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(54) HOLDING ARRANGEMENT FOR A CAP APPLICATOR AND METHOD OF HOLDING A CAP

(57) The present invention relates to a holding arrangement (100) for a cap applicator (300). The holding arrangement (100) comprising an open cavity (102) configured to receive a cap (200). One or more protrusions (120) are provided along a circumferential surface portion (104) of the open cavity (102) and extending radially inwards from the circumferential surface portion (104), wherein the one or more protrusions (120) are configured to cooperate with a circumferential weakening line (202a, 202b) of the cap (200) by depressing the cap (200) at a location (L) of the weakening line (202a, 202b), when the cap (200) is received in the open cavity (102), or to cooperate with a bottom edge (204) of the cap (200) by engaging the cap (200) at a location (L') of the bottom edge (204), when the is cap (200) received in the open cavity (102), thereby counteracting unintentional movement of the cap (200) out of the open cavity (102). A cap applicator (300), a food product packaging system (400) and a method (500) are also provided.

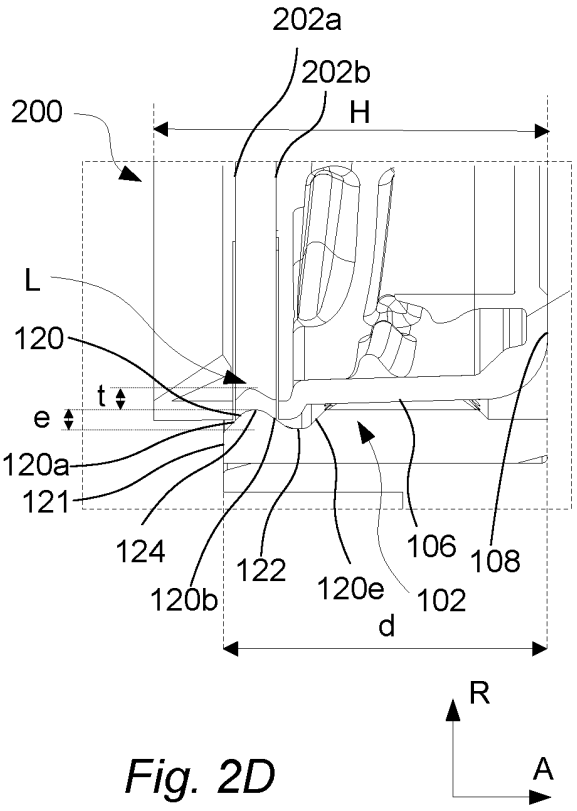

Fig. 2D

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Description

Technical Field

[0001] The invention relates to the field of food packaging. More particularly, it is related to a holding arrangement for a cap applicator of a food product packaging system, a cap applicator comprising a holding arrangement, a food product packaging system comprising a cap applicator station and a method of holding a cap by using a holding arrangement. The holding arrangement has an open cavity configured to receive a cap. The open cavity is provided with a textured surface portion configured to engage with and to transfer a rotational torque to cap received in the open cavity.

Background Art

[0002] Packages in general, and packages for liquid food products in particular, are available in many different forms and formats. Such packages are further available in many materials or material combinations. Some packages are opened by being deformed or penetrated while other packages are provided with caps, lids or similar. Caps are often provided with threads or other features providing that the caps or lids may be removed from and later replaced onto the package.

[0003] When filling a package provided with a cap, the cap is generally screwed onto to the package after the package has been filled with the product. The cap is in this regard typically screwed onto package directly after having been filled while using what is commonly referred to as a cap applicator. A cap applicator is hence typically a station or machine that is dedicated to screw caps onto packages. A cap that is to be screwed onto a package is typically inserted into a dedicated opening or cavity of the cap applicator and thereafter screwed onto the package by being rotated while the interaction between the opening and the cap is transferring a rotational torque to the cap.

[0004] A cap that is to be screwed onto a package is typically held in its dedicated opening by friction. This means that the cap must fit tightly in the opening or else the cap will risk popping or falling out of the opening before actually being screwed onto a package. If the cap pops out prematurely several problems may arise, such as damage to machinery or downtime. The risk of the cap popping out prematurely is more outspoken if the cap includes a release agent for lowering the force needed to open the cap. The use of such a release agent makes the cap slippery and hence more prone to popping out of the cavity prior to being screwed onto packages.

[0005] Further, the problems related to the caps popping out of the opening of the cap applicator prematurely has recently become even more outspoken. This because, new legal requirements which stipulate that a cap must remain tethered to its package even after being opened has lately been introduced in many jurisdictions. In this regard, caps are today commonly provided with tether band. Such tether bans will for natural reasons occupy a height portion of the cap and consequently lead to an even more reduced friction between the caps and the opening of the cap applicator. Thus, such new legal requirements have led to a new problematic situation when it comes to screwing caps onto packages.

[0006] Hence there is room for improvement when it comes to applying caps to packages.

Summary

[0007] It is an object of the invention to at least partly overcome one or more of the above-identified limitations of the prior art.

[0008] It is an object to provide a holding arrangement for a cap applicator were unintentional or premature popping out of the cap from the holding arrangement is counteracted.

[0009] Further, it is an object to provide a holding arrangement for a cap applicator where unintentional movement of the cap out of the holding arrangement is counteracted.

[0010] Another object is to provide a holding arrangement for a cap applicator which is capable of handling lager variations or deviations when it comes to the size of the cap.

[0011] Another object is to provide a holding arrangement for a cap applicator which is capable of handling caps provided with tether bands.

[0012] According to a first aspect there is provided a holding arrangement for a cap applicator of a food product packaging system, the holding arrangement comprising: an open cavity configured to receive a cap, wherein the open cavity comprises a circumferential surface portion configured to circumscribe the cap, when the cap is received in the open cavity, wherein the circumferential surface portion comprises a textured surface portion configured to engage with and to transfer a rotational torque to the cap when the cap is received in the open cavity, and one or more protrusions provided along the circumferential surface portion and extending radially inwards from the circumferential surface portion, wherein the one or more protrusions are configured to cooperate with a circumferential weakening line of the cap by depressing the cap at a location of the weakening line, when the cap is received in the open cavity, or to cooperate with a bottom edge of the cap by engaging the cap at a location of the bottom edge, when the is cap received in the open cavity, thereby counteracting unintentional movement of the cap out of the open cavity.

[0013] Hereby an improved a holding arrangement for a cap applicator of a food product packaging system is provided.

[0014] A significant advantage with the holding arrangement may be that unintentional movement of the cap out of the open cavity or unintentional popping out of the open cavity may be counteracted by the holding

arrangement comprising one or more protrusions. The one or more protrusions being provided along the circumferential surface portion and extending radially inwards from the circumferential surface portion.

[0015] Hence, the one or more protrusions may interact with the cap by establishing a cooperation with the cap when the cap is received in the open cavity. This may allow for that the force required to move the cap out of the open cavity may be increased such that the cap is counteracted from unintentional movement of the cap out of the open cavity or unintentional popping out of the open cavity. This may allow for that the force required to start moving the cap out of the open cavity may be increased such that the cap is counteracted from unintentional movement of the cap out of the open cavity or unintentional popping out of the open cavity. In other words, a force threshold for start moving the cap out of the open cavity may be introduced by the provision of the one or more protrusions.

[0016] The one or more protrusions may be configured to cooperate with a circumferential weakening line of the cap when the cap is received in the open cavity. Thereby, the cap may thus be counteracted from unintentional movement out of the open cavity or unintentional popping out of the open cavity by the one or more protrusions depressing the cap a location of the weakening line. The one or more protrusions may interact with the weakening line, by extending into the weakening line. The one or more protrusions may penetrate the weakening line. The one or more protrusions may align with the weakening line. The one or more protrusions may depress the cap in proximity of the weakening line. The one or more protrusions may interact with the weakening line. The one or more protrusions may grip about an edge of the weakening line.

[0017] The one or more protrusions may be configured to cooperate with a bottom edge of the cap when the cap is received in the open cavity. Thereby, the cap may thus be counteracted from unintentional movement out of the open cavity or unintentional popping out of the open cavity by the one or more protrusions engaging the cap at a location of the bottom edge. The one or more protrusions may grip about the bottom edge.

[0018] It should be noted that within the context of this application the term "weakening line" may mean any feature of the cap, resulting in that the cap is made mechanically weaker at the location of the weaking line. The weakening line may circumscribe the cap. The weakening line may partially circumscribe the cap. The weakening line may sectionized. The weakening line may comprise or be formed of a depression in the material of the cap. The weakening line may comprise or be formed of a thinner section of the material of the cap. The weakening line may comprise or be formed of cut through the material of the cap. Such cut may be a full cut through the material of the cap and/or a partial cut through the material of the cap. The weakening line may comprise or be formed of a transition portion between a major portion of the cap and a tamper and/or theater band thereof. The weakening line may be provided on the inside and/or the outside of the cap.

[0019] The one or more protrusions may be distributed circumferentially evenly along the circumferential surface portion, which is advantageous in that an even holding force may be applied to the cap by the one or more protrusions of the holding arrangement. Further, by distributing the one or more protrusion circumferentially evenly along the circumferential surface portion of the open cavity, the cap may be shaped symmetrically by the one or more protrusions when received in the open cavity. Hence, a potentially skew or not circular cap may be shaped such that it may be screwed onto a package more easily and with a reduced risk of getting stuck or similar.

