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- **ROSBERG, Robert**
242 34 HÖRBY (SE)
- **JOHANSSON, Göran**
240 36 STEHAG (SE)
- **OLSSON, Leif**
268 72 Teckomantorp (SE)
- **PETERSSON, Viktor**
245 64 Hjärap (SE)
- **ANDERSSON, Henrik**
214 35 MALMÖ (SE)

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(71) Applicant: **Tetra Laval Holdings & Finance S.A.**
1009 Pully (CH)

(74) Representative: **Tetra Pak - Patent Attorneys SE**
AB Tetra Pak
Patent Department
Ruben Rausings Gata
221 86 Lund (SE)

(72) Inventors:
• **DANIELSSON, Anders**
242 91 Hörby (SE)

(54) **A CAP FOR A FOOD PACKAGE**

(57) The solution is a cap (30) arranged to interact with a neck (20) where the cap (30) comprises an inner wall portion (33) provided with at least one cutting element (50) projecting radially inwards. The cutting element (50) has a hinge portion (52) connected to the inner wall portion (33), and a cutting portion (53) extending radially inwards from the hinge portion (52), wherein the axial

thickness (K2) of the hinge portion (52) is between 35 and 80% of the axial thickness (K1) of the cutting portion (53).

Moreover, the solution is also an assembly comprising the cap (30) and a spout (100) having a membrane (150) closing a tubular member (110) of the spout (100).

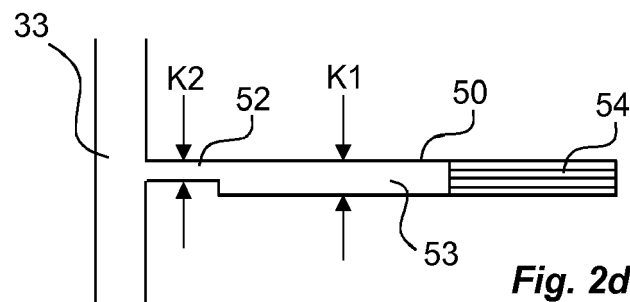


Fig. 2d

Description

Technical Field

[0001] The present solution relates to a cap for a food package. In particular, the present solution relates to a cap being capable of cutting off a membrane sealing an end of an associated spout.

Background

[0002] Food packages are generally provided with an opening device in order to facilitate discharging of the enclosed food product. The opening device may either be an irreversible opening, i.e. once the package is opened it may not be closed again, or a recloseable opening device. In order to extend the shelf-life and quality of the food product the latter is often desired. A common way of providing a recloseable opening device is to arrange a threaded neck including a pouring spout on the upper part of the package. The threaded neck is designed such that it may receive a cap, including internal threads, such that the cap is capable of being unscrewed from the neck. Since the cap covers the open spout of the neck, the enclosed food product is protected from the outer environment and the quality of the product may thus be preserved during some time.

[0003] Although the above solution provides an improvement over the irreversible openings which always remain open, it is still possible for polluted media to enter the interior of the package via the neck/cap interface, e.g. via the threads. Hence, further improvements have been proposed for sealing the open spout of the neck when the package is stored.

[0004] In WO2011144569 a solution is described in which the spout is provided with a membrane. The membrane, which initially is connected to the spout leaving the spout perfectly closed, is cut from the spout during an opening action, i.e. when the cap is unscrewed from the neck.

[0005] For improving the cutting action, WO2014202518 describes a cap having cutting elements projecting radially inwards. Each cutting element has a free end portion, wherein the free end portion is provided with a blunt tip and a comparatively sharper cutting edge on a lateral side of the free end portion.

[0006] Although the above-mentioned solutions provide well-proven and reliable opening and re-sealing of packages, it has been realized that further improvements are desirable especially in terms of the cutting action, i.e. when the membrane is initially cut loose from the spout. If the membrane is not cut properly re-sealing will be affected negatively.

