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(54) **PACKAGE AND CAP FOR SEALING A PACKAGE**

(57) A package (100) for holding a liquid food product (110) comprising: a main body (106) configured to hold the liquid food product (110), and a neck (200) connected to the main body (106), the neck (200) comprising, a cylindrical side wall portion (217) having an outer neck surface (210) and an inner neck surface (212), the outer neck surface (210) comprising an outer thread (214) configured to interact with an inner thread (218) of a cap (102), wherein the inner neck surface (212) comprises a textured sealing surface (212a) configured to abut an annular sealing protrusion (304) of the cap (102) when the cap (102) is screwed onto the neck (200) is provided. A cap (120) comprising a textured external sealing surface (304a) is also provided as well as a molding tool (500) for molding a neck (200) of a package and a molding tool (502) for molding a cap (102).

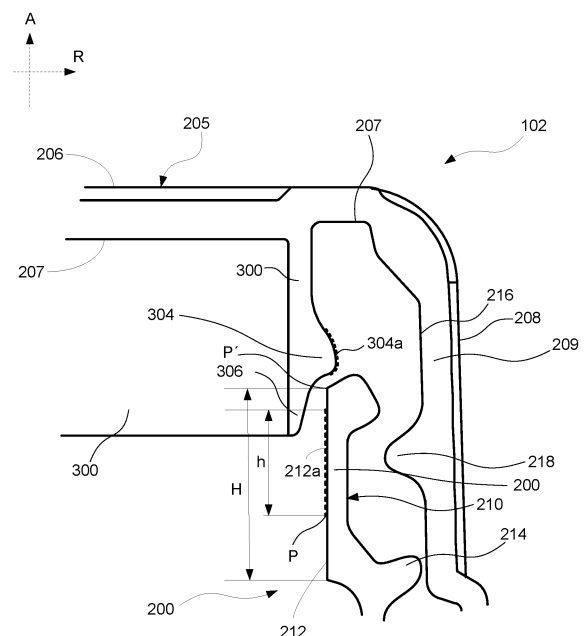


Fig. 4A

Description

Technical Field

[0001] The invention relates to the field of food packaging. More particularly, it is related to a package for holding a liquid food product, a cap for sealing a package, a molding tool for molding a neck of a package and a molding tool for molding a cap. The package has a main body and a neck connected to the main body. The cap has an inner cylindrical protrusion extending downwards from an inner top surface of the cap. The inner cylindrical protrusion being provided with an annular sealing protrusion.

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 and lids 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] Today, many consumers prefer packages provided with threaded caps. A major reason for this being that the package can be opened by screwing the cap off the package, and thereafter closed again by screwing the cap back onto the package. Another reason for using threaded caps on packages is that such caps offer a convenient way of closing a package in a tight manner. In other words, a package with a threaded cap can generally be stored or transported in any orientation, even after the cap has been opened and screwed back onto the package. Further, the fact that the cap provides for a tight sealing of the package even after being screwed back onto the package allows for that the product contained in the package can be stored and kept fresh for a prolonged period compared to when a non-tight package is used.

[0004] In order for a threaded cap to be able to close a package, it will generally have to be screwed onto a neck or otherwise threaded portion of the package. Such neck or otherwise threaded portion will for natural reasons have to fit the cap at hand. The required fit in combination with the fact that the cap is to provide a tight closing of the package can result in that a lot of force is needed to unscrew the cap. This problem is commonly most outspoken when the cap is unscrewed for the first time, i.e., when opening the package for the first time. Hence, consumers can experience problems with opening treaded caps or may even be unable to open threaded caps without using tools.

[0005] Today, caps are commonly provided with tamper bands or tamper rings such that the consumer easily can detect if the package has been opened or not. By

unscrewing the cap from the package, the tamper band is, as an effect, separated from the rest of the cap. However, the use of tamper bands typically results in that even more force is required to unscrew the cap for the first time. Even more force may be required when a tether band is used for retaining the uncrewed cap to the package.

[0006] Given the force needed to unscrew the cap for the first time it has been suggested to use so-called release agents in the neck of the package and/or in the cap. Such release agents serve the purpose of lubricating the interfaces between the neck and the cap such that the cap can be more easily unscrewed. Release agents are generally reducing the force needed to unscrew the cap. However, release agents are generally less efficient when the package and its associated cap are cold. Moreover, release agents are costly and should as a rule not be used too excessively when it comes to packages and caps for food products.

[0007] Hence there is still room for improvement when it comes to the force required to unscrew a cap from the neck of a package.

Summary

[0008] It is an object of the invention to at least partly overcome one or more of the above-identified limitations of the prior art.

[0009] In particular, it is an object to provide a package which is easier to open.

[0010] Further, it is an object to provide a cap which is easier to unscrew.

[0011] Another object is to provide a package which is easier to close.

[0012] Another object is to provide a cap which is easier to screw onto the neck of a package.

[0013] According to a first aspect there is provided a package for holding a liquid food product comprising: a main body configured to hold the liquid food product, and a neck connected to the main body, the neck comprising, a cylindrical side wall portion having an outer neck surface and an inner neck surface, the outer neck surface comprising an outer thread configured to interact with an inner thread of a cap, wherein the inner neck surface comprises a textured sealing surface configured to abut an annular sealing protrusion of the cap when the cap is screwed onto the neck.

[0014] The main body of the package may be carton-based. The main body may be based of made of plastic or metal. The main body may comprise a flexible bag or pouch.

[0015] The neck of the package may be connected directly to the main body of the package. The neck of the package may be connected indirectly to the main body of the package. The neck of the package may be integrally formed with the main body of the package. The neck may be formed of plastic. The neck may be molded from plastic.

[0016] The main body may comprise a carton-based material, wherein the main body and the neck are connected via a shoulder, and wherein the neck and the shoulder are integrally formed by being molded from a plastic material.

[0017] The neck comprises a cylindrical side wall portion which has an outer neck surface and an inner neck surface. The outer neck surface comprises an outer thread. The outer thread is configured to interact with an inner thread of the cap. Hence, the cap may be screwed onto and unscrewed from the neck.

[0018] The inner neck surface comprises a textured sealing surface configured to abut an annular sealing protrusion of the cap when the cap is screwed onto the neck. An advantage of having a textured sealing surface on the inner neck surface is that a reduced force may be needed when unscrewing the cap from the neck. Similarly, an advantage of having a textured sealing surface on the inner neck surface is that a reduced force may be needed when screwing the cap onto the neck. This allows for that the cap may more easily be removed from the package by being unscrewed. The textured sealing surface may consequently reduce frictional forces or contact forces between itself and the annular sealing protrusion of the cap. Such reduced frictional forces may emanate from a reduced contact surface between the textured sealing surface and the annular sealing protrusion of the cap. Such reduced frictional forces may emanate from a reduced surface adhesion between the textured sealing surface and the annular sealing protrusion of the cap. Such reduced frictional forces may emanate from an improved ability for air to enter in-between the textured sealing surface and the annular sealing protrusion of the cap. Importantly, the initial force required for opening the cap for the first time may be significantly reduced.

[0019] The textured sealing surface may be textured in different ways. The textured sealing surface may be a rough surface. The textured sealing surface may comprise a rough surface portion. The textured sealing surface may comprise a pattern. The textured sealing surface may comprise an embossed pattern. The textured sealing surface may comprise a protruding pattern or a protruding feature, such a dimple or ridge.

[0020] The texture of the textured sealing surface may be formed when forming the neck, e.g., by being included as an inverse texture in a molding tool. The texture of the textured sealing surface may be formed subsequent to forming the neck, e.g., by laser patterning or imprinting.

[0021] The textured sealing surface may extend along a circumference of the inner neck surface, which is advantageous in that the force required to unscrew a cap from the neck may be further reduced. The textured sealing surface may extend along the complete circumference of the inner neck surface. The textured sealing surface may extend along a portion of the circumference of the inner neck surface. The textured sealing surface may extend along a plurality of portions of the circumference of the inner neck surface.

[0022] The textured sealing surface may extend, as seen along an axial direction of the cylindrical side wall portion, along at least 30% of an inner height of the inner neck surface, which is advantageous in that the textured sealing surface may be provided where most needed in terms of achieving a reduced force for unscrewing a cap from the neck. At the same time, fabrication of the neck may be simplified since the complete inner neck surface needs not to be textured.

[0023] The textured sealing surface may extend, as seen along an axial direction of the cylindrical side wall portion, at least from a position of the inner neck surface where the annular sealing protrusion abuts the inner neck surface when the cap is screwed onto the neck in its lowermost position on the neck, upwards towards a rim of the inner neck surface, which is advantageous in that the textured sealing surface may be provided where the annular sealing protrusion abuts the inner neck surface when the cap is unscrewed from the neck. In particular, the textured sealing surface may be provided at a location where the annular sealing protrusion abuts the inner neck surface when an initial or first time unscrew action is initiated. Consequently, the initial force required for opening the cap for the first time may be further reduced.

[0024] The textured sealing surface may have a surface roughness of 5-30 μm , more preferably 12-18 μm , most preferably 14-16 μm . Alternatively, the textured sealing surface may have a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm . This is advantageous in that the overall force required for unscrewing the cap from the neck for the first time may be further reduced. Moreover, when the surface roughness is kept within these ranges, leakage past the textured sealing surface can still be avoided. In this regard, the surface roughness is typically measured as Ra according to the ISO 4287:1997 standard. Also, the force required for screwing the cap onto the neck may be further reduced.