[0020] The one or more protrusions may be 4 to 7 protrusions, preferably 5 protrusions, which is advantageous in that a satisfactory, adequate, sufficient or desired holding force may be applied to the cap by the one or more protrusions of the holding arrangement such that the cap is not unintentionally moved out of the open cavity while still allowing for that the cap may be easily released form the holding arrangement after having been screwed onto a package. In other words, the cap may be securely held during the screw action and thereafter released without being damaged, scratched or otherwise negatively affected. Further, the cap may be shaped to advantage by the one or more protrusions being 4 to 7 protrusions, preferably 5 protrusions.

[0021] A protrusion of the one or more protrusions may have a radial extension, from a bottom thereof to a top thereof, of 0,5 mm -1.0 mm, preferably, 0,6 - 0,8 mm, more preferably 0,7 - 0.75 mm, which is advantageous in that a satisfactory, adequate, sufficient or desired holding force may be applied to the cap by the one or more protrusions of the holding arrangement such that the cap is not unintentionally moved out of the open cavity while still allowing for that the cap may be easily released form the holding arrangement after having been screwed onto a package. In other words, the cap may be securely held during the screw action and thereafter released without being damaged, scratched or otherwise negatively affected.

[0022] It should be noted that within the context of this application the term "radial extension" may mean any extension in any radial direction of the holding arrangement. It is to be noted that the one or more protrusions of the holding arrangement which are provided along the circumferential surface portion are extending radially inwards from the circumferential surface portion and hence are extending in an inwards radial direction. The radial extension of the one or more protrusions may be seen as a height from a bottom thereof to a top thereof.

[0023] A protrusion of the one or more protrusions may have a radial extension, from a bottom thereof to a top thereof, corresponding to 80 - 120% of a radial extension thickness of the cap at the location of the weakening line

or at the location of the bottom edge, preferably corresponding to 95 - 105 % of the thickness of the cap at the location of the weakening line or at the location of the bottom edge, which is advantageous in that the one or more protrusions may deflect or deform the cap such that that a satisfactory, adequate, sufficient or desired holding force may be applied to the cap by the one or more protrusions of the holding arrangement such that the cap is not unintentionally moved out of the open cavity while still allowing for that the cap may be easily released form the holding arrangement after having been screwed onto a package.

[0024] A radial extension of a protrusion of the one or more protrusions may increase continuously from a bottom thereof to a top thereof.

[0025] A protrusion of the one or more protrusions may have an elongated shape that extends in the circumferential direction of the holding arrangement.

[0026] A protrusion of the one or more protrusions may have an elongated shape that extends in the circumferential direction of the holding arrangement along the circumferential surface portion of the open cavity.

[0027] A protrusion of the one or more protrusions may have a circumferential extension which is at least twice as large as each of a width of the protrusion in an axial direction and the radial extension of the protrusion.

[0028] The top of a protrusion of the one or more protrusions may be configured to contact the cap at most 1,2 mm from the weakening line of the cap or at most 1,2 mm from the bottom edge of the cap when the cap is received in the open cavity, preferably at most 0,8 mm from the weakening line of the cap or at most 0,8 mm from the bottom edge of the cap when the cap is received in the open cavity, which is advantageous in that the one or more protrusions may deflect or deform the cap such that that a satisfactory, adequate, sufficient or desired holding force may be applied to the cap by the one or more protrusions of the holding arrangement such that the cap is not unintentionally moved out of the open cavity while still allowing for that the cap may be easily released form the holding arrangement after having been screwed onto a package.

[0029] The cap may be depressed 0,3 - 0,5 mm radially inwards by a protrusion of the one or more protrusion when the cap is received in the open cavity, preferably 0,36 - 0,40 mm radially inwards by a protrusion of the one or more protrusion when the cap is received in the open cavity, which is advantageous in that the one or more protrusions may depress, deflect or deform the cap such that that a satisfactory, adequate, sufficient or desired holding force may be applied to the cap by the one or more protrusions of the holding arrangement such that the cap is not unintentionally moved out of the open cavity while still allowing for that the cap may be easily released form the holding arrangement after having been screwed onto a package.

[0030] A protrusion of the one or more protrusions may extend over an angle of 20 - 40 degrees of the circumference of circumferential surface portion, preferably over the angle of 25 - 33 degrees of the circumference of the circumferential surface portion, more preferably over the angle of 28 - 30 degrees of the circumference of the circumferential surface portion, which is advantageous in that the one or more protrusions may engage the cap along a circumference portion of the cap thereby enabling an increased contact surface between the one or more protrusions and the cap. Further a satisfactory, adequate, sufficient or desired holding force may be applied to the cap by the one or more protrusions of the holding arrangement such that the cap is not unintentionally moved out of the open cavity while still allowing for that the cap may be easily released form the holding arrangement after having been screwed onto a package.

[0031] The one or more protrusions may be located below the textured surface portion, which is advantageous in that the one or more protrusions may cooperate with the circumferential weakening line or the bottom edge of the cap to satisfaction. The circumferential weakening line is typically provided below a textured gripping surface of the cap, meaning that the one or more protrusions typically are to be located below the textured surface portion to be able to cooperate with the circumferential weakening line of the cap.

[0032] A diameter of the open cavity may be at least three times a depth of the open cavity, and/or the depth of the open cavity may correspond to 80% - 120% of a height of the cap to be received in the open cavity.

[0033] The textured surface portion may extend over 40% - 60% of the depth of the open cavity, which is advantageous in that the textured surface portion may engage with and to transfer a rotational torque to the cap when the cap is received in the open cavity with a reduced risk of the cap slipping in the open cavity while being screwed onto a package.

[0034] The textured surface portion may be at least partially complementary to an external surface of the cap to be received in the open cavity, which is advantageous in that the textured surface portion may engage with and to transfer a rotational torque to the cap when the cap is received in the open cavity with a reduced risk of the cap slipping in the open cavity while being screwed onto a package.

[0035] The holding arrangement may comprise a first part comprising the circumferential surface portion, and a second part configured to be connected to the first part and to transfer a rotational torque therebetween, which is advantageous in that the holding arrangement may easily be adapted to be used with different types of caps by replacing the first part. Further, the holding arrangement may easily be refurbished by replacing the first part. Correspondingly, the holding arrangement may easily be adapted to different cap applicators by replacing the second part.

[0036] The first part and the second part may be formed of a same material. The first part and the second

part may comprise different materials. The first part and the second part may be formed of different materials.

[0037] According to a second aspect there is provided a cap applicator for a food product packaging system comprising a holding arrangement according to the first aspect, and a drive arrangement configured to rotate the holding arrangement about a central axis thereof, thereby rotating the cap received in the open cavity of the holding arrangement about the central axis.

[0038] In general, the above-mentioned features and advantages of the first aspect, when applicable, apply to this second aspect as well. In order to avoid undue repetition, reference is made to the above.

[0039] According to a third aspect there is provided a food product packaging system comprising a cap applicator station comprising one or more cap applicators according to the second aspect.

[0040] In general, the above-mentioned features and advantages of the first aspect and the second aspect, when applicable, apply to this third aspect as well. In order to avoid undue repetition, reference is made to the above.

[0041] According to a fourth aspect there is provided a method of holding a cap by using a holding arrangement for a cap applicator of a food product packaging system comprising, an open cavity, wherein the open cavity comprises a circumferential surface portion comprising a textured surface portion and one or more protrusions provided along the circumferential surface portion and extending radially inwards from the circumferential surface portion, the method comprising: receiving, in the open cavity of the holding arrangement a cap having a circumferential weakening line and/or a bottom edge, such that the circumferential surface portion of the open cavity circumscribes the cap, whereby the textured surface portion engages with the cap such that a rotational torque of the holding arrangement is transferable to the cap, whereby the one or more protrusions cooperates with the circumferential weakening line of the cap by depressing the cap at a location of the weakening line, thereby counteracting unintentional movement of the cap out of the open cavity, or whereby the one or more protrusions cooperates with the bottom edge of the cap by depressing the cap at a location of the bottom edge, thereby counteracting unintentional movement of the cap out of the open cavity.

[0042] In general, the above-mentioned features and advantages of the first aspect, the second aspect and the third aspect, when applicable, apply to this fourth aspect as well. In order to avoid undue repetition, reference is made to the above.

[0043] A further scope of applicability of the present invention will become apparent from the detailed description given below. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the scope of the invention will become apparent to those skilled in the art from this detailed description.

[0044] Hence, it is to be understood that this invention is not limited to the particular component parts of the device described as such device may vary. It is also to be understood that the terminology used herein is for purpose of describing particular embodiments only and is not intended to be limiting. It must be noted that, as used in the specification and the appended claim, the articles "a," "an," "the," and "said" are intended to mean that there are one or more of the elements unless the context clearly dictates otherwise. Thus, for example, reference to "a unit" or "the unit" may include several devices, and the like. Furthermore, the words "comprising", "including", "containing" and similar wordings does not exclude other elements or steps.

Drawings

[0045] The above and other aspects of the present inventive concept will now be described in more detail, with reference to appended figures showing variants. The figures should not be considered limiting, instead, they are used for explaining and understanding.

[0046] As illustrated in the figures, the sizes of layers and regions may be exaggerated for illustrative purposes and, thus, are provided to illustrate the general structures of variants. Like reference numerals refer to like elements throughout.

Fig. 1A is a perspective view of an exemplary holding arrangement.

Fig. 1B is a perspective view of an exemplary holding arrangement comprising a first part and a second part.

Fig.1C is a cross-sectional view of the holding arrangement of Fig. 1A.

Fig.1D is a planar top view of the holding arrangement of Fig. 1A.