[0007] Thus, there is a need for a cap having cutting elements providing improved cutting action of the membrane which allows for enhanced re-sealing in order to preserve the quality of a food product enclosed within a food package, as well as prolonging the shelf life of the

food product.

Summary

[0008] It is, therefore, an object of the present invention to overcome or alleviate the above described problems. According to a first aspect, the present solution is a cap arranged to interact with a neck, where the cap comprises an inner wall portion provided with at least one cutting element projecting radially inwards. The cutting element has a hinge portion connected to the inner wall portion and a cutting portion which extends radially inwards from the hinge portion, wherein the axial thickness of the hinge portion is between 35 and 80% of the axial thickness of the cutting portion.

[0009] Now, the relation between the axial thickness K2 of the hinge portion and the axial thickness K1 of the cutting portion may be, such that

$$\frac{3}{7}K1 \leq K2 \leq \frac{5}{7}K1.$$

Expressed in absolute numbers, the axial thickness of the hinge portion may be between 0.3 and 0.5 mm.

[0010] Also, the number of cutting elements may be between 1 and 7. Their function is to cut off a membrane from a pouring spout on a packaging container. The cutting action will be readily performed with only one cutting element, but at least three are necessary to retain the membrane after cutting it off from the spout.

[0011] According to another aspect, the present solution is an assembly which comprises a cap mentioned in the beginning of this section and which has a spout with a membrane closing a tubular member of the spout.

In embodiment of the present solution, the tubular member may comprises a main body and an end portion releasably attached to said membrane, wherein the axial thickness (K1) of the cutting portion of the cutting element is between 200 and 400% of the axial length (L1) of the end portion.

In another embodiment of the present solution the membrane comprises a membrane flange with an outer portion extending radially outside the end portion of the tubular member.

It should be mentioned here that in one variant the axial length (L1) of the end portion is between 15-65% of the axial thickness (D1) of the outer portion of the membrane flange. In another variant the axial length of the end portion may be between 20-50% of the axial thickness (D1) of the outer portion of the membrane flange. In yet another embodiment of the assembly according to the present solution the membrane flange further comprises an inner portion, where said end portion of the tubular member is attached to the interface between the inner and outer portions of the membrane flange, wherein the axial thickness (D2) of the inner portion is equal to, or less than the axial thickness (D1) of the outer portion.

In yet another embodiment of the assembly according to the present solution the inner surface of the inner portion

of the membrane flange is arranged at an axial distance (H1) from the inner surface of the outer portion of the membrane flange. In another embodiment of the solution it is proposed to make the inner surface of the inner portion of the membrane flange and the inner surface of the outer portion of the membrane flange parallel in relation to each other.

In yet another embodiment of the solution it is proposed to make the outer surface of the inner portion of the membrane flange and the outer surface of the outer portion of the membrane flange coincide with each other.

Finally, in yet another embodiment of the present solution it is proposed to have the membrane comprise a sealing lip protruding into the tubular member, wherein the sealing lip extends from an axial position being arranged at a distance (H1) from the axial end position of the end portion of the tubular member (110). Here the outer radius of the cutting portion of the at least one cutting element may correspond to the outer radius of the sealing lip.

Brief Description of the Drawings

[0012] The above, as well as additional objects, features, and advantages of the present solution, will be better understood through the following illustrative and nonlimiting detailed description of preferred embodiments of the present invention, with reference to the appended drawings, wherein:

Fig. 1 is a schematic view of a package having a spout according to an embodiment;

Fig. 2a is a cross-sectional view of a cap for use with a spout according to various embodiments;

Fig. 2b is a cross-sectional view of a neck, including a spout according to an embodiment;

Fig. 2c is a top view of a cutting element for separating a membrane from a neck according to an embodiment;

Figs. 2d-f are side views of a cutting element according to various embodiments;

Figs. 3-6 are cross-sectional views of an assembly comprising a neck and cap during closing of the spout;

Fig. 7a is a cross-sectional view of a spout according to an embodiment; and

Fig. 7b is an enlarged view of parts of the spout shown in Fig. 7a.