[0025] The textured sealing surface may comprise tops and bottoms, and wherein the average, or the arithmetic average, of profile height deviations of the tops and the bottoms from a mean line is between 2 μm to 16 μm , alternatively between 5 μm to 30 μm , which is advantageous in that the overall force required for unscrewing the cap from the neck for the first time may be further reduced. Also, the force required for screwing the cap onto the neck may be further reduced.

[0026] The textured sealing surface may comprise a plurality of tops and bottoms provided along the axial direction of the cylindrical side wall portion, wherein the plurality of tops and bottoms are mutually offset along a circumference of the inner neck surface, which is advantageous in that leakage between the textured sealing surface and the annular sealing protrusion of the cap may be prevented or counteracted while still providing for that a reduced overall force is required for unscrewing the cap from the neck e.g., for the first time. Such leakage may be prevented or counteracted since such mutual

offset of the tops and bottoms provide for that no or only few passages in form of channels, channel-like structures or otherwise elongated grooves or groove-like structures are formed in the textured sealing surface along the axial direction of the cylindrical side wall portion. In other words, any liquid or similar may be prevented or counteracted from entering in between the textured sealing surface and the annular sealing protrusion by the mutually offset or staggered arrangement of the tops and bottoms.

[0027] The neck may further comprise a retention ring extending radially outwards from the outer neck surface and configured to engage a tamper and/or tether band of the cap, wherein the retention ring comprises a downward facing textured retention surface, which is advantageous in that the force required for rotating the cap and its associated tamper and/or tether band may be reduced since the contact forces or frictional forces between the tamper and/or tether band of the cap and the downward facing textured retention surface may be reduced. Hence, the overall force required for unscrewing a cap having a tamper and/or tether band from the neck for the first time may be reduced.

[0028] The textured retention surface may be textured in different ways. The textured sealing surface may be a rough surface. The textured retention surface may comprise a rough surface portion. The textured retention surface may comprise a pattern. The textured retention surface may comprise an embossed pattern. The textured retention surface may comprise a protruding pattern or a protruding feature, such a dimple or ridge.

[0029] The textured retention surface may comprise tops and bottoms, and wherein the average, or the arithmetic average, of profile height deviations of the tops and bottoms from the mean line is between 10 μm to 50 μm , which is advantageous in that the overall force required for unscrewing a cap having a tamper and/or tether band from the neck for the first time may be further reduced. A typical height of a protrusion may be about 60 μm from a bottom thereof to a top thereof.

[0030] The textured retention surface may comprise an embossed pattern having a height of 30-90 μm , more preferably 40-80 μm , most preferably 20-50 μm , which is advantageous in that the overall force required for unscrewing a cap having a tamper and/or tether band from the neck for the first time may be further reduced.

[0031] The textured retention surface may comprise a plurality of radially extending protrusions which is advantageous in that the overall force required for unscrewing a cap having a tamper and/or tether band from the neck for the first time may be further reduced.

[0032] According to a second aspect there is provided a cap for sealing a package by screwing the cap onto a neck of the package, the cap comprising: a top portion having an outer top surface and an inner top surface, a cylindrical side wall portion having an outer side wall surface and an inner side wall surface, an inner thread provided on the inner side wall surface, wherein the inner

thread is configured to interact with an outer thread of the neck of the package, and an inner cylindrical protrusion extending downwards from the inner top surface, the inner cylindrical protrusion comprising, a peripheral lip configured to guide the inner cylindrical protrusion into the neck of the package, for positioning the cap with the inner cylindrical protrusion radially inside the neck and the inner tread radially outside the neck, and an annular sealing protrusion arranged above the peripheral lip and extending radially outwards from the inner cylindrical protrusion towards the inner side wall surface, wherein the annular sealing protrusion comprises a textured external sealing surface.

[0033] 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.

[0034] The textured external sealing surface of the annular sealing protrusion may be of the same type as the textured sealing surface of the cap.

[0035] In short, the textured external sealing surface of the annular sealing protrusion may be textured in different ways. The textured external sealing surface of the annular sealing protrusion may be a rough surface. The textured external sealing surface of the annular sealing protrusion surface may comprise a rough surface portion. The textured external sealing surface of the annular sealing protrusion may comprise a pattern. The textured external sealing surface of the annular sealing protrusion may comprise an embossed pattern. The textured external sealing surface of the annular sealing protrusion may comprise a protruding pattern or a protruding feature, such a dimple or ridge.

[0036] The texture of the textured external sealing surface of the annular sealing protrusion may be formed when forming the cap, e.g., by being included as an inverse texture in a molding tool. The texture of the textured external sealing surface of the annular sealing protrusion surface may be formed subsequent to forming the cap, e.g., by laser patterning or imprinting.

[0037] The textured sealing surface may have a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm . Alternatively, the textured external sealing surface of the annular sealing protrusion may have a surface roughness of 5-30 μm , more preferably 12-18 μm , most preferably 14-16 μm , which is advantageous in that the overall force required for unscrewing the cap from the neck for the first time may be further reduced. In this regard, the surface roughness is typically measured a Ra according to the ISO 4287:1997 standard. Also, the force required for screwing the cap onto the neck may be further reduced.

[0038] The textured external sealing surface of the annular sealing protrusion may comprise tops and bottoms, and wherein the average, or the arithmetic average, of profile height deviations of the tops and the bottoms from a mean line is between 5 μm to 30 μm , which is advantageous in that the overall force required

for unscrewing the cap from the neck for the first time may be further reduced. Also, the force required for screwing the cap onto the neck may be further reduced.

[0039] The textured external sealing surface of the annular sealing protrusion may comprise a plurality of tops and bottoms provided along the axial direction of the cylindrical side wall portion, wherein the plurality of tops and bottoms are mutually offset along a circumference of the annular sealing protrusion, which is advantageous in that leakage between the textured external sealing surface of the annular sealing protrusion and the textured sealing surface of the inner neck surface of the neck may be prevented or counteracted while still providing for that a reduced overall force is required for unscrewing the cap from the neck for the first time. Such leakage may be prevented or counteracted since such mutual offset of the tops and bottoms provide for that no passages in form of channels, channel-like structures or otherwise elongated grooves or groove-like structures are formed in the textured external sealing surface of the annular sealing protrusion along the axial direction of the annular sealing protrusion. In other words, any liquid or similar may be prevented or counteracted from entering in between the textured sealing surface of the neck and the annular sealing protrusion of the cap by the mutually offset or staggered arrangement of the tops and bottoms.

[0040] The cap may be void of any release agent, which is advantageous in that the cap may be easier and/or less costly to fabricate. Further, a cap void of release agents may have a reduced effect on e.g., a liquid food product when contacting the same.

[0041] The neck connected to the main body may be void of any release agent.

[0042] It is to be noted that the wording "void of any release agent" is meant to encompass a situation where a cap and/or the neck is completely void of any release agent but also a situation where a cap and/or neck comprises a minor or negligible amount of a release agent. A "minor or negligible amount of a release agent" is here meant to encompass a situation where there is less than 200 ppm release agent in the cap and/or the neck. Typical examples of release agents include but are not limited to erucamide and siloxane.

[0043] According to a third aspect there is provided a molding tool for molding a neck of a package according to the first aspect, the molding tool comprising a textured external surface configured to mold the textured sealing surface of the neck, wherein the textured external surface of the molding tool has a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm . Alternatively, the textured sealing surface may have a surface roughness of 5-30 μm , more preferably 12-18 μm , most preferably 14-16 μm .

[0044] The textured external surface of the molding tool may in practice be of the same type as the textured sealing surface of the neck but for natural reasons an inverse thereof. In other words, the textured external surface of the molding tool may be complementary to

the textured sealing surface of the neck.

[0045] 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.

[0046] According to a fourth aspect there is provided a molding tool for molding a cap according to the second aspect, the molding tool comprising a textured internal surface configured to mold the textured external sealing surface of the cap wherein the textured internal surface of the molding tool has a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm . Alternatively, the textured sealing surface may have a surface roughness of 5-30 μm , more preferably 12-18 μm , most preferably 14-16 μm .

[0047] The textured internal surface of the mold may in practice be of the same type as the textured external sealing surface of the cap but for natural reasons an inverse thereof. In other words, the textured internal surface of the molding tool may be complementary to the textured external sealing surface of the cap.

[0048] 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.

[0049] According to a fifth aspect there is provided a package for holding a liquid food product comprising a main body configured to hold the liquid food product, and a neck connected to the main body, the neck comprising a cylindrical side wall portion having an outer neck surface and an inner neck surface, the outer neck surface comprising an outer thread configured to interact with an inner thread of a cap. The neck further comprises a retention ring extending radially outwards from the outer neck surface and configured to engage a tamper and/or tether band of the cap, wherein the retention ring comprises a downward facing textured retention surface.

[0050] The package according to the fifth aspect may include all features and embodiments of the package according to the first aspect.

[0051] 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.

[0052] 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.

Brief Description of the Drawings

[0053] 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.

[0054] 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. 1 is a perspective view of a package.

Fig. 2A and 2B illustrate a cap and a shoulder of the package of Fig. 1.