Fig. 2A is a perspective view of the holding arrangement of Fig. 1A and an exemplary cap to be received by the holding arrangement.

Fig. 2B is a perspective view of the holding arrangement of Fig. 2A with the cap of Fig. 2A received by the holding arrangement.

Fig. 2C is a cross-sectional view of the holding arrangement of Fig. 2B with the cap of Fig. 2B received by the holding arrangement.

Fig. 2D is a cross-sectional enlarged view of a portion of Fig. 2C.

Fig. 2E is a cross-sectional enlarged view of a portion of Fig. 2C but with a different type of exemplary cap received by the holding arrangement.

Fig. 3 is a schematic perspective view of an exemplary cap applicator.

Fig. 4 is a schematic view of an exemplary a food product packaging system including a cap application station including two cap applicators of Fig. 3.

Fig. 5 is a flow chart showing an exemplary method of holding a cap by using a holding arrangement for a cap applicator of a food product packaging system according to an embodiment of the invention.

Description

[0047] The present inventive concept will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred variants or embodiments of the inventive concept are shown. This inventive concept may, however, be implemented in many different forms and should not be construed as limited to the variants set forth herein; rather, these variants are provided for thoroughness and completeness, and fully convey the scope of the present inventive concept to the skilled person.

[0048] Now turning to the figures. Figs. 1A, 1C and 1D schematically illustrate by way of example an exemplary holding arrangement 100 according to the present inventive concept. The holding arrangement 100 may be used in a cap applicator 300 which will be described in more detail below with reference to Fig. 3. Such cap applicator 300 may in turn be used in a food product packaging system 400 which will be described in more detail below with reference to Fig. 4.

[0049] The depicted holding arrangement 100 of Figs. 1A, 1C and 1D includes an open cavity 102. The open cavity 102 is configured to receive a cap 200. How the cap 200 may be held by the holding arrangement 100 will be described in more detail below with reference to Figs. 2A-2E. In other words, the interaction between the holding arrangement 100 and the cap will be described in greater detail below after describing the general design of the holding arrangement 100.

[0050] The open cavity 102 comprises a circumferential surface portion 104. The circumferential surface portion 104 is configured to circumscribe the cap 200, when the cap 200 is received in the open cavity 102. In other words, the circumferential surface portion 104 is configured or designed to surround an external surface portion of the cap 200. The circumferential surface portion 104 is partially defining the open cavity 102 and is generally speaking a surface portion 104 of the open cavity 102 which is configured or designed to interact with the cap 200 when the cap 200 is receive in the open cavity 102. The cap may however contact other surface or surface portions of the holding arrangement 100 when received in the open cavity 102.

[0051] The circumferential surface portion 104 includes a textured surface portion 106. The textured surface portion 106 is configured to engage with and to transfer a rotational torque to the cap 200 when the cap 200 is received in the open cavity 102. The textured surface portion 106 may be textured in any suitable way such that it may interact with the cap 200 and transfer a rotational torque to the cap 200 when the cap is received in the open cavity 102.

[0052] The circumferential surface portion 104 of the depicted holding arrangement 100 of Figs. 1A, 1C and 1D include five protrusions 120 provided along the circumferential surface portion 104. The protrusions extend radially inwards from the circumferential surface portion 104 as clearly illustrated in Fig. 1D where the radial direction R is indicated by a hatched arrow. In other words, the hatched arrow in Fig. 1D points radially outwards, whereas the five protrusions 120 extend radially inwards, i.e., in a direction opposite to the hatched arrow of Fig. 1D.

[0053] According to embodiments, one or more protrusions 120 may be provided along the circumferential surface portion 104. Such one or more protrusions may extend radially inwards from the circumferential surface portion 104. For example, the one or more protrusions 120 may be 4 to 7 protrusions. For example, the one or more protrusions 120 may be 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 protrusions. However, five protrusions 120 are generally preferred.

[0054] The protrusions 120 are configured to cooperate with the cap 200 to counteract unintentional movement of the cap 200 out of the open cavity 102. The protrusions 120 will be described in greater detail hereinafter.

[0055] Now also turning to Figs. 2A-2E. Figs. 2A-2E illustrate the holding arrangement and a cap 200. In Fig. 2A, the cap 200 is shown outside of the holding arrangement 100 while being aligned with a central axis C of the holding arrangement 100. The central axis C of the holding arrangement is indicated by a hatched line in Figs. 1A, 1C, 2A and 2C. Hence, the cap 200 as illustrated in Fig. 2A may be received in the open cavity 102 of the holding arrangement 100 by being translated along the central axis C. In Figs. 2B and 2C, the cap 200 is received by the open cavity 102 of the holding arrangement 100.

[0056] Hence, in Figs. 2B and 2C the circumferential surface portion 104 of the open cavity 102 circumscribes the cap 200. Further, the textured surface portion 106 of the circumferential surface portion 104 engages with the cap 200. More specifically, textured surface portion 106 may engage with an external textured surface 201 of the cap 200. As illustrated in Fig. 2A, the textured surface portion 106 and the external textured surface 201 of the cap 200 may be at least partially complementary. By the engagement between the textured surface portion 106 and the external textured surface 201 of the cap 200, a

rotational torque may be transferred to the cap 200 when the cap 200 is received in the open cavity 102.

[0057] Now referring specifically also to Fig. 2D. The depicted protrusions 120 are configured to cooperate with a circumferential weakening line 202a, 202b of the cap 200 by depressing the cap 200 at a location L of the weakening line 202a, 202b when the cap 200 is received in the open cavity 102. In this way unintentional movement of the cap 200 out of the open cavity 102 is counteracted.

[0058] As illustrated in Fig. 2D, the protrusion 120 depresses the cap 200 at the location generally indicated by L. This means that the cap 200 of Fig. 2D is depressed in proximity to the weaking line 202a as well in proximity to the weakening line 202b. The cap 200 may however include a single weakening line 202a, 202b and be depressed in proximity to such single weakening line 202a, 202b. The cap 200 of Fig. 2D has a height H which is larger than a depth d if the open cavity 102. This means that the cap 200 of Fig. 2D will as illustrated extend out of the open cavity 102 along an axial direction of the holding arrangement 100 when received in the open cavity. The axial direction is generally indicated by the arrow A in Figs. 2D and 2E. As is illustrated in Fig. 2D, the cap 200 will extend out of the open cavity 102 along a direction opposite to the axial direction pointed out by the arrow A. Correspondingly, the radial direction R of the holding arrangement 100 is pointed out by the arrow R in Figs. 2D and 2E.

[0059] Now referring specifically also to Fig. 2E. Fig. 2E illustrates how a cap 200 with a slightly different design as compared to the cap 200 of Fig. 2D is received in the open cavity 102 of the holding arrangement 100. In Fig. 2E, the cap 200 comprises a single weakening line 202b and has a height H which is smaller than the depth d if the open cavity 102. This means that the cap 200 of Fig. 2E will as illustrated not extend out of the open cavity 102 along the direction being opposite to the axial direction A of the holding arrangement 100 when received in the open cavity. The different design of the cap 200 of Fig. 2E allows for that the depicted protrusions 120 may cooperate with the cap 200 in a different manner. In this regard, the depicted protrusions 120 of the holding arrangement are configured to cooperate with a bottom edge 204 of the cap 200 by engaging the cap 200 at a location L' of the bottom edge 204. In this way unintentional movement of the cap 200 out of the open cavity 102 is counteracted. Further, the cap 200 of Fig. 2E may be void of any weakening line 202b since the depicted protrusions 120 of the holding arrangement are configured to cooperate with a bottom edge 204 of the cap 200 by engaging the cap 200 at a location L' of the bottom edge 204.

[0060] Hence, the protrusions 120 are configured to cooperate with one or more weakening lines 202a, 202b and/or a bottom edge 204 of the cap 200.

[0061] As illustrated in Figs. 2D and 2C, the depth d of the open cavity 102 may correspond to 80% - 120% of the height H of the cap 200.

[0062] As illustrated in Figs. 2D and 2C, the textured surface portion 106 may extend over 40% - 60% of the depth d of the open cavity 102. The extension of the textured surface portion 106 may vary to suit different designs of caps. Further, extension of the textured surface portion 106 may vary to provide for that a sufficient or desired rotational torque may be transferred from the holding arrangement 100 to the cap 200 without negatively affecting the cap.

[0063] As illustrated in Figs. 1A, 1C and 1D, and best shown in Figs. 2D and 2E, the protrusions 120 are typically located below the textured surface portion 106 along the axial direction pointed out by the arrow A. However, the location of the protrusions 120 in relation to the textured surface portion 106 may vary depending on the design of the cap 200 that is to be received in the open cavity 102 of the holding arrangement 100.

[0064] As illustrated in Figs. 1A, 1C and 1D, the protrusions 120 may be distributed circumferentially evenly along the circumferential surface portion 104. Thus, the five protrusions 120 of the depicted holding arrangement are as illustrated in Figs. 1A, 1C and 1D distributed circumferentially evenly along the circumferential surface portion 104.

[0065] As illustrated in Fig. 1D, a protrusion 120 of the one or more protrusions 120, e.g., the five protrusions 120 of Fig. 1D, may extend over an angle a of the circumference of circumferential surface portion 104. In Fig. 1D, each protrusion 120 of the five protrusions 120 extend over an angle a of 29 degrees of the circumference of circumferential surface portion 104. However, such angle a over which a protrusion 120 may extend may be 20 - 40 degrees of the circumference of circumferential surface portion 104. Preferably such angle a over which a protrusion 120 may extend may be 25 - 33 degrees of the circumference of the circumferential surface portion 104. More preferably such angle a over which a protrusion 120 may extend may be 28 - 30 degrees of the circumference of the circumferential surface portion 104. Further, different protrusions 120 of the protrusions 120 may extend over different angles a.