Detailed Description

[0013] With reference to Fig. 1 an example of a food package 10 is schematically shown. The food package 10 has a shape of a bottle formed by a body portion 11, which may preferably be made of a carton-based laminate and a top portion 12, which may preferably be made of plastic. The top portion 12 is provided with a neck 20 forming the upper part of the plastic top portion 12. The neck 20 may be integrally formed with the top portion 12,

such that the entire top portion 12, including the neck 20, may be manufactured as a single piece.

[0014] A cap 30 is arranged onto the neck for sealing a spout 100 (see e.g. Fig. 2b) forming the upper end of the neck 20. The cap 30 may optionally be provided with a tamper ring 40 as is well known in the art.

[0015] The package 10 may be manufactured by first forming a sleeve of the carton-based laminate, i.e. a tubular body extending between two open ends. In a second step, performed before, after, or in parallel with the sleeve forming, the plastic top portion 12 is manufactured by molding. The plastic top portion 12 may, as is shown in Fig. 1, comprise a shoulder section 13 arranged below the neck 20 and to which the tubular body is later attached. The shoulder section 13 is thus arranged to connect the sleeve, which forms basis for the body portion 11, to the neck 20. The neck 20 is preferably provided with threads for engaging with corresponding threads of the cap 30 including the tamper ring 40. As previously explained, the neck 20 and the shoulder section 13 may be provided as one piece, or as two separate pieces which are molded together.

[0016] After the cap 30 is screwed onto the top portion 12 the sleeve is filled with food content. Preferably, this is done by turning the sleeve and the top portion 12 assembly upside down, such that the remaining open end of the sleeve is facing upwards. After being filled the open end of the sleeve may be sealed and folded to a flat bottom as illustrated in Fig. 1.

[0017] Alternatively, the cap 30 is screwed onto the top portion 12 after the package 10 is filled. This may e.g. be the case if the neck 20 is provided with a membrane 150 (see Fig. 2b and onward) sealing the spout 100 of the neck 20, which will be described in more detail below.

[0018] Now turning to Figs. 2a and 2b details of the neck 20 and cap 30 will be described further. The cap 30, including the tamper ring 40, is shown in Fig. 2a. The cap 30 has a lower portion 31 being provided with internal threads 32. The threads 32 are configured to engage with corresponding threads 22 of the neck 20 (see e.g. Fig. 2b). The lower portion 31 extends into an upper portion 33 which forms the closed upper end of the cap 30. The interior of the upper portion 33 is provided with means for separating the membrane 150 from the spout 100, as well as for retaining the cut-off membrane 150.

[0019] For this purpose, following the threads 32 cutting elements 50 are arranged. The purpose of the cutting elements or knives 50 is to penetrate a section of the spout 100, immediately below the membrane 150, and to separate that membrane 150 from the rest of the spout 100. After that step, the cutting elements 50 serve the purpose of securing the membrane 150 in an axial position (i.e. along the A-axis in Fig. 2A) between the cutting elements 50 and the interior of the top part of the upper portion 33. This will reduce the amount of litter generated, yet the technical reason is that the membrane 150 serves an important purpose when resealing the closure. There are a number of cutting elements 50 distributed around

the perimeter of the upper portion 33. In the present embodiment there are five. The number of cutting elements 50 will depend on several factors, yet one important factor is the rising of the threads 32. The cutting action is effected when unscrewing the cap 30, and the cutting elements 50 will follow the rotational motion of the cap 30 as well as the axial movement thereof, all relative to the neck 20. This implies that the cutting action, or "removal action" to be more general, has to be finalized within a certain turning angle since otherwise the axial movement will move the cutting element 50 out of reach from the area to be cut. So, the steeper the rising of the threads, the more cutting elements 50 are needed. On the other hand, each cutting element 50 will generate a torque resistance when the cap 30 is unscrewed the first time, and in order to reduce the opening torque to an acceptable level the cap 30 should not have too many cutting elements 50. Hence, for the present embodiment five cutting elements 50 have been used, yet it is up to the skilled person to deduce a suitable number. In general, one cutting element 50 is sufficient to perform the cutting action in order to separate the membrane 150 from the spout 100. However, it has been found that at least three cutting elements 50 are necessary to perform the cutting and the membrane 150 retaining action, after the membrane 150 has been cut off from the spout 100.