Fig. 3A is a cross-sectional view of the cap and the neck in a pre-sealed state.

Fig. 3B is a cross-sectional view of the cap and the neck in a sealed state.

Fig. 4A illustrates part of the cross-sectional view illustrated in fig. 3A in further detail.

Fig. 4B illustrates a schematical cross-sectional view of a textured surface with tops and bottoms extending about a mean line.

Fig. 4C is a cross-sectional view of a textured retention surface of the neck according to two different versions.

Fig. 5A schematically illustrates a molding tool for molding a neck.

Fig. 5B schematically illustrates a molding tool for molding a cap.

Fig. 6A schematically illustrates an apparatus for comprising a molding tool for molding a neck.

Fig. 6B schematically illustrates an apparatus comprising a molding tool for molding a cap.

Detailed Description

[0055] 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.

[0056] Now turning to Fig. 1. Fig. 1 schematically illus-

trates by way of example a package 100, more particularly a so-called carton bottle package. However, it is to be understood that the present inventive concept is applicable to other types of packages although exemplified by a so-called carton bottle package below.

[0057] Now also turning to Figs. 2A and 2B. The depicted package 100 is provided with a cap 102. The cap 102 may be made of plastic, such as polypropylene, PP, but other materials are also possible. The cap 102 may be molded from plastic. The cap 102 may be connected to a neck 200 by being screwed onto the neck 200, as schematically illustrated in fig. 2A and 2B. The neck 200 may in turn be connected to a so-called shoulder 104. When producing the package 100, the neck 200 and the shoulder 104 may be molded at the same time and in this way constitute one and the same element. In other words, the neck 200 and the shoulder 104 may be integrally formed. Another alternative is to have the neck 200 pre-made and mold the shoulder 104 in a filling machine such that the neck 200 is connected to the shoulder 104. When moulding the neck and shoulder 104, or only shoulder in case the neck is pre-made, the shoulder may be connected to a carton-based main body 106. The main body 106 may be formed from a sheet of packaging material that is folded and longitudinally sealed. Hence, a food product 110 may typically be held in an interior 108 of the package 100.

[0058] Fig. 2A and 2B illustrate the cap 102 and the shoulder 104 with the neck 200 in further detail where the cap 102 is separated from the neck 200. Fig. 2A provides a perspective view from above and fig. 2B provides a perspective view from below.

[0059] The neck 200 is, as illustrated, connected to the shoulder 104 via a connection rim 202. In case the neck 200 and shoulder 104 are molded in one piece, as is the case with the illustrated neck 200 and shoulder 104 in fig. 2A and 2B, the connection rim 202 may be a thickened section assuring rigidity when screwing and unscrewing the cap 102 from the neck 200. Further, the cap 102 may be provided with a tamper and/or tether band 204, i.e. a ring, placed at a lower part of the cap 102, that remains with the neck 200 once the cap 102 is unscrewed for the first time. In the example illustrated in fig. 2A and 2B, the cap 102 is designed to be applied to the package 100, by being screwed onto the package 100. When the cap 102 is screwed onto the neck 200 of the package for the first time, the tamper and/or tether band 204 is attached to the neck 200. More specifically, the tamper and/or tether band 204 is attached to the neck in a one way fashion where the tamper and/or tether band 204 cannot be removed from the neck 200 without being damaged or without using a significant force.

[0060] The depicted cap 102 comprises a top portion 205 having an outer top surface 206, facing outwards when the cap 102 is applied, and an inner top surface 207, facing inwards when the cap 102 is applied. The cap 102 has a cylindrical side wall portion 209 having an outer side wall surface 208 and an inner side wall surface 216.

The outer side wall surface 208 may be provided with vertical grooves, as illustrated, to provide improved gripping for consumers.

[0061] The depicted neck 200 has a cylindrical side wall portion 217 that is connected to the shoulder 104 and comprises an outer neck surface 210 and an inner neck surface 212.

[0062] To provide for that the cap 102 and the neck 200 may interact with one another, the neck 200 is provided with an outer thread 214 facing radially R outwards, and the inner side wall surface 216 of the cap 102 is provided with an inner thread 218 facing radially R inwards.

[0063] Now also turning to Fig. 3A and 3B. Fig. 3A and 3B illustrate cross-sectional views of the cap 102, neck 200 and shoulder 104 in a pre-sealed state and a sealed state, respectively. More specifically, Fig. 3A illustrates a state in which the cap 102 is placed on the neck 200, but not screwed onto the neck 200. On the other hand, Fig. 3B illustrates a state in which the cap 102 is fully screwed onto the neck 200.

[0064] As illustrated in fig. 3A and 3B, as well as fig. 2B, the cap 102 is provided with an inner cylindrical body or inner cylindrical protrusion 300 extending from the inner top surface 207 of the cap 102. A peripheral end 306 of the inner cylindrical body 300, is used for guiding, or directing, the cap 102 correctly with respect to the neck 200 during e.g. cap application in a filling machine. As explained more in detail below, the peripheral end 306 may be tapered to provide for more reliable guiding during the cap application.

[0065] To provide for that the package 100 is adequately sealed when the cap 102 is applied onto the neck 200 by being screwed onto the neck 200, either in a cap application process in a filling machine or when being screwed back onto the neck 200 by the consumer, an annular sealing protrusion 304 is provided at the inner cylindrical body 300. As illustrated, the annular sealing protrusion 304 may typically extend radially R outwards from the inner cylindrical body 300. Between the peripheral end 306 and the annular sealing protrusion 304, a transition portion 308 is provided. Since the cap 102 typically may be molded in one piece, the transition portion 308 may constitute a continuous transition from the peripheral end 306 to the annular sealing protrusion 304. Having such continuous transition, i.e. having no sharp edges, may be advantageous in that a risk of having food residues stuck can be reduced, which in turn improves food safety.

[0066] The depicted tamper and/or tether band 204 is provided in the form of a ring and is provided for assuring that the package has not been tampered and/or for tethering the ring to the package 100. The tamper and/or tether band 204 may typically comprise a spring element 312 providing for that the cap 102 with the tamper and/or tether band 204 may be applied onto the neck 200, but that the tamper and/or tether band 204 remains, due to interaction between the spring element 312 and a protrusion, in form of a retention ring 203, of the neck 200, with

the neck 200 once the package 100 is opened for the first time by the consumer. To provide for that the tamper and/or tether band 204 may be completely or partly separated from the cap 102, perforations are typically provided in the cap 102. In other words, the tamper and/or tether band 204 may to advantage be configured to slide over the retention ring 203 of the neck 200 of the package 100 when the cap 102 is screwed onto the neck 200 of the package 100. The tamper and/or tether band 204 may to advantage have a one-way retention element 312 configured to snap past and engage the downward facing retention surface 203a of the retention ring 203 when the cap is screwed onto the neck 200 of the package 100 for the first time. The one-way retention element 312 may to advantage be a spring element 312 of the above-described type. Thus, the tamper and/or tether band 204 is prevented or counteracted from sliding back over the retention ring 203 of the neck 200 of the package 100 when the cap is unscrewed from the neck 200 of the package 100.

[0067] The annular sealing protrusion 304 is advantageous in that a risk of having surrounding air entering the interior 108 of the package 100 may be reduced. In other words, the annular sealing protrusion 304 is advantageous in that it provides for a reduced risk of leakage. Since microorganisms, such as spores and bacteria, that may risk deteriorating the food product 110 may be present in the surrounding air, reducing an inflow of the surrounding air is highly desired. Similarly, a leakage from the package is for natural reasons also not desired and is generally to be counteracted. Once the cap 102 is applied fully by being screwed onto the neck 200, as illustrated in fig. 3B, the annular sealing protrusion 304 abuts the inner neck surface 212 in combination with that the neck 200 abut the inner top surface 207 of the cap 102 such that two closing or sealing locations are achieved.

[0068] Now also turning to Fig. 4A and 4B. Fig. 4A schematically illustrates a partial cross-sectional view of the pre-sealed state, i.e., where the cap 102 is not screwed onto the neck 200, shown in Fig. 3A in further detail. However, in Fig. 4, the cap 102 has been elevated slightly from the neck 200 as compared to Fig. 3A to more clearly illustrate the details of the of the cap 102 and the neck 200.

[0069] As can be seen in Fig. 4A, the depicted inner neck surface 212 of the neck 200 comprises a textured sealing surface 212a. As have been described above primarily in conjunction to Figs. 3A-B, the inner neck surface 212 is configured to abut the annular sealing protrusion 304 of the cap 102 when the cap 102 is screwed onto the neck 200. This means in turn that the textured sealing surface 212a is configured to abut the annular sealing protrusion 304 of the cap 102 at least to some extent when the cap 102 is screwed onto the neck 200 and consequently also when the cap 120 is unscrewed from the neck 200. In other words, the textured sealing surface 212a is configured to abut the annular sealing protrusion 304 of the cap 102 at least at some

stage when the cap 102 is screwed onto the neck 200 and consequently also when the cap 120 is unscrewed from the neck 200.