[0066] As illustrated in Fig 1C, a diameter D of the open cavity 102 may be at least three times a depth d of the open cavity 102. This means that a cap 200 which has a significantly larger diameter than height may be received in the open cavity 102 pf the holding arrangement while being counteracted from unintentional movement out of the open cavity 102 as have been explained above.

[0067] As illustrated in Figs. 2D and 2C, the depth d of the open cavity 102 may correspond to 80% - 120% of the height H of the cap 200.

[0068] In the following characteristics of the protrusions 120 of the depicted holding arrangement 100 will be described mainly with reference to Figs. 2D and 2E.

[0069] The five protrusions 120 of the depicted holding arrangement 100 may typically have a radial extension e, from a bottom 122 thereof to a top 124 thereof, of 0,5 mm - 1.0 mm. In other words, generally speaking the protru-

sions 120 may have height of 0,5 mm - 1.0 mm. By the protrusions having a radial extension e, from a bottom 122 thereof to a top 124 thereof, of 0,5 mm -1.0 mm the protrusions may cooperate with one or more weakening lines 202a, 202b and/or a bottom edge 204 of the cap 200 so as to counteract unintentional movement of the cap out of the open cavity 102. The protrusions may preferably have a radial extension e, from a bottom 122 thereof to a top 124 thereof of 0,6 - 0,8 mm, more preferably 0,7 - 0.75 mm. Different protrusions 120 may have different radial extensions e, from a bottom 122 thereof to a top 124 thereof. All protrusions 120 may have a same radial extensions e, from a bottom 122 thereof to a top 124 thereof.

[0070] The five protrusions 120 of the of the depicted holding arrangement 100 may typically have radial extension e, from a bottom 122 thereof to a top 124 thereof, corresponding to 80 - 120% of a radial extension thickness t of the cap 200 at the location L of the weakening line 202a, 202b. Correspondingly, The five protrusions 120 of the of the depicted holding arrangement 100 may typically have radial extension e, from a bottom 122 thereof to a top 124 thereof, corresponding to 80 - 120% of a radial extension thickness t of the cap 200 at the location L' of the bottom edge 204. By the protrusions having a radial extension e corresponding to 80 - 120% of a radial extension thickness t of the cap 200 at the location L of the weakening line 202a, 202b or at the location L' of the bottom edge 204, the protrusions 120 may deflect or depress the cap and hence cooperate with one or more weakening lines 202a, 202b and/or a bottom edge 204 of the cap 200 so as to counteract unintentional movement of the cap out of the open cavity 102. The five protrusions 120 of the of the depicted holding arrangement 100 may preferably have radial extension e, corresponding to 95 - 105 % of the thickness t of the cap 200 at the location L of the weakening line 202a, 202b or at the location L' of the bottom edge 204. Different protrusions 120 may have different radial extensions e, in relation to the radial thickness at the location L of the weakening line 202a, 202b or at the location L' of the bottom edge 204. All protrusions 120 may have a same radial extensions e, in relation to the radial thickness at the location L of the weakening line 202a, 202b or at the location L' of the bottom edge 204.

[0071] The top 120 of the five protrusions 120 of the of the depicted holding arrangement 100 may typically be configured to contact the cap 200 at most 1,2 mm from the weakening line 202a, 202b of the cap 200 at most 1,2 mm from the bottom edge 204 of the cap 200 when the cap 200 is received in the open cavity 120. By the protrusions 120 contacting the cap at most 1,2 mm from the weakening line 202a, 202b of the cap 200 or at most 1,2 mm from the bottom edge 204 of the cap 200 when the cap 200 is received in the open cavity 120, the protrusions 120 may deflect or depress the cap and hence cooperate with one or more weakening lines 202a, 202b and/or a bottom edge 204 of the cap 200 so as to counteract unintentional movement of the cap out of the open cavity 102. The five protrusions 120 of the of the depicted holding arrangement 100 may preferably contact the cap 200 at most 0,8 mm from the weakening line 202a, 202b of the cap 200 or at most 0,8 mm from the bottom edge 204 of the cap 200 when the cap 200 is received in the open cavity 120. Different protrusions 120 may contact the cap 200 at different distances from the weakening line 202a, 202b of the cap 200 or from the bottom edge 204 of the cap 200 when the cap 200 is received in the open cavity 120. All protrusions 120 may contact the cap 200 at a same distance from the weakening line 202a, 202b of the cap 200 or from the bottom edge 204 of the cap 200 when the cap 200 is received in the open cavity 120.

[0072] As best illustrated in Fig. 2D, a protrusion 120 of the five protrusions 120 of the depicted holding arrangement 100 may have local radial extension which varies gradually along the axial direction A of the holding arrangement 100. The depicted protrusion 120 of Fig. 2D follows a certain profile from an end portion 121 of the holding arrangement along the axial direction A of the holding arrangement 100. More specifically, the depicted protrusion 120 of Fig. 2D as seen in the axial direction A from the end portion 121 of the holding arrangement 100 to a cap abutment surface 108 of the holding arrangement 100, starts with a first sloping section 120a over which the local radial extension gradually increases until the first sloping section 120a meets the top 124 of the protrusion 120. After the top 124, also referred to as a top section 124, the protrusion proceeds with a second sloping section 120b over which the local radial extension gradually decreases until the second sloping section 120b meets the bottom 122 of the protrusion 120.

[0073] The one or more protrusions 120 may comprise, as seen along the axial direction A of the holding arrangement 100, in sequence: the first sloping section 120a; the top section 124; and the second sloping section 120b.

[0074] The first sloping section 120a may have a radial extension towards the center of the cavity 102 that gradually increases until it reaches the top section 124, the top section 124 may form a point of maximum radial extension towards the center of the cavity 102, and the second sloping section 120b following the top 124 may have a radial extension towards the center of the cavity 102 that gradually decreases.

[0075] With reference to Fig. 1D, the one or more protrusions 120 may comprise, as seen along the inner periphery of the of the cavity 102 (i.e., in the peripheral direction P of the cavity 120), in sequence: a third sloping section 120c; the top section 124; and a fourth sloping section 120d.

[0076] The third sloping section 120c may have a radial extension towards the center of the cavity 102 that gradually increases until it reaches the top section 124, the top section 124 may form a point of maximum radial extension towards the center of the cavity 102, and the fourth sloping section 120d following the top 124 may

have a radial extension towards the center of the cavity 102 that gradually decreases.

[0077] The sloping sections contribute to the efficient attachment and release of the cap from the cap holder, minimizing any unnecessary damage to the cap.

[0078] As used, herein, the "axial direction" A may refer to the direction that extends along the centerline of the open cavity 102, perpendicular to the plane of the open cavity 102.

[0079] As used herein, the "radial direction" R may refer to the direction that extends outward from the centerline of the open cavity 102, perpendicular to the axial direction A and lying within the plane of the open cavity 102.

[0080] As used herein, the "peripheral direction" P may refer to the direction that follows the circumference of the open cavity 102, lying within the plane of the open cavity 102 and oriented perpendicular to both the axial direction A and the radial direction R.

[0081] As used herein, "sloping" may refer to a gradual increase or decrease in radial extension, giving the respective section a continuous and smooth curvature rather than a stepwise or abrupt change.

[0082] The open cavity 102 may have a cylindrical shape.

[0083] The circumferential surface portion 104 may be integrally formed as a unitary element. The holding arrangement 100 may be integrally formed as a unitary element. that comprises the open cavity 102.

[0084] This means that the circumferential surface portion 104 and/or the holding arrangement 100 may be made from a single piece of material, without seams or joints, enhancing the structural integrity and possibly simplifying the manufacturing process.

[0085] After the bottom 122 of the protrusion 120, the circumferential surface portion 102 of the holding arrangement 100 proceeds, along the axial direction A, with a fourth sloping section 120e over which the local radial extension gradually increases until the third sloping section 120a meets the textured surface portion 106. After the textured surface portion 106, along the axial direction A, the circumferential surface portion 102 of the holding arrangement 100 proceeds until it meets the cap abutment surface 108. As illustrated in Fig. 2D, the textured surface portion 106 extends further radially inwards as compared to the top 124 of the protrusion 120. In other words, the textured surface portion 106 is located closer to the central axis C of the holding arrangement 100 than the top 124 of the protrusion 120. Hence, the externa textured surface 201 of cap 200 may be translated into the open cavity 102 without being affected or contacted by the protrusion 120.

[0086] Now turning also to Fig. 1B. As illustrated in Fig. 1B, the holding arrangement 100 may according to an exemplary embodiment include a first part 130 and a second part 140. The first part may include the circumferential surface portion 104. The second part 140 may be configured to be connected to the first part 130 and to transfer a rotational torque therebetween. Any type of suitable connection between the first part 130 and the second part 140 may be used to advantage as long as a rotational torque is transferable between the first part 130 and the second part 104. Apart from including a first part 130 and a second part 140, the depicted holding arrangement 100 of Fig. 1B have features corresponding to those of the holding arrangement 100 depicted in e.g., Figs. 1A, 1C, 1D and 2A-2E. Given this, refence is made to the above.