[0020] At about the same axial position as the cutting elements 50 stop elements 60 are arranged. In the present embodiment the stop elements 60 are realized by stop ledges, i.e. flanges extending from the top part of the upper portion 33 down to a specific axial position, and a small distance radially inwards. It should be noted that within the context of this specification, all references to "axial" or "radial" should be interpreted as shown by the dashed arrows in Fig. 2a. The axial direction is indicated by the letter "A", while the radial direction is indicated by the letter "R".

[0021] In the present embodiment there are a total of five stop ledges 60 and they are dimensioned so as to allow for the membrane 150 to fit between them. The purpose of the stop elements 60 is to prevent the cap 30 from being screwed too far down (i.e. in a closing direction) onto the neck 20, and thus to prevent damage to the membrane 150 during application of the cap 30 or when resealing the closure after initial opening. The stop elements 60 of the cap 30 cooperate with a counter element 24 of the neck 20 (see Fig. 2b). In this embodiment the counter element 24 is represented as a shoulder extending radially outwards.

[0022] There are other means for preventing the cap 30 from rotating any further once it has reached a certain position on the neck 20. Examples include various stop arrangement in the thread 32, may it be a physical block at the end of the threads 22 of the neck 20 which the threads 32 cannot override, or a change in rising of the threads 22 of the neck 20 preventing further rotation of the cap 30. There are more options available. The solution used in the present embodiment is simple, straight-

forward, does not involve any other operational parts of the cap 30 or neck 20, as well as being predictable, straightforward and providing a distinct stop.

[0023] An example of a cutting element 50 is shown in further details in Fig. 2c. In this drawing the cutting element 50 is shown from above. As is clearly shown the cutting element 50 is attached to the inner perimeter of the cap 30, at an axial position indicated in Fig. 2a. The cutting element 50 is allowed to pivot by means of a hinge connection with the inner perimeter of the cap 30 as will be further described with reference to Figs. 2d-f. As will be explained, the hinge connection is in this embodiment realized by a reduced thickness at an area 52 immediately adjacent to the inner perimeter of the cap 30.

[0024] The region 54 is the cutting region of the cutting element 50, and in this region the thickness of the cutting element 50 is reduced to form a cutting edge 54. The cutting edge 54 may be rectilinear, as in the present embodiment.

[0025] The free end 56, remote to the hinged attachment may preferably be blunt, and may preferably be less sharp than the cutting region 54. The result is the benefit that the free end 56 is not prone to damage the connection region between the membrane 150 and the rest of the spout 100 when it is not supposed to. This may e.g. be important when the cap 30 is arranged on the spout 100 for the first time.

[0026] Figs. 2d-f show various embodiments of the cutting element 50, taken along the line I-I in Fig. 2c. The inner wall of the cap 30, here denoted by reference numeral 33, is provided with the cutting element 50. The cutting element 50 has a hinge portion 52 connected to the inner wall 33, and a cutting portion 53 extending radially inwards, i.e. towards the centre of the cap 30, from the hinge portion 52. The axial thickness K2 of the hinge portion 52 is preferably between 35 and 80% of the axial thickness K1 of the cutting portion 53. Even more preferably, the axial thickness of K2 of the hinge portion 52 is between 3/7 and 5/7 of the axial thickness K1 of the cutting portion 53. In one specific example, the axial thickness K2 of the hinge portion 52 is 0.4 mm, while the axial thickness K1 of the cutting portion 53 is 0.68 mm.