[0070] The textured sealing surface 212a provides for that a reduced friction is provided between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102. Such reduced friction may be attributed to a reduced contact surface between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102. Such reduced friction may be attributed to a reduced surface adhesion between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102. It has surprisingly been found that, by providing the textured sealing surface 212a on the inner neck surface 212 the rotational torque need for opening the cap 102 for the first time may be reduced by about 20%. It has been shown that the rotational torque needed to open a cap 200 for the first time without the textured sealing surface 212a provided on the inner neck surface 212 is about 1,5 Nm. It has also through tests been shown that the rotational torque needed to open a cap 200 of exactly the same design for the first time with the textured sealing surface 212a provided at the inner neck surface 212 is about 1,2 Nm. Hence, a significant reduction of the rotational torque needed to open a cap 200 for the first time may be achieved by providing the textured sealing surface 212a on the inner neck surface 212.

[0071] In the following, the textured sealing surface 212a on the inner neck surface 212 will be described in greater detail. Variations to the textured sealing surface 212a on the inner neck surface 212 will also be described in greater detail below.

[0072] The depicted textured sealing surface 212a of the inner neck surface 212 of Fig. 4A extends along the complete circumference of the inner neck surface 212. However, the textured sealing surface 212a of the inner neck surface 212 may according to variants extend along a portion of the circumference of the inner neck surface 212. Further, the textured sealing surface 212a may be sectionized such that the inner neck surface 212 is textured in some radial directions R while not being textured in other radial directions R.

[0073] The textured sealing surface 212a of the inner neck surface 212 may to advantage have different extensions or heights h along the inner height H of the inner neck surface 212. For instance, as depicted in Fig. 4A, the textured sealing surface 212a of the inner neck surface 212 may extend over a height h which forms part of the inner height H of the inner neck surface 212. On the other hand, the textured sealing surface 212a of the inner neck surface 212 may extend over a height h which corresponds to the inner height H of the inner neck surface 212. In other words, the complete inner height H of the inner neck surface 212 may be textured so as to form the textured sealing surface 212a.

[0074] For instance, the textured sealing surface 212a may extend, as seen along the axial direction A of the cylindrical side wall portion 217, along at least 30% of the

inner height H of the inner neck surface 212. For instance, the textured sealing surface 212a may extend, as seen along the axial direction A of the cylindrical side wall portion 217, along at least 50% of the inner height H of the inner neck surface 212. For instance, the textured sealing surface 212a may extend, as seen along the axial direction A of the cylindrical side wall portion 217, along at least 10% of the inner height H of the inner neck surface 212.

[0075] The textured sealing surface 212a may to advantage extend, as seen along the axial direction A of the cylindrical side wall portion 217, at least from a position P of the inner neck surface 212 where the annular sealing protrusion 304 abuts the inner neck surface 212 when the cap 102 is screwed onto the neck 200 in its lowermost position on the neck upwards towards the rim P' of the inner neck surface 212. This means that the textured sealing surface 212a will abut the annular sealing protrusion 304 of the cap 102 when the cap 102 is completely closed. Hence, the textured sealing surface 212a will abut the annular sealing protrusion 304 of the cap 102 before the cap 102 is opened for the first time. The fact that the textured sealing surface 212a may extend upwards from the position P of the inner neck surface 212 allows for that the annular sealing protrusion 304 will slide along the textured sealing surface 212a when the cap 102 is unscrewed from the neck 200. By tailoring the height h of the textured sealing surface 212a the contact time between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102 when the cap 102 is unscrewed from the neck 200 may be tailored.

[0076] For instance, when the textured sealing surface 212a is provided as depicted in Fig 4A, the annular sealing protrusion 304 will abut and slide along the textured sealing surface 212a for significant extent an opening action of the cap 102. In other words, the annular sealing protrusion 304 will abut and slide along the textured sealing surface 212a when the cap 102 is unscrewed except for the last part of the unscrewing action of the cap 102. By the arrangement of the textured sealing surface 212a as depicted in Fig. 4A the annular sealing protrusion 304 will abut and slide along the textured sealing surface 212a when the cap is screwed from its lowermost or totally closed position. When the cap 102 is in the lowermost totally closed position, the rotational torque needed to turn the cap 102 is generally highest. Thus, the textured sealing surface 212a is to advantage provided from the position P of the inner neck surface 212 where the annular sealing protrusion 304 abuts the inner neck surface 212 when the cap 102 is screwed onto the neck 200 in its lowermost position.

[0077] If the cap 102 is provided with a tamper and/or tether band 204, the rotational torque needed to rotate the cap 102 as the perforations of the tamper and/or tether band 204 breaks is generally higher. It is therefore advantageous to let the textured sealing surface 212a extend along the inner height H of the inner neck surface 212 to at least a point where the annular sealing protrusion

sion 304 abuts the inner neck surface 212 as the perforations of the tamper and/or tether band 204 breaks. Hence, in general the textured sealing surface 212a may to advantage extend at least from the position P of the inner neck surface 212 where the annular sealing protrusion 304 abuts the inner neck surface 212 when the cap 102 is screwed onto the neck 200 in its lowermost position on the neck upwards towards the rim P' of the inner neck surface 212 to a point where the annular sealing protrusion 304 abuts the inner neck surface 212 as the perforations of the tamper and/or tether band 204 breaks.

[0078] The textured sealing surface 212a may be textured in many different ways while still providing for that a reduced friction is provided between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102. By way of example, the textured sealing surface 212a may be textured in different ways. The textured sealing surface 212a may comprise a rough surface. The textured sealing surface 212a may comprise a pattern. The textured sealing surface 212a may comprise an embossed pattern. The textured sealing surface 212a may comprise a protruding pattern or a protruding feature, such a dimple or ridge.

[0079] For instance, the sealing surface 212a may have a surface roughness of 5-30 μm measured as Ra according to the ISO 4287:1997 standard. For instance, the sealing surface 212a may have a surface roughness of 2-16 μm , 5-10 μm , or 6-8 μm . Alternatively, the textured sealing surface may have a surface roughness of measured as Ra according to the ISO 4287:1997 standard. Alternatively, the sealing surface 212a may have a surface roughness of 12-18 μm measured as Ra according to the ISO 4287:1997 standard. It has however been found that a surface roughness of about 15 μm , such as 14-16 μm provide for a particularly advantageous situation, where a reduced friction is provided between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102, while still not affecting the sealing between the cap 102 and the neck negatively.

[0080] Now also turning to Fig. 4A. Fig. 4A is a schematic magnification of a rough or otherwise textured or patterned surface, such as the textured sealing surface 212a of Fig. 4. As is known in the art, a rough surface includes tops T and bottoms B located at opposite sides of a mean line ML. Hence, when the sealing surface 212a is a rough surface or otherwise textured or patterned surface, the average, or the arithmetic average, of profile height deviations of the tops T and the bottoms B from the mean line ML is typically between 5 μm to 30 μm . Such average, or the arithmetic average, of profile height deviations Ra of the tops T and the bottoms B from the mean line ML may be calculated using the following formula

$$Ra = \frac{1}{l_r} \int_0^{l_r} |z(x)| dx$$

where l_r is the length of the measurement along the surface being measured and z is the vertical deviations along the surface being measured.

[0081] As have been discussed above, the textured sealing surface 212a, typically comprises a plurality of tops T and bottoms B in order to e.g., achieve a rough surface or a patterned surface which results in that a reduced friction is provided between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102. Such plurality of tops T and bottoms B may to advantage be provided along the axial direction A of the cylindrical side wall portion 217 in a mutually offset or staggered fashion along the circumference of the inner neck surface 212. In this way leakage between the textured sealing surface and the annular sealing protrusion of the cap may be prevented or counteracted while still providing that a reduced friction is provided between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102. In practice, leakage may be prevented or counteracted by the fact that the mutual offset of the tops T and bottoms B provide for that no or only few passages in form of channels, channel-like structures or otherwise elongated grooves or groove-like structures are formed in the textured sealing surface 212a along the axial direction A of the cylindrical side wall portion 217.

[0082] Now turning back to Figs. 3A and 3B. The neck 200 depicted in Figs. 3A and 3B is provided with a protrusion, in form of a retention ring 203. The depicted retention ring 203 extends radially outwards from the outer neck surface 210. The depicted retention ring 203 is configured to engage a tamper and/or tether band 204 of the cap 102, as have been discussed above. The depicted retention ring 203 comprises a downward facing textured retention surface 203a.

[0083] Now also turning to Fig. 4C. Fig. 4C schematically illustrates the downward facing textured retention surface 203a of Figs. 3A and 3B according to two different alternatives. More specifically, Fig. 4C schematically illustrates the downward facing textured retention surface 203a of Fig. 3A along the section A-A of Fig. 3A. In the left half of Fig. 4C, the downward facing textured retention surface 203a is textured by being formed as a rough surface. On the other hand, in the right half of Fig. 4C, the downward facing textured retention surface 203a is textured by being provided with a plurality of radially extending protrusions 203b.

[0084] When the textured retention surface 203a is provided in form of a rough or otherwise randomly textured or patterned surface as in the left half of Fig. 4C, the average, or the arithmetic average, of profile height deviations of the tops T and bottoms B from the mean line ML may to advantage typically be between 10 μm to 50 μm . In other words, a typical vertical distance from a

bottom B to an adjacent top T may be about 60 μm . Hence, the textured retention surface 203a may to advantage be made more rough or coarser than the textured sealing surface 212a of the neck. This for example because leakage is not an issue at the location of the retention ring 203. Hence, the friction between the downward facing textured retention surface 203a and the tamper and/or tether band 204 of the cap 102 may be significantly reduced.

