresponding to the axial extension of said groove (17);
and wherein said second cylindrical portion (21) has an axial extension, with respect to said second axis (C), corresponding to the axial extension of said cutting tooth (16).
 10. The device (1') as claimed in any one of claims 7 to 9, wherein said base body (8) comprises at least a further groove (17') defining a further recess in said raised portion (11) and arranged in a position radially spaced from said groove (17), with respect to said first axis (B);
said device (1') further comprising at least two interchangeable elements (30'), alternatively couplable in a releasable manner to the main portion (14) of the cutting body (13), coaxially to the second axis (C), and carrying a respective cutting tooth (16, 16') extending axially from the relative interchangeable element (30');
said cutting teeth (16, 16') being arranged at different respective radial distances from the second axis (C), measured when the interchangeable elements (30') are coupled, alternatively, to the cutting body (13), each radial distance substantially corresponding to the radial distance from the first axis (B) of the groove (17, 17') adapted to be engaged by the relative cutting tooth (16, 16').







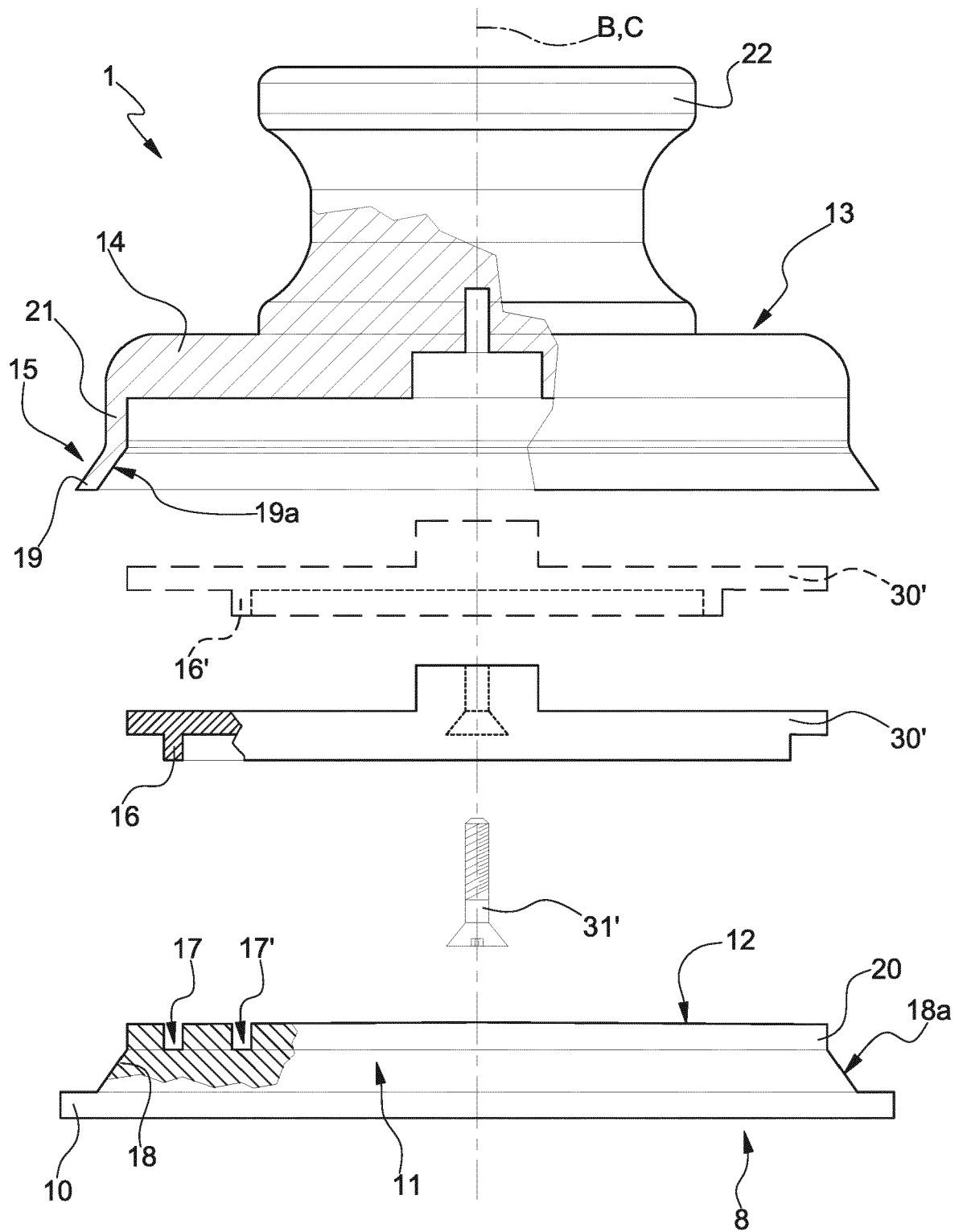


FIG. 5



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Place of search Munich		Date of completion of the search 11 June 2021	Examiner Canelas, Rui
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