[0027] The inventors have surprisingly realized that by selecting the axial thickness K2 of the hinge portion 52 as a ratio of the axial thickness K1 of the cutting portion 53 the cutting element 50 will significantly reduce risks for i) unintentional folding of the hinge, and ii) reduced pivoting action of the cutting element 50.

[0028] Now turning to Figs. 3-6 a description of the engagement between the cap 30 and the neck 20 will be given.

[0029] Starting in Fig. 3, the cap 30 is screwed onto the neck 20 for the first time, i.e. when the membrane 150 is attached to the neck 20. As can be understood by Fig. 3, the cutting elements 50 will bend downwards when the cap 30 is unscrewed from the neck 20, whereby the cutting elements 50 will be urged inwards and thus cut off the membrane 150 from the neck 20.

[0030] Preferably, the cutting elements 50 are subject to an idle position in which they protrude over a radially outer part of the membrane 150, more specifically a free end of the cutting elements 50 extend past a circumferential edge of the membrane 150. Hence, the cutting elements 50 will retain the membrane 150 within the cap 30 after the cap 30 has been completely unscrewed from the neck 20.

[0031] Now turning to Figs. 4-6, a closing sequence of a cap and neck assembly is shown. Prior to such sequence, it is assumed that the cap 30 has once been unscrewed from the neck 20 such that the membrane 150 has been separated from the neck 20.

[0032] Starting with Fig. 4, the cap 30 has been screwed on the neck 20. As the cutting elements 50 are retaining the membrane 150 initially, the cutting elements 50 will however be disengaged from the membrane 150 when the membrane 150 is reaching the open spout 100 of the neck 20. Hence, as is shown in Fig. 4, the membrane 150 will rest on the spout 100 while the cap 30 moves down the neck due to the provision of the threads, converting a rotational movement to a vertical movement.

[0033] In Fig. 4, the membrane 150 is on its upper side in contact with the closed end of the cap 30, while it rests on the open spout 100 of the neck 20 on its lower side.

[0034] When the cap 400 is screwed further downwards, as is shown in Fig. 5, the closed end of the cap 30 will interact with the membrane 150. Hence, the membrane 150 will flex such that its diameter increases, whereby a sealing lip 160 of the membrane 150 moves towards the interior side of the spout 100.

[0035] This procedure is continued as the cap 30 is further rotated down the neck 20. In Fig. 6 the cap 30 is tightly screwed onto the neck 20, and the membrane 150 has been subjected to an increased flexing. Hence, the sealing lip 160 is urged radially outwards until it contacts the interior wall of the spout 100 of the neck 20. At the same time, the upper end of the spout 100 engages with a membrane flange 170 such that the membrane 150 locks in the desired sealing position. The membrane 150 thus seals the spout 100 of the neck 20 such that the outer environment is unable to affect the food product enclosed within a package equipped with the neck spout 100, including the membrane 150, and the cap 30.

[0036] Now turning to Fig. 7 details of the spout 100 will be described. As explained earlier the spout 100 is defined as the upper part of the neck 20 through which the package content is discharged. Prior to opening of the package the spout 100 thus comprises the membrane 150, however once opened the membrane 150 is separated from the spout 100. In Fig. 7 the spout 100 is shown prior to opening of the package, i.e. the membrane 150 forms part of the spout 100. As indicated by the dashed box in Fig. 7, the spout 100 forms the upper part of the neck 20, approximately starting from the shoulder 24 and extending upwards.

[0037] The spout 100 is formed by a tubular member 110 extending from the shoulder 24 of the neck and up-

wards. The tubular member 110 has a main body 112 and an upper end portion 114 which forms the connection to the membrane 150. During opening, the cutting elements 50 of the cap 30 will cut through the upper end portion 114 of the spout 100 such that the membrane 150 is separated from the main body 112 of the tubular member 110.

[0038] The membrane 150, forming a circular closure of the spout 100, comprises a central circular disc member 152 and an outer annular disc member 154. The outer annular disc member is arranged radially in between the central circular disc member 152 and a membrane flange 170.