[0085] When the textured retention surface 203a is textured by being provided with a plurality of radially extending protrusions 203b as in the right half of Fig. 4C, the radially extending protrusions 203b may to advantage have a height of 30-90 μm . However, the height of such radially extending protrusions 203b may to advantage have a height of 40-80 μm . It has been found that particularly advantageous results are achieved when such radially extending protrusions 203b have a height of 20-50 μm or about 30 μm .

[0086] The textured retention surface 203a may be textured by being provided with any type of suitable embossed or imprinted pattern. Such embossed or imprinted pattern may to advantage have a height of 30-90 μm , i.e., a typical vertical distance from a bottom of the pattern to an adjacent top of the pattern may be in the range of 30-90 μm . However, the height of such embossed pattern may to advantage have a height of 40-80 μm . It has been found that particularly advantageous results are achieved when such embossed pattern have a height of 20-50 μm or about 30 μm .

[0087] Now again turning to Figs. 2A, 2B, 3A, 3B and 4A. As have been discussed above, the depicted cap 102 has an annular sealing protrusion 304 arranged above the peripheral lip 306 of the inner cylindrical protrusion 300. In order to achieve a further reduced friction between the textured sealing surface 212a and the annular sealing protrusion 304 of the cap 102, the annular sealing protrusion 304 may comprise a textured external sealing surface 304a as depicted in Fig. 4C.

[0088] The textured external sealing surface 304a may correspond to the external surface 304b of the sealing protrusion 304. The textured external sealing surface 304a may partially occupy the external surface 304b of the sealing protrusion 304. In other words, the extension and size of the textured external sealing surface 304a may be tailored to suit different needs and desires.

[0089] The textured external sealing surface 304a of the annular sealing protrusion 304 may be of the same type as the textured sealing surface 212a of the cap, as have been discussed above in the summary section as well as in the detailed description. Reference is therefore made to the above to avoid undue repetition. In short, the textured external sealing surface 304a of the annular sealing protrusion 304 may to advantage, like the textured sealing surface 112a of the neck 200 be textured in different ways. The textured external sealing surface 304a of the annular sealing protrusion 304 may be a rough surface. The textured sealing surface 304a of

the annular sealing protrusion 304 may comprise a rough surface portion. The textured external sealing surface 304a of the annular sealing protrusion 304 may comprise a pattern. The textured external sealing surface 304a of the annular sealing protrusion 304 may comprise an embossed pattern. The textured external sealing surface 304a of the annular sealing protrusion 304 may comprise a protruding pattern or a protruding feature, such a dimple or ridge.

[0090] Since a cap 102 provided with an external sealing surface 304a on its annular sealing protrusion 304 may provide for a reduced friction between the annular sealing protrusion 304 and the inner neck surface 212, with or without the textured sealing surface 212a, the cap 102 may to advantage be formed without any release agent included in the cap 102. In other words, a cap 102 void of any release agent may be formed to advantage. Such cap 102 void of any release agent may still be easily openable by a customer due to the reduced friction between the annular sealing protrusion 304 and the inner neck surface 212. The friction may be further reduced when the neck 200 is provided with a textured sealing surface 212a of the above-described kind in combination with the external sealing surface 304a of the cap 102. Hence, the fact that there may be no need for a release agent in the cap 102 may be further outspoken by combining the external sealing surface 304a of the cap 102 with the textured sealing surface 212a of the neck 200.

[0091] Now also turning to Fig. 5A. In Fig. 5A, a molding tool 500 for molding the above-described neck 200 of the package 100 is schematically illustrated in a cross-sectional view. The depicted molding tool 500 which may be used to mold the neck 200 is typically used to mold the neck 200 from plastic although other materials may be used to advantage.

[0092] The depicted molding tool 500 comprises a first part 500a and a second part 500b. When the first part 500a and the second part 500b are joined to form the molding tool 500 in its operable state, a molding cavity 500c for molding the neck 200 is formed between the first part 500a and the second part 500b as is known in the art. The molding tool 500 comprises a textured external surface 501 which is configured to mold the textured sealing surface 212a of the neck 200. The textured external surface 501 is as illustrated in Fig. 5A provided on the first part 500a. In the depicted molding tool 500, the textured external surface 501 has a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm , alternatively a surface roughness of 10-20 μm , more preferably 12-18 μm , most preferably 14-16 μm . By the textured external surface 501 having a surface roughness of 10-20 μm , the textured sealing surface 212a of the neck 200 will when being molded in practice become an inverse replica of the textured external surface 501 and hence get a corresponding surface roughness.

[0093] The first part 500a and the second part 500b of the molding tool 500, are to advantage machined from steel or other metals or alloys. The textured external

surface 501 may be textured by using different patterning or texturing techniques. It has been found that a rough surface with highly favorable surface characteristics may be achieved by blasting the surface portion of the first part 500a that is to form the textured external surface 501 with glass beads. By this technique, small craters, dimples or impressions may be formed in the surface portion of the first part 500a, thereby forming the textured external surface 501.

[0094] It has further been found that, by blasting the surface portion of the first part 500a that is to form the textured external surface 501 with glass beads having a diameter of 150-250 μm a particularly advantageous textured external surface 501 having a surface roughness of 2-16 μm may be achieved. Smaller glass beads may result in a too fine texture of the molded textured sealing surface 212a not providing for the desired friction reduction. On the other hand, larger glass beads may result in a too coarse texture of the textured sealing surface 212a which may risk resulting in leakage.

[0095] The texture of the textured external surface 501 may according to an example be etched into the material of the first part 500a.

[0096] The texture of the textured external surface 501 may according to a further example be laser engraved into the material of the first part 500a.

[0097] The texture of the textured external surface 501 may according to a further example be milled into the material of the first part 500a.

[0098] The texture of the textured external surface 501 may according to a further example be machined into the material of the first part 500a.

[0099] Now also turning to Fig. 5B. In Fig. 5B, a molding tool 502 for molding the above-described cap 102 is schematically illustrated in a cross-sectional view. The depicted molding tool 502 which may be used to mold the cap 102 is typically used to mold the cap 102 from plastic although other material may be used to advantage. The molding tool 502 has many features in common with the molding tool 500. Therefore, only relevant differences between the molding tools 500, 502 will be described in the following.

[0100] The depicted molding tool 502 comprises a first part 502a and a second part 502b. When the first part 502a and the second part 502b are joined to form the molding tool 502, a molding cavity 502c for molding the cap 102 is formed between the first part 502a and the second part 502b as is known in the art. The molding tool 502 comprises a textured internal surface 503 which is configured to mold external sealing surface 304a of the cap 102. The textured internal surface 503 is as illustrated in Fig. 5B provided on the first part 502a. In the depicted molding tool 502, textured internal surface 503 has a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm , alternatively has a surface roughness of 10-20 μm , more preferably 12-18 μm , most preferably 14-16 μm . By the textured internal surface 503 having a surface roughness of 2-16 μm , the

textured external sealing surface 304a of the cap 102 will when being molded in practice become an inverse replica of the textured internal surface 503 and hence get a corresponding surface roughness.

[0101] The first part 502a and the second part 502b of the molding tool 502, are to advantage formed of steel or other metals or alloys, like the first and second parts 500a, 500b of the molding tool 500. Further, the textured internal surface 503 is to advantage textured or formed like the textured external surface 501 of molding tool 500. Reference is therefore made to the above.

[0102] Now also turning to Figs. 6A and 6B. Fig. 6A schematically illustrates an apparatus 600 for manufacturing the package 100. The apparatus comprises a molding tool 500 of the above-described type. In other words, apparatus 600 includes a molding tool 500 including a textured external surface 501 configured to mold the textured sealing surface 212a of the neck 200.

[0103] Fig. 6B schematically illustrates an apparatus 602 for manufacturing the cap 102. The apparatus comprises a molding tool 502 of the above-described type. In other words, apparatus 602 includes a molding tool 502 including a textured internal surface 503 configured to mold the textured external sealing surface 304a of the cap 102.

[0104] 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.

[0105] Additionally, variations to the disclosed embodiments can be understood and effected by the skilled person in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims.

Claims

1. A package (100) for holding a liquid food product (110) comprising:
 - a main body (106) configured to hold the liquid food product (110), and
 - a neck (200) connected to the main body (106), the neck (200) comprising,
 - a cylindrical side wall portion (217) having an outer neck surface (210) and an inner neck surface (212), the outer neck surface (210) comprising an outer thread (214) configured to interact with an inner thread (218) of a cap (102),
 - wherein
 - the inner neck surface (212) comprises a textured sealing surface (212a) configured to abut an annular sealing protrusion (304) of the cap (102) when the cap (102) is screwed onto the neck (200).