[0087] Now turning to Figs. 3 and 4. Fig 3 illustrates by way of example an exemplary cap applicator 300. The depicted cap applicator 300 is designed to be used in a food product packaging system 400, as generally illustrated in Fig. 4. The depicted cap applicator 300 includes a holding arrangement 100 of the type described above. Hence, the holding arrangement 100 will not be described in further detail here to avoid undue repetition.

[0088] The depicted cap applicator 300 includes a drive arrangement 302 configured to rotate the holding arrangement 100. More specifically, the drive arrangement 302 is configured to rotate the holding arrangement 100 about the central axis C thereof. Hence, be rotating the rotating the holding arrangement 100 about the central axis C the cap 200 will when received in the open cavity 120 of the holding arrangement 100 co-rotate with the holding arrangement 100 about the central axis C. In this way, the cap 200 may be screwed onto a package. The depicted drive arrangement 302 includes a motor 304 which is configured to rotate the holding arrangement 100 via a drive belt 306. The motor 304 may for example be an electrical motor, a pneumatic motor or a hydraulic motor to give a few non-limiting examples. The drive belt 306 may for example be a toothed belt or a flat belt.

[0089] An exemplary food product packaging system 400 including a cap applicator station 402 is illustrated by way of example in Fig. 4. The depicted cap applicator station 402 includes two cap applicators 300 of the type describe above in relation to Fig. 3. The depicted food product packaging system 400 further includes other stations 404, 406 such as a filling station and a heat treatment station.

[0090] Now also turning to Fig. 5. A method 500 of holding a cap 200 will be described. More specifically a method 500 of holding a cap 200 by using a holding arrangement 100 for a cap applicator 300 of a food product packaging system 400 will be described. The holding arrangement 100 comprising, an open cavity 102, wherein the open cavity 102 comprises a circumferential surface portion 104 comprising a textured surface portion 106 and one or more protrusions 120 provided along the circumferential surface portion 104 and extending radially inwards from the circumferential surface portion 104. In other words, a holding arrangement 100 of the above-described type is used when performing the method 500.

[0091] The method includes receiving 502, in the open

cavity 102 of the holding arrangement 100 a cap having a circumferential weakening line 202a, 202b and/or a bottom edge 204, such that the circumferential surface portion 104 of the open cavity circumscribes the cap 200, whereby the textured surface portion 106 engages with the cap 200 such that a rotational torque of the holding arrangement 100 is transferable to the cap 200, whereby the one or more protrusions 120 cooperates with the circumferential weakening line 202a, 202b of the cap 200 by depressing the cap 200 at a location L of the weakening line 202a, 202, thereby counteracting unintentional movement of the cap 200 out of the open cavity 102, or whereby the one or more protrusions 120 cooperates with the bottom edge 204 of the cap 200 by depressing the cap 200 at a location L' of the bottom edge 204, thereby counteracting unintentional movement of the cap 200 out of the open cavity 102.

[0092] From the description above follows that, although various embodiments of the invention have been described and shown, the invention is not restricted thereto, but may also be embodied in other ways within the scope of the subject-matter defined in the following claims.

Claims

1. A holding arrangement (100) for a cap applicator (300) of a food product packaging system (400), the holding arrangement (100) comprising:

   an open cavity (102) configured to receive a cap (200), wherein the open cavity (102) comprises a circumferential surface portion (104) configured to circumscribe the cap (200), when the cap (200) is received in the open cavity (102),
   wherein the circumferential surface portion (104) comprises a textured surface portion (106) configured to engage with and to transfer a rotational torque to the cap (200) when the cap (200) is received in the open cavity (102), and one or more protrusions (120) provided along the circumferential surface portion (104) and extending radially inwards from the circumferential surface portion (104), **wherein**
   the one or more protrusions (120) are configured to

   - cooperate with a circumferential weakening line (202a, 202b) of the cap (200) by depressing the cap (200) at a location (L) of the weakening line (202a, 202b), when the cap (200) is received in the open cavity (102), or to
   - cooperate with a bottom edge (204) of the cap (200) by engaging the cap (200) at a location (L') of the bottom edge (204),

   when the is cap (200) received in the open cavity (102), thereby counteracting unintentional movement of the cap (200) out of the open cavity (102).

2. The holding arrangement (100) according to claim 1, wherein the one or more protrusions (120) are distributed circumferentially evenly along the circumferential surface portion (104).

3. The holding arrangement (100) according to claim 1 or 2, wherein the one or more protrusions (120) are 4 to 7 protrusions (120), preferably 5 protrusions (120).

4. The holding arrangement (100) according to any one of the preceding claims, wherein a protrusion (120) of the one or more protrusions (120) has a radial extension (e), from a bottom (122) thereof to a top (124) thereof, of 0,5 mm - 1.0 mm, preferably, 0,6 - 0,8 mm, more preferably 0,7 - 0.75 mm.

5. The holding arrangement (100) according to any one of claims 1-3, wherein a protrusion (120) of the one or more protrusions (120) has a radial extension (e), from a bottom (122) thereof to a top (124) thereof, corresponding to 80 - 120% of a radial extension thickness (t) of the cap (200) at the location (L) of the weakening line (202a, 202b) or at the location (L') of the bottom edge (204), preferably corresponding to 95 - 105 % of the thickness (t) of the cap (200) at the location (L) of the weakening line (202a, 202b) or at the location (L') of the bottom edge (204).

6. The holding arrangement (100) according to claim 4 or 5, wherein the top (124) of a protrusion (120) of the one or more protrusions (120) is configured to contact the cap (200) at most 1,2 mm from the weakening line (202a, 202b) of the cap (200) or at most 1,2 mm from the bottom edge (204) of the cap (200) when the cap (200) is received in the open cavity (120), preferably at most 0,8 mm from the weakening line (202a, 202b) of the cap (200) or at most 0,8 mm from the bottom edge (204) of the cap (200) when the cap (200) is received in the open cavity (120).

7. The holding arrangement (100) according to any one of the preceding claims, wherein the cap (200) is depressed 0,3 - 0,5 mm radially inwards by a protrusion (120) of the one or more protrusion (120) when the cap (200) is received in the open cavity (102), preferably 0,36 - 0,40 mm radially inwards by a protrusion (120) of the one or more protrusion (120) when the cap (200) is received in the open cavity (102).

8. The holding arrangement (100) according to any one of the preceding claims, wherein a protrusion (120) of the one or more protrusions (120) extends over an

angle (a) of 20 - 40 degrees of the circumference of circumferential surface portion (104), preferably over the angle (a) of 25 - 33 degrees of the circumference of the circumferential surface portion (104), more preferably over the angle (a) of 28 - 30 degrees of the circumference of the circumferential surface portion (104).

9. The holding arrangement (100) according to any one of the preceding claims, wherein the one or more protrusions (120) are located below the textured surface portion (106).

10. The holding arrangement (100) according to any one of the preceding claims, wherein a diameter (D) of the open cavity (102) is at least three times a depth (d) of the open cavity (102), and/or wherein the depth (d) of the open cavity (102) corresponds to 80% - 120% of a height (H) of the cap (200) to be received in the open cavity (102).

11. The holding arrangement (100) according to claim 10, wherein the textured surface portion (106) extends over 40% - 60% of the depth (d) of the open cavity (102).

12. The holding arrangement (100) according to any one of the preceding claims, wherein the holding arrangement (100) comprises a first part (130) comprising the circumferential surface portion (104), and a second part (140) configured to be connected to the first part (130) and to transfer a rotational torque therebetween.

13. A cap applicator (300) for a food product packaging system (400) comprising a holding arrangement (100) according to any one of claims 1-12, and a drive arrangement (302) configured to rotate the holding arrangement (100) about a central axis (C) thereof, thereby rotating the cap (200) received in the open cavity (102) of the holding arrangement (100) about the central axis (C).

14. A food product packaging system (400) comprising a cap applicator station (402) comprising one or more cap applicators (300) according to claim 13.

15. A method (500) of holding a cap (200) by using a holding arrangement (100) for a cap applicator (300) of a food product packaging system (400) comprising, an open cavity (102), wherein the open cavity (102) comprises a circumferential surface portion (104) comprising a textured surface portion (106) and one or more protrusions (120) provided along the circumferential surface portion (104) and extending radially inwards from the circumferential surface portion (104), the method comprising:
receiving (502), in the open cavity (102) of the holding arrangement (100) a cap having a circumferential weakening line (202a, 202b) and/or a bottom edge (204), such that the circumferential surface portion (104) of the open cavity circumscribes the cap (200),

whereby the textured surface portion (106) engages with the cap (200) such that a rotational torque of the holding arrangement (100) is transferable to the cap (200),
whereby the one or more protrusions (120) cooperates with the circumferential weakening line (202a, 202b) of the cap (200) by depressing the cap (200) at a location (L) of the weakening line (202a, 202), thereby counteracting unintentional movement of the cap (200) out of the open cavity (102), or
whereby the one or more protrusions (120) cooperates with the bottom edge (204) of the cap (200) by depressing the cap (200) at a location (L') of the bottom edge (204), thereby counteracting unintentional movement of the cap (200) out of the open cavity (102).