2. The package according to claim 1, wherein the textured sealing surface (212a) extends along a circumference of the inner neck surface (212).
3. The package according to any preceding claim, wherein the textured sealing surface (212a) extends, as seen along an axial direction (A) of the cylindrical side wall portion (217), along at least 30% of an inner height (H) of the inner neck surface (212).
4. The package according to any preceding claim, wherein the textured sealing surface (212a) extends, as seen along an axial direction (A) of the cylindrical side wall portion (217), at least from a position (P) of the inner neck surface (212) where the annular sealing protrusion (304) abuts the inner neck surface (212) when the cap (102) is screwed onto the neck (200) in its lowermost position on the neck, upwards towards a rim (P') of the inner neck surface (212).
5. The package according to any preceding claim, wherein the textured sealing surface (212a) has a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm .
6. The package according to any preceding claim, wherein the textured sealing surface (212a) comprises tops (T) and bottoms (B), and wherein the average, or the arithmetic average, of profile height deviations of the tops (T) and the bottoms (B) from a mean line (ML) is between 2 μm to 16 μm .
7. The package according to any preceding claim, wherein the textured sealing surface (212a) comprises a plurality of tops (T) and bottoms (B) provided along the axial direction (A) of the cylindrical side wall portion (217), wherein the plurality of tops (T) and bottoms (B) are mutually offset along a circumference of the inner neck surface (212).
8. The package according to any preceding claim, wherein the neck (200) further comprises a retention ring (203) extending radially outwards from the outer neck surface (210) and configured to engage a tamper and/or tether band (204) of the cap (102), wherein the retention ring (203) comprises a downward facing textured retention surface (203a).
9. The package according to claim 8, wherein the textured retention surface (203a) comprises tops (T) and bottoms (B), and wherein the average, or the arithmetic average, of profile height deviations of the tops and bottoms from the mean line (ML) is between 10 μm to 50 μm .
10. The package according to claim 8 or 9, wherein the textured retention surface (203a) comprises an embossed pattern having a height of 30-90 μm , more preferably 40-80 μm , most preferably 20-50 μm .
11. The package according to any one of claims 8-10, wherein the textured retention surface (203a) comprises a plurality of radially extending protrusions (203b).
12. A cap (102) for sealing a package (100) by screwing the cap (102) onto a neck (200) of the package (100), the cap (102) comprising:
 - a top portion (205) having an outer top surface (206) and an inner top surface (207),
 - a cylindrical side wall portion (209) having an outer side wall surface (208) and an inner side wall surface (216),
 - an inner thread (218) provided on the inner side wall surface (216), wherein the inner thread (218) is configured to interact with an outer thread (214) of the neck (200) of the package (100), and
 - an inner cylindrical protrusion (300) extending downwards from the inner top surface (207), the inner cylindrical protrusion (300) comprising,
 - a peripheral lip (306) configured to guide the inner cylindrical protrusion (300) into the neck (200) of the package (100), for positioning the cap (102) with the inner cylindrical protrusion (300) radially inside the neck (200) and the inner tread (218) radially outside the neck (200), and
 - an annular sealing protrusion (304) arranged above the peripheral lip (306) and extending radially outwards from the inner cylindrical protrusion (300) towards the inner side wall surface (216), **wherein**
- the annular sealing protrusion (304) comprises a textured external sealing surface (304a).
13. The cap (102) according to claim 12, wherein the cap (102) is void of any release agent.
14. Molding tool (500) for molding a neck (200) of a package (100) according to any one of claims 1-11, the molding tool (500) comprising a textured external surface (501) configured to mold the textured sealing surface (212a) of the neck (200), wherein the textured external surface (501) of the molding tool (500) has a surface roughness of 2-16 μm , more preferably 5-10 μm , most preferably 6-8 μm .
15. Molding tool (502) for molding a cap (102) according to any one of claims 12-13, the molding tool (502) comprising a textured internal surface (503) configured to mold the textured external sealing surface

(304a) of the cap (102) wherein the textured internal surface (503) of the molding tool (503) has a surface roughness of 10-20 μm , more preferably 12-18 μm , most preferably 14-16 μm .

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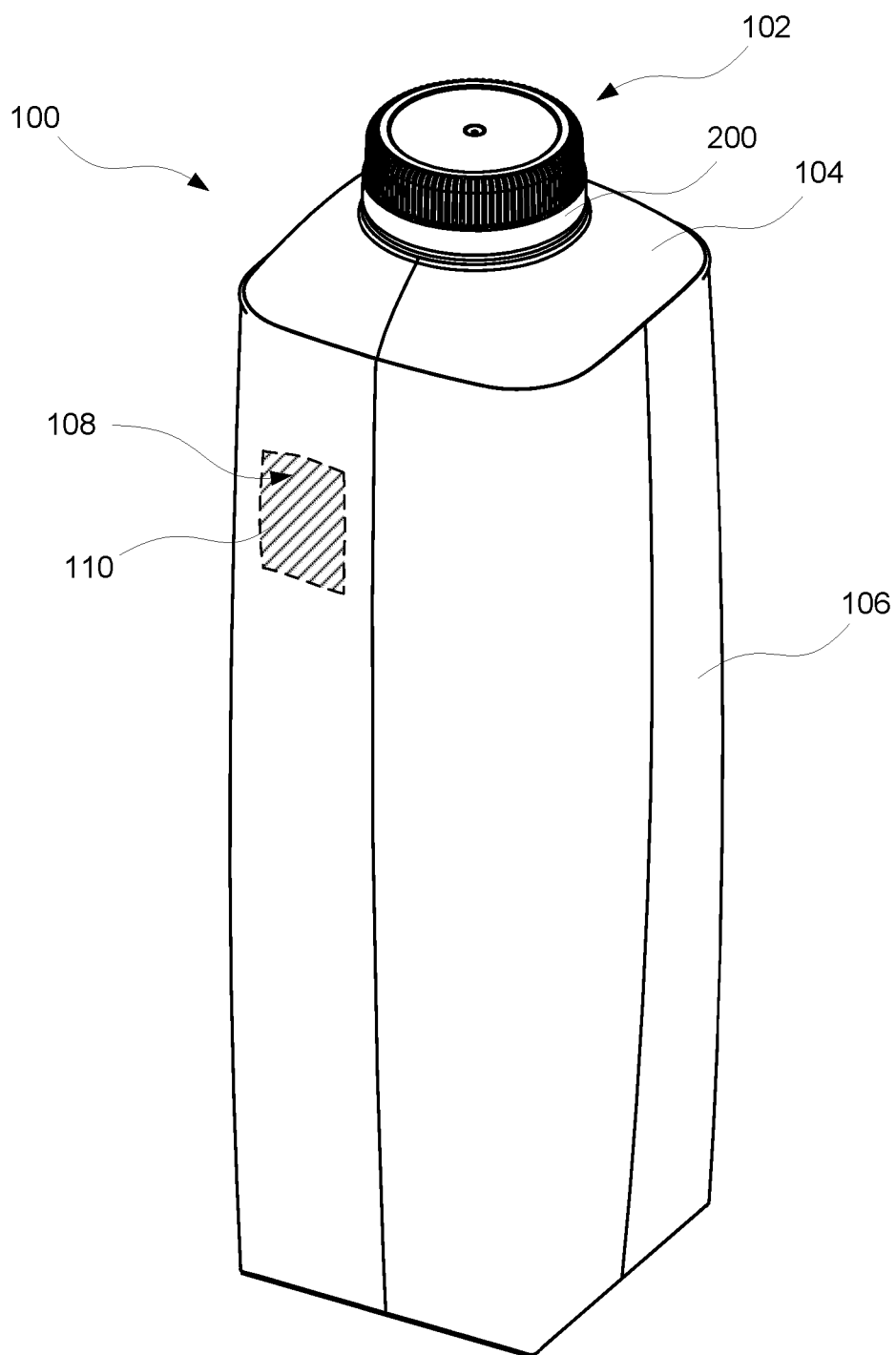