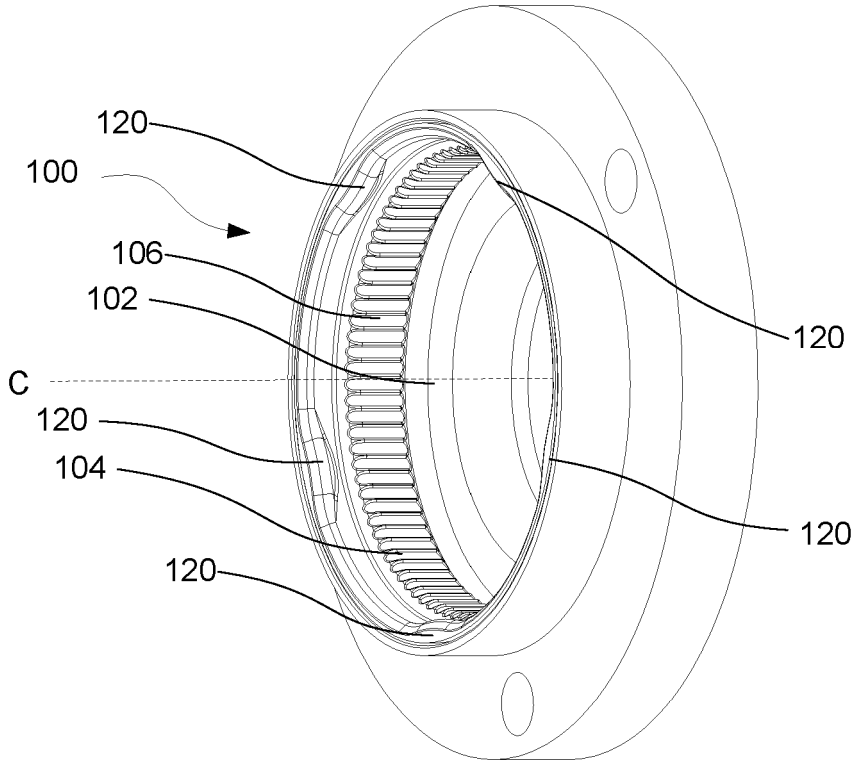
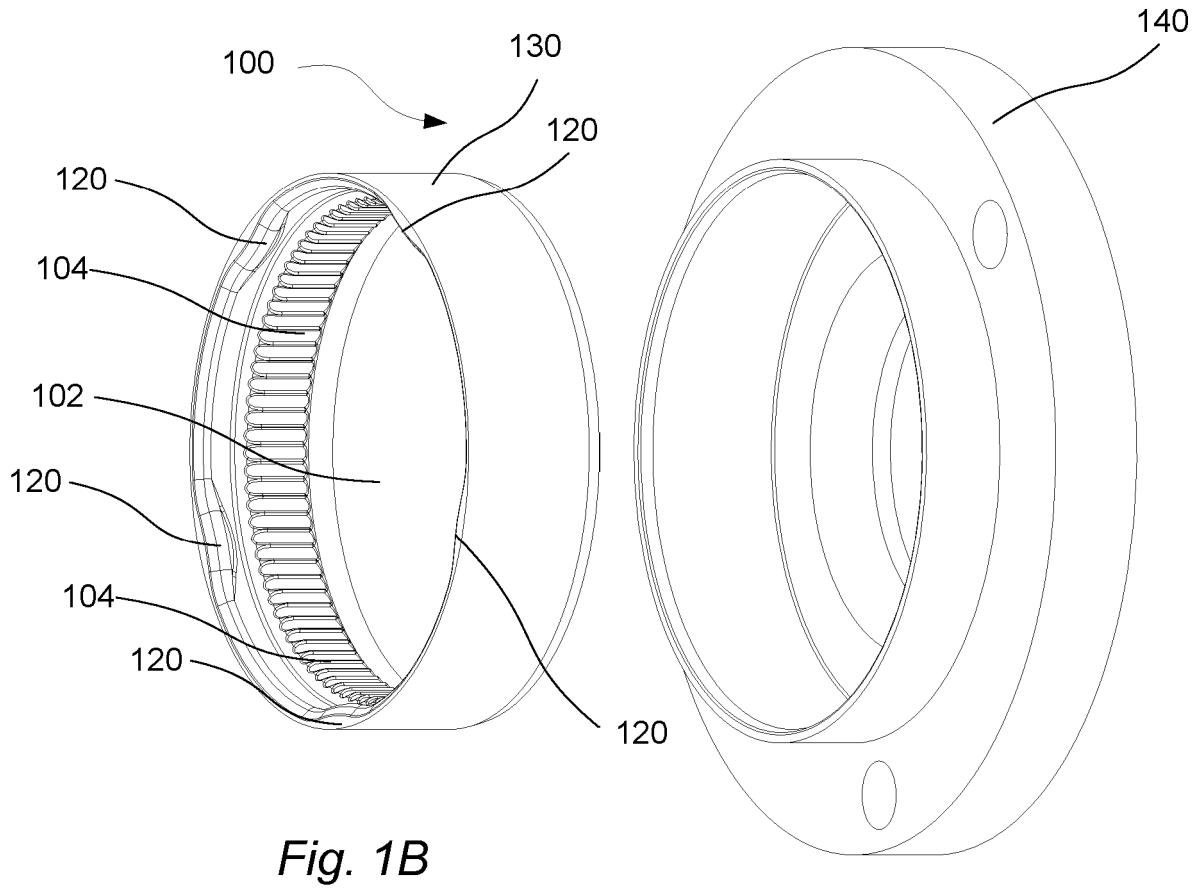

120
100
106
102
C
120
104
120
120
120

Fig. 1A


140
130
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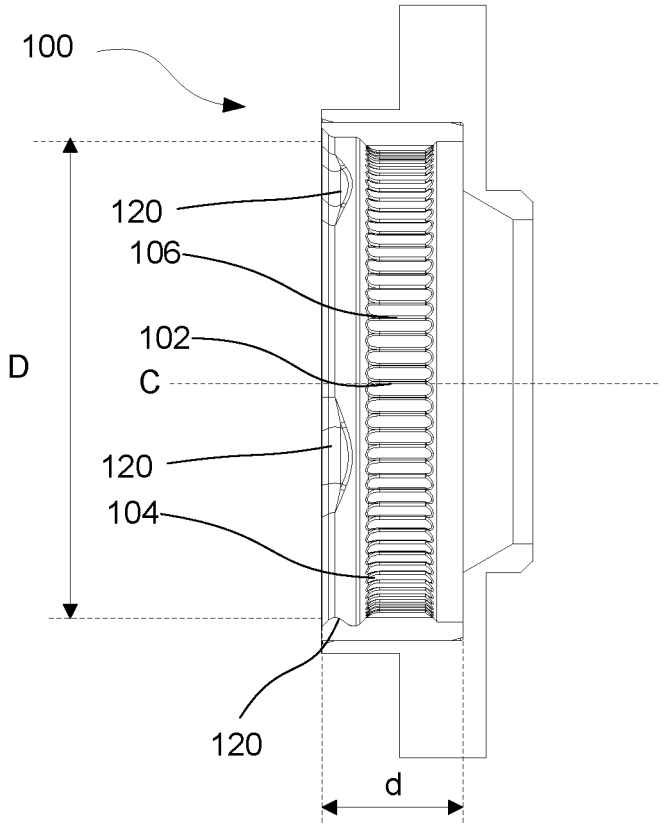
120
104
102
120
104
120
120

Fig. 1B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106
102
D
C
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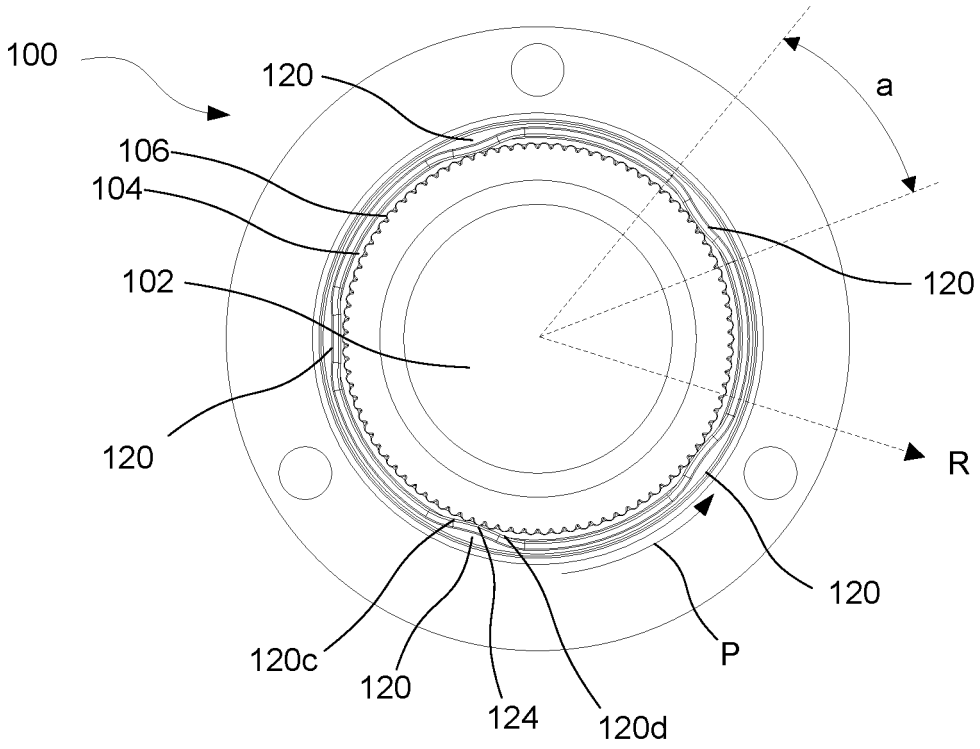
104
120
d

Fig. 1C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102
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120
R
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120c
120
124
120d
P

Fig. 1D

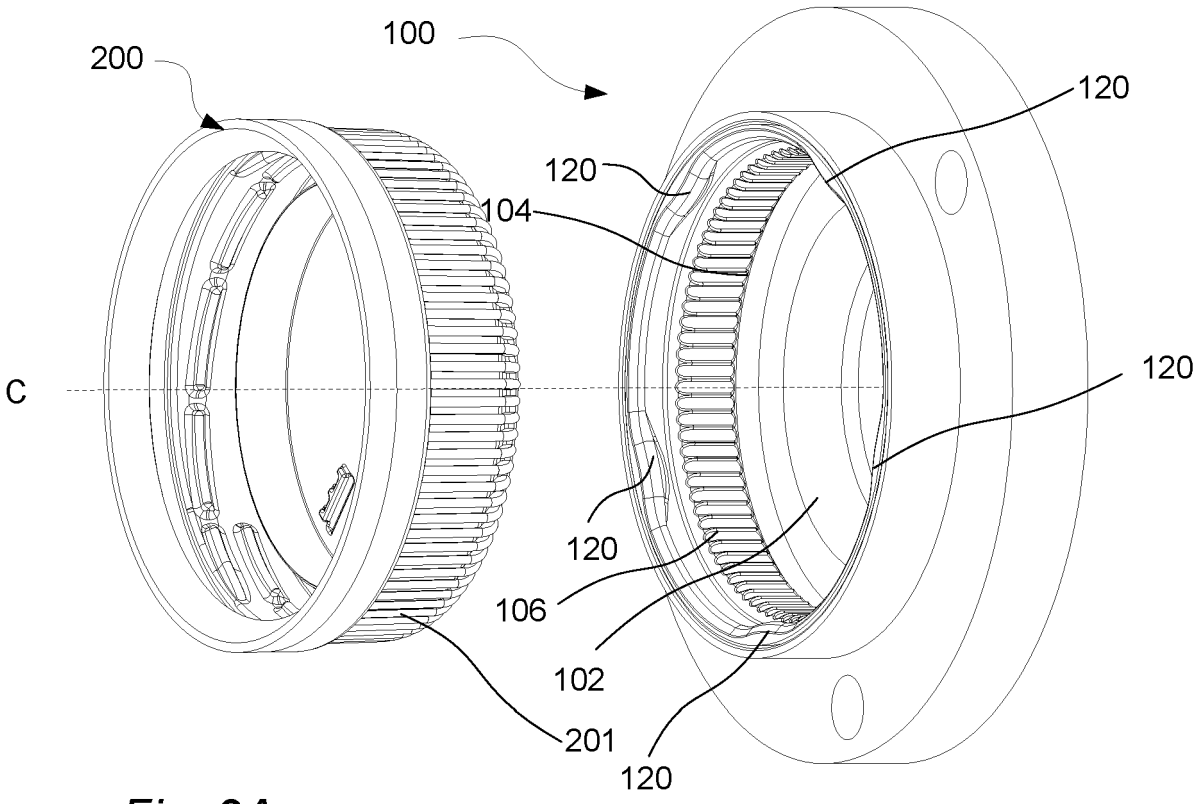

Fig. 2A

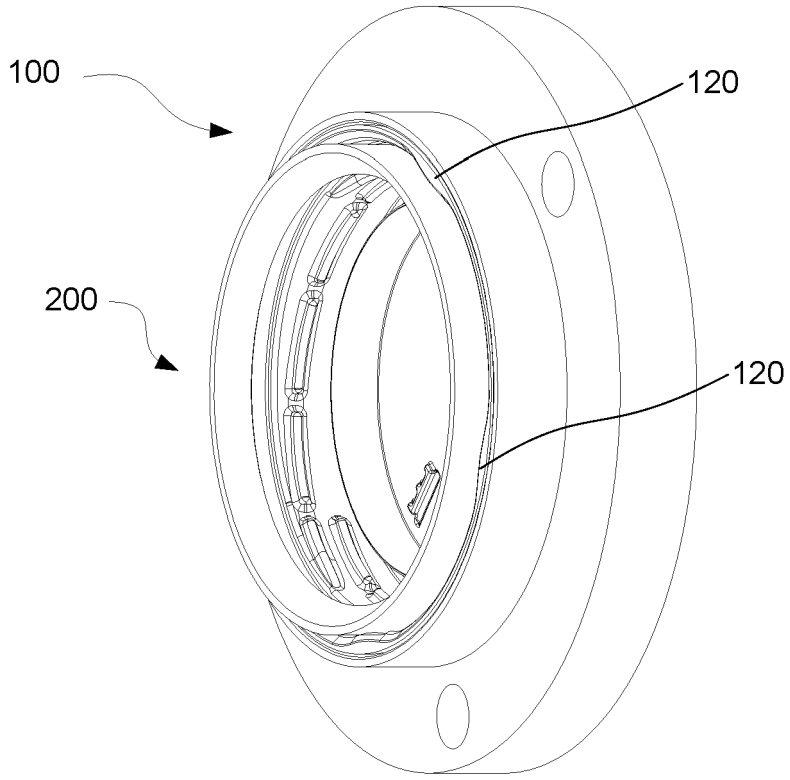

Fig. 2B

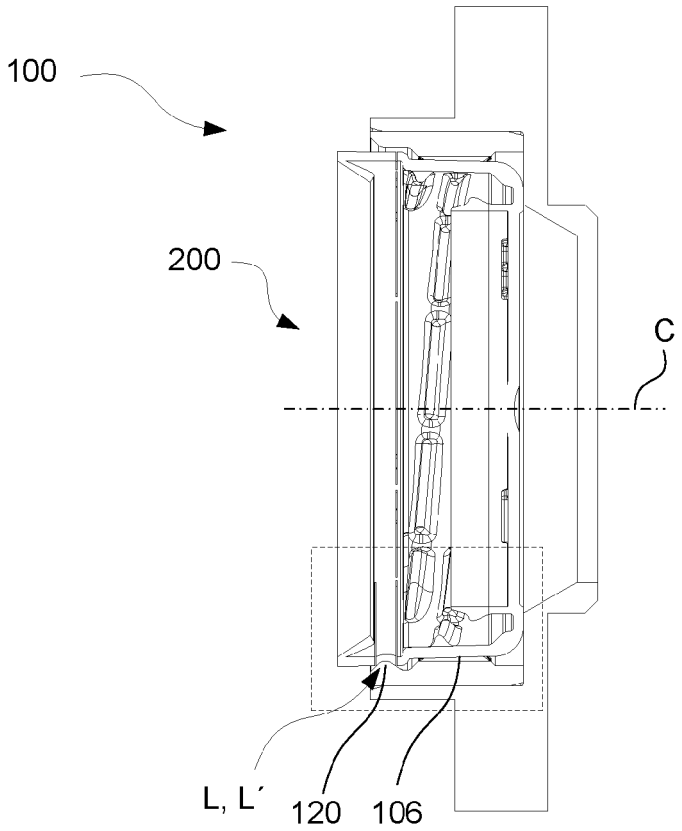

Fig. 2C

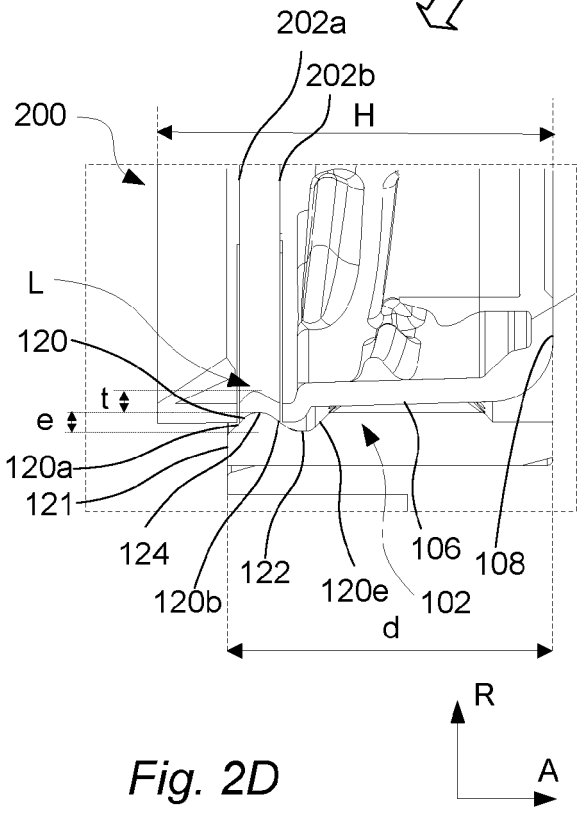

Fig. 2D

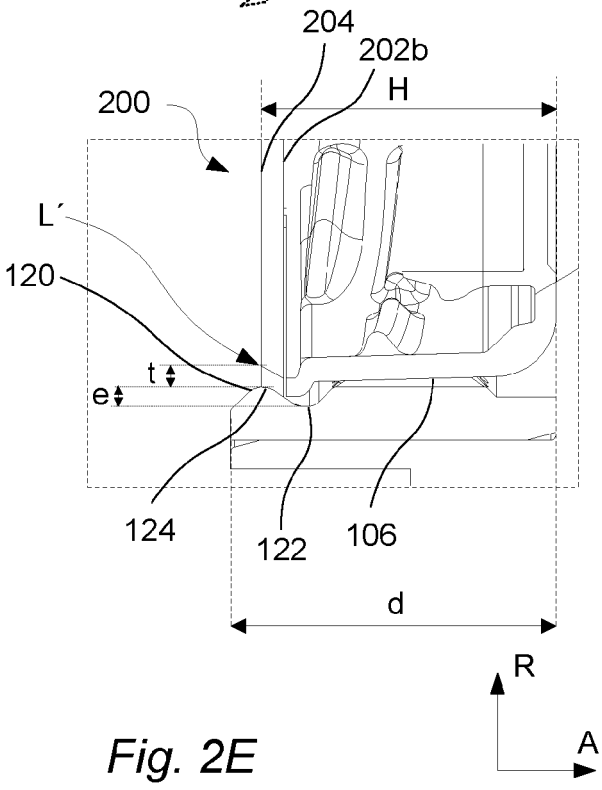

Fig. 2E

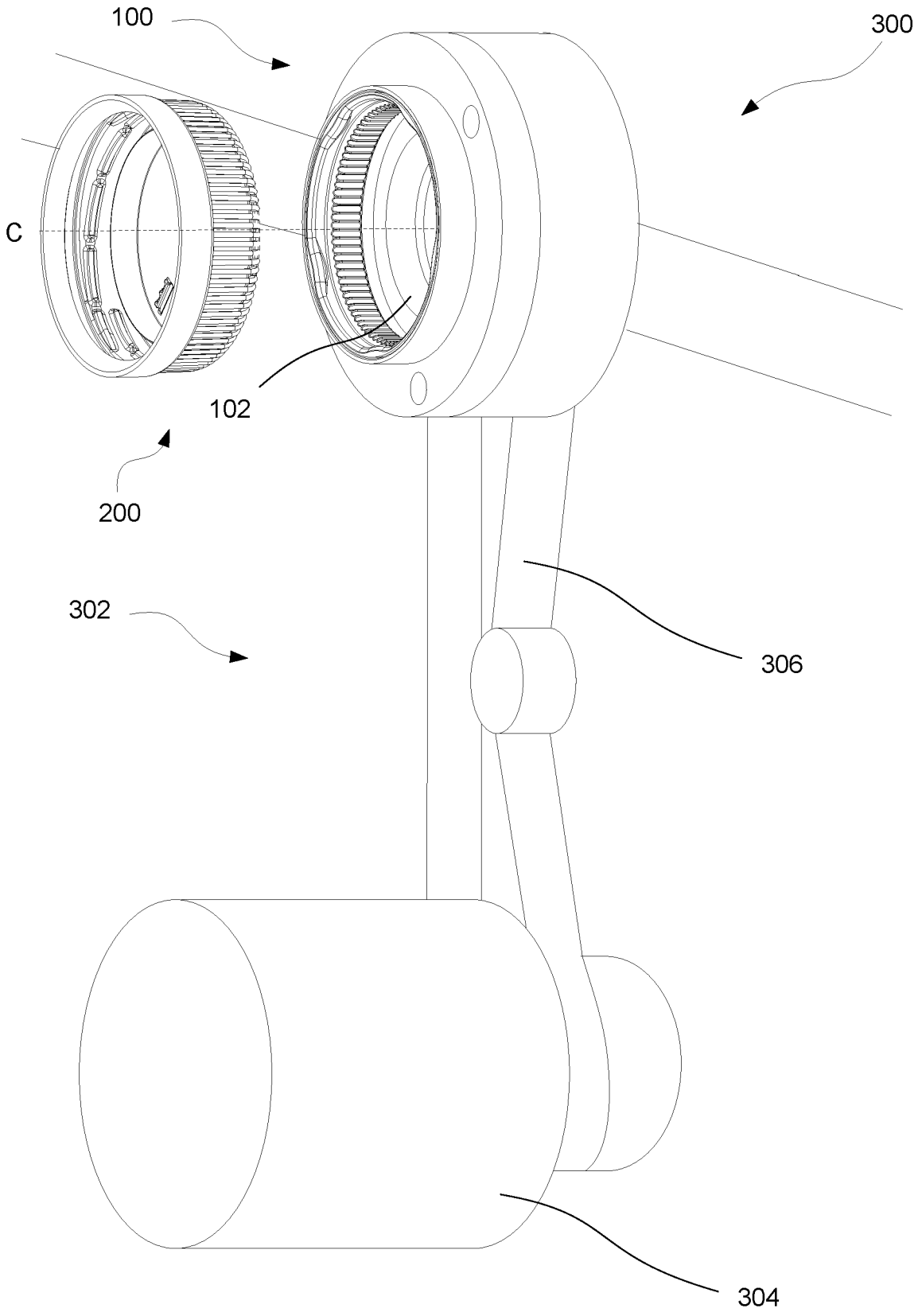

Fig. 3

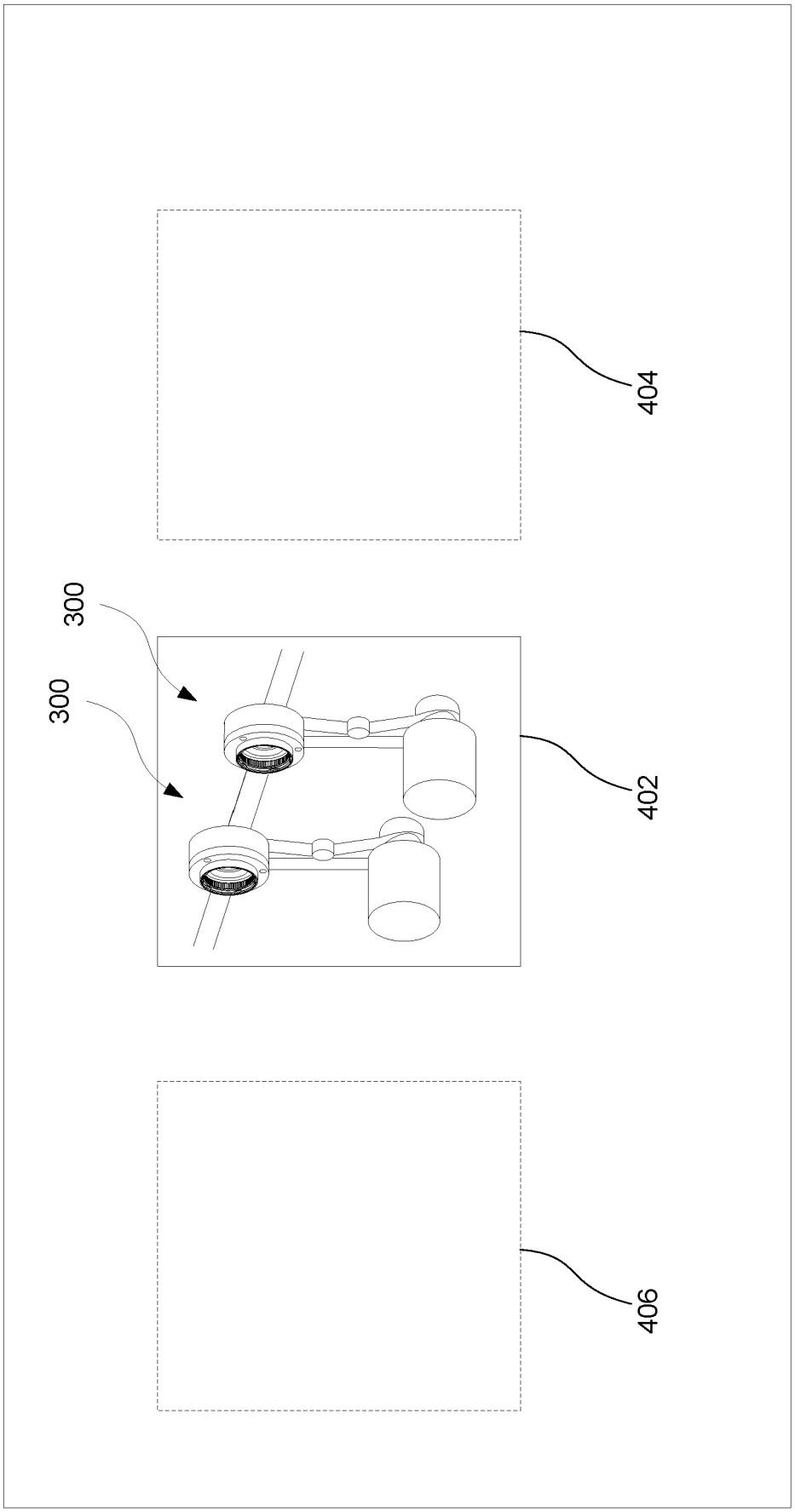

Fig. 4

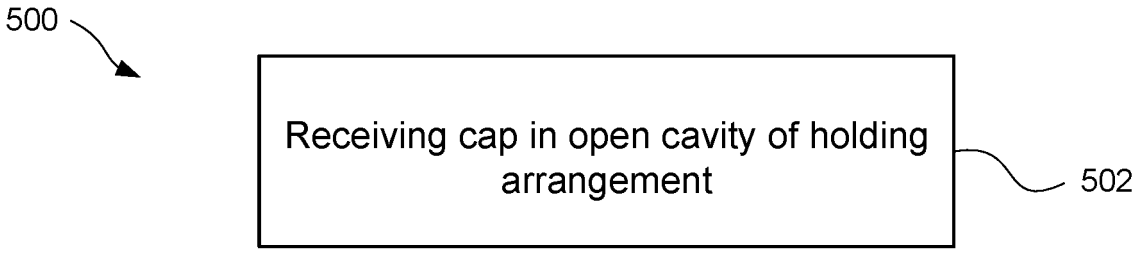
500
Receiving cap in open cavity of holding arrangement
502

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 9349

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B67B B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 January 2025	Pardo Torre, Ignacio

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 20 9349

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