Fig. 1

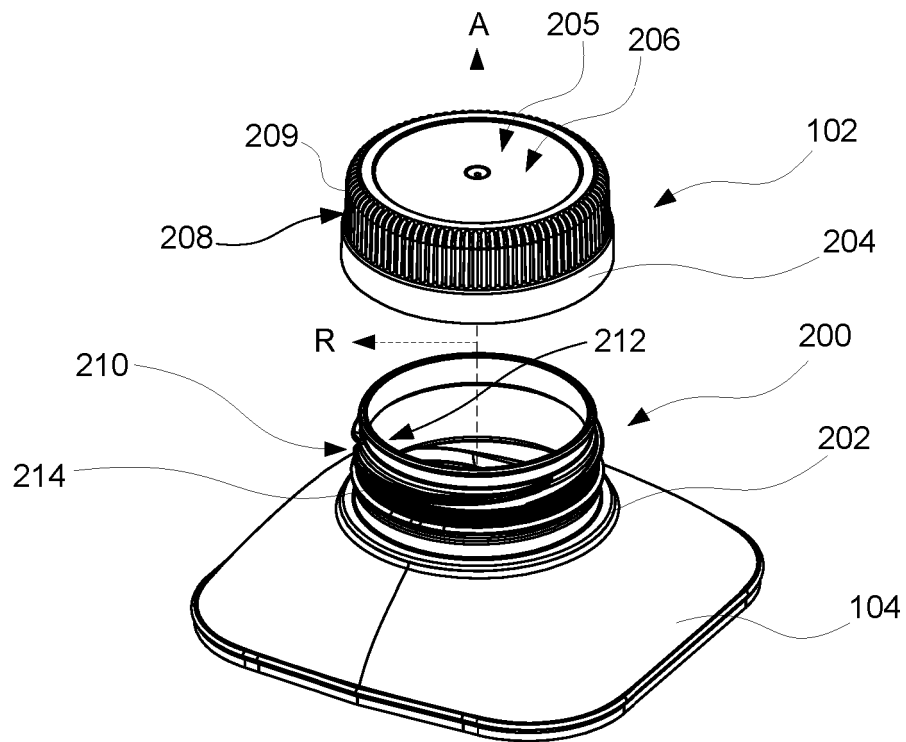


Fig. 2A

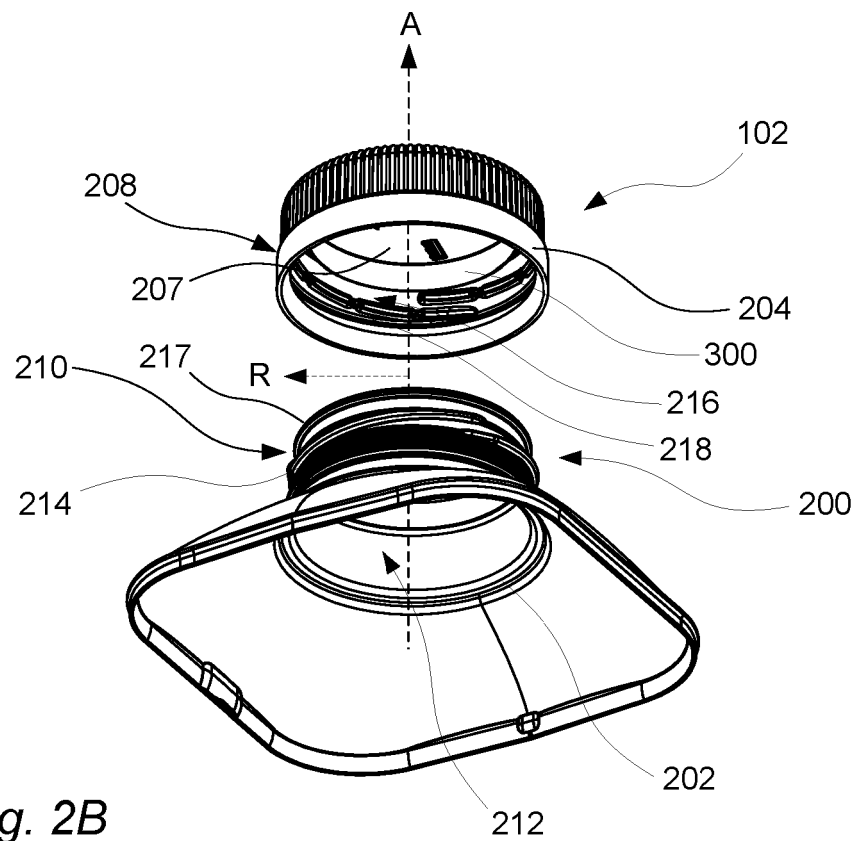


Fig. 2B

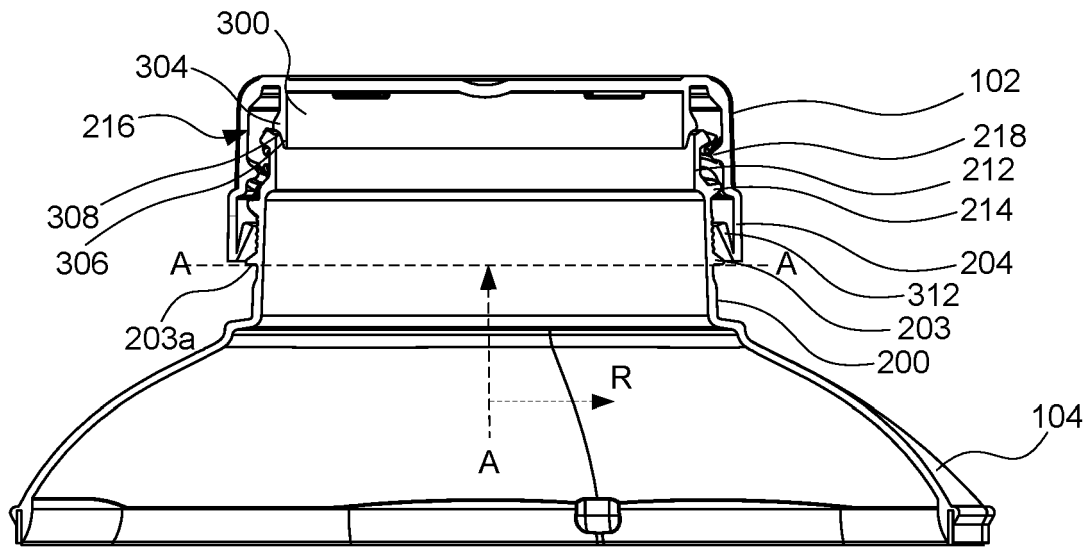


Fig. 3A

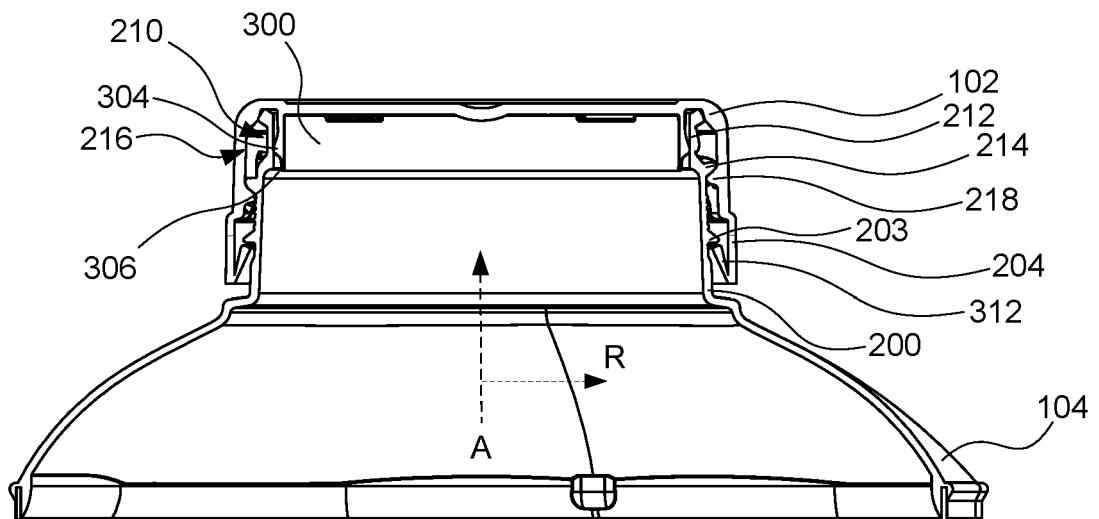


Fig. 3B

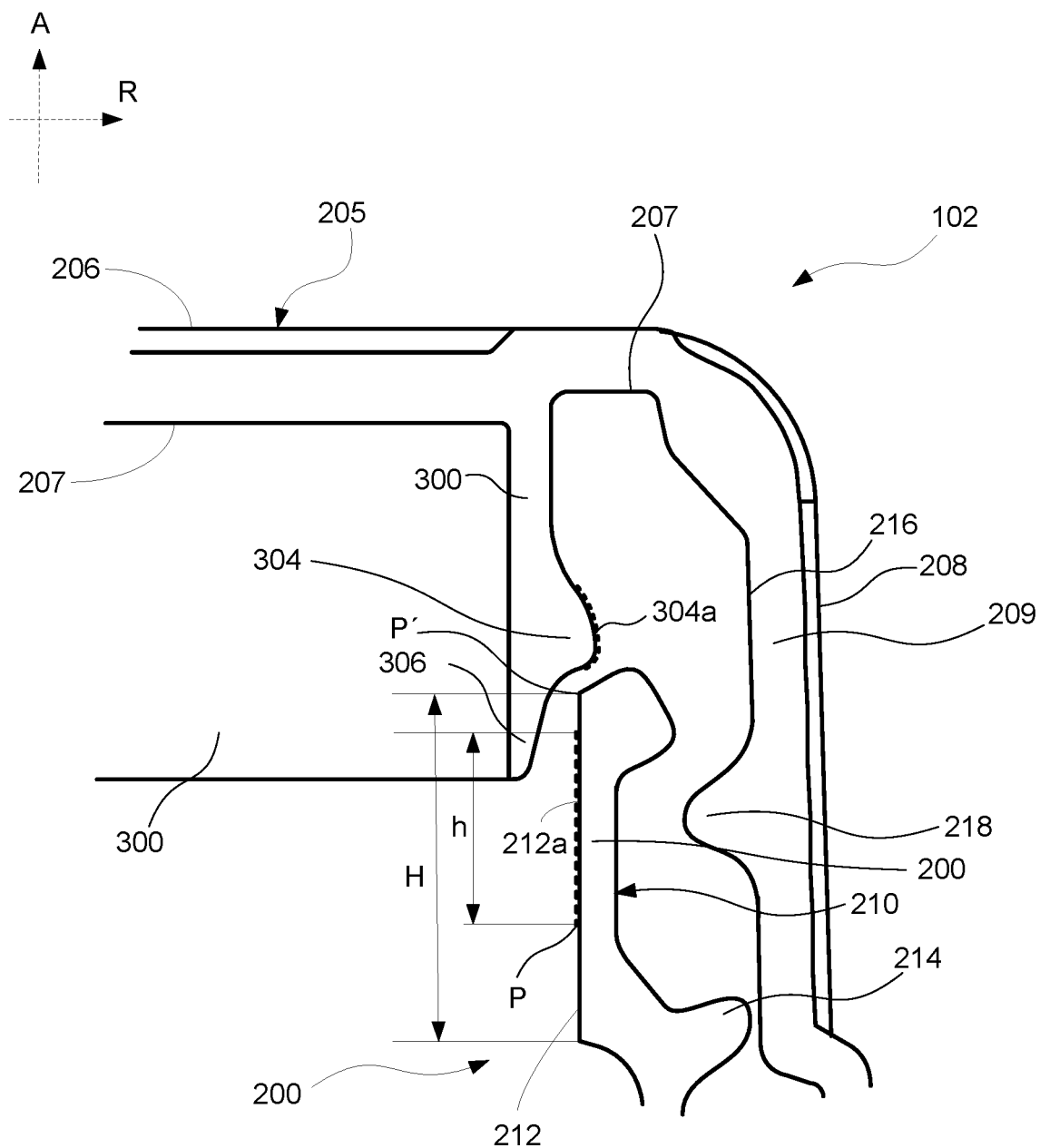
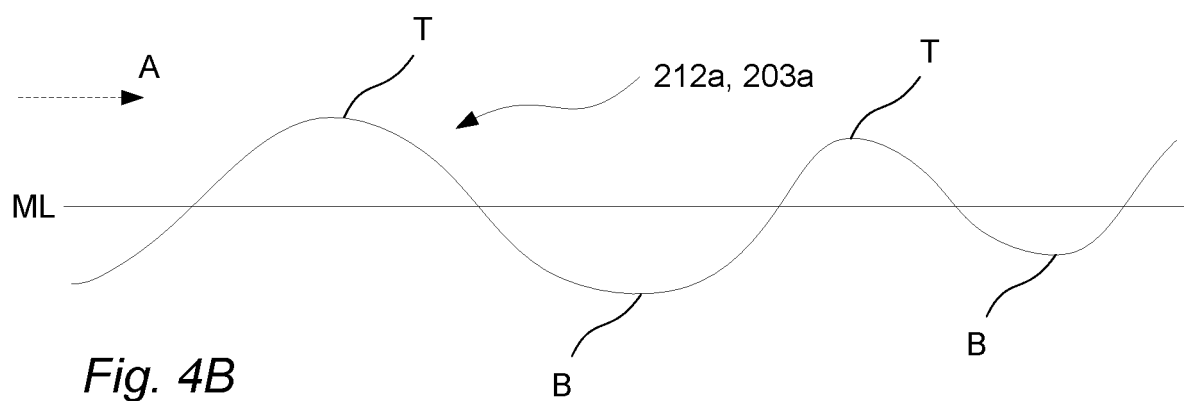


Fig. 4A



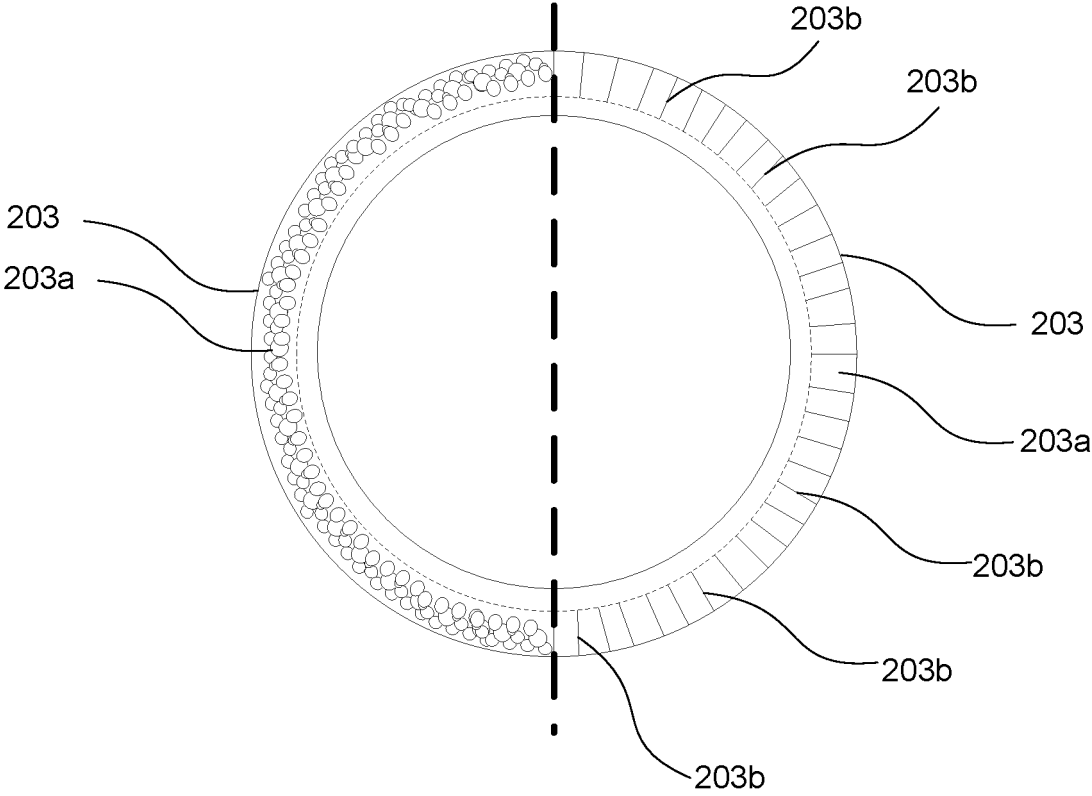


Fig. 4C

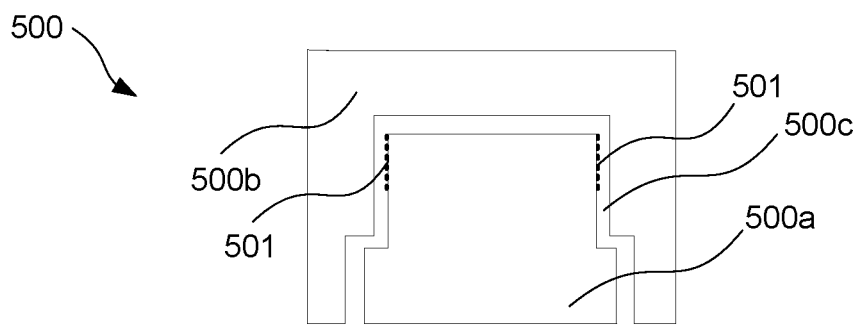


Fig. 5A

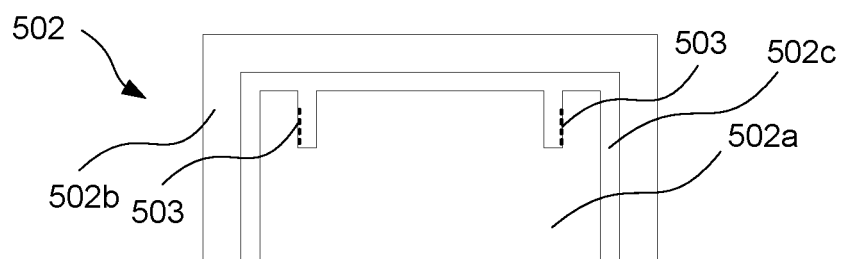


Fig. 5B

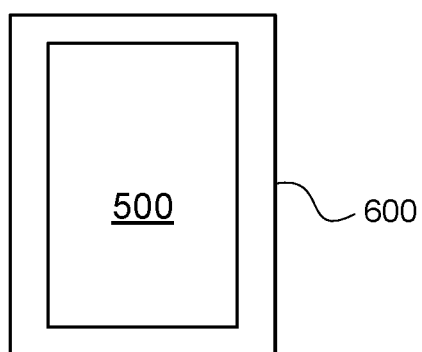


Fig. 6A

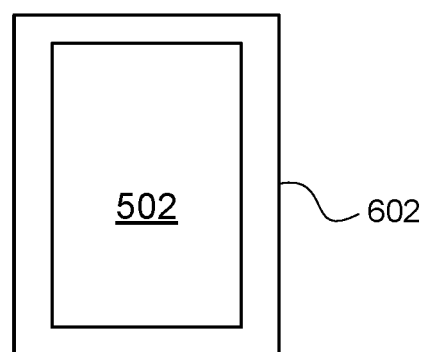


Fig. 6B



EUROPEAN SEARCH REPORT

Application Number

EP 24 20 5320

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2017/210503 A1 (DE CLEIR PIARAS [US] ET AL) 27 July 2017 (2017-07-27) * paragraph [0067] * -----	1-15	INV. B65D1/02 B65D41/04 B65D41/34
A	US 2021/101707 A1 (HANAN JAY CLARKE [US]) 8 April 2021 (2021-04-08) * paragraphs [0010], [0011], [0026]; claim 3; figures 4-6 * -----	1-15	
A	JP H11 165750 A (DAINIPPON PRINTING CO LTD) 22 June 1999 (1999-06-22) * paragraph [0031] * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		3 December 2024	Serrano Galarraga, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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