[0039] As can be seen in Fig. 7a the outer annular disc member 154 is connected to the central circular disc member 152 at an angle α , and the membrane flange 170 is connected to the outer annular disc member 154 at an angle β . These angles facilitates the flexing of the membrane 150 during re-sealing, such that the entire diameter of the membrane 150 may increase as the angles α , β increases due to a downward pressing action at the centre of the membrane 150. Upon such increase of the membrane's 150 diameter, the sealing lip 160 will be urged towards the inner sidewalls of the main body 112 of the tubular member 110. In an idle position where no downward force is applied to the membrane 150 the sealing lip 160 is projecting downwards.

[0040] In Fig. 7b the connection between the tubular member 110 and the membrane 150 is shown in further detail. The membrane flange 170 is formed by two adjoining parts; an outer portion 172 which extends radially outside the end portion 114 of the tubular member 110, and an inner portion 174. The end portion 114 of the tubular member 110 is attached to the interface between the inner and outer portions 172, 174 of the membrane flange 170.

[0041] The end portion 114 of the tubular member 110 has a certain axial length L1. The axial length L1 is e.g. defined as the distance at which the uppermost portion of the tubular member 110 exhibits a substantially constant thickness. Hence, although the main body 112 is tapered towards the end portion 114 the axial length L1 does not include such tapered portion. On the other hand, the axial length L1 could also be defined as the distance at which the uppermost portion of the tubular member 110 exhibits a thickness which is less than the thickness of the main tubular member 110 at a position which, when the membrane 150 is separated from the tubular member 110, forms the outlet of the neck 20. Yet further, the axial length L1 could also be defined as the distance at which the uppermost portion of the tubular member 110 exhibits a thickness which is within a certain percentage, such as e.g. 20-60%, of the thickness of the main tubular member 110 at a position which, when the membrane 150 is separated from the tubular member 110, forms the outlet of the neck 20. To give some general values suitable for liquid food packages, the axial length L1 of the end portion 114 may e.g. be in the range of 0.1-0.4 mm.

[0042] In some embodiments the axial thickness K1 of the cutting portion 53 of the cutting element 50 is between 200 and 400% of the axial length L1 of the end portion 114.

[0043] The axial thickness of the membrane flange 170 varies along its radial extension. As can be seen in Fig. 7b the outer portion 172 has a specific axial thickness D1 which is equal to, or greater than the thickness D2 of the inner portion 174. Specifically, the axial length L1 of the end portion 114 should be in the range of 15-65%, preferably in the range of 20-50%, of the axial thickness D1 of the outer portion 172 of the membrane flange 170. This ratio between the axial length L1 and the axial thickness D1 has surprisingly proven to allow for a better re-sealing as a reduced number of plastic projections are formed. Such plastic projections may otherwise make it more difficult to provide re-sealing, especially if they are arranged at right angles.

[0044] As mentioned earlier the axial thickness D2 of the inner portion 174 of the membrane flange 170 is equal to, or less than the axial thickness D1 of the outer portion 172 of the membrane flange 170. As is shown in Fig. 7b the outer surface 175a of the inner portion 174 of the membrane flange 170 coincide with the outer surface 173a of the outer portion 172 of the membrane flange 170. This means that an inner surface 175b of the inner portion 174 of the membrane flange 170 is arranged at an axial distance from an inner surface 173b of the outer portion 172 of the membrane flange 170. These inner surfaces 173b, 175b may be parallel, and the free height H1 defined as the axial distance between the inner surfaces 173b, 175b should always be a positive value, or zero. This means that the inner surface 175b of the inner portion 174 is always at the same level, or above, the inner surface 173b of the inner portion 172. The configuration of the free height H1 has surprisingly proven easier penetration of the cutting elements 50, as well as it reduces the risk for warping or distorting the cutting elements 50 during penetration.

[0045] The sealing lip 160 protrudes downwards into the tubular member 110. The sealing lip 160 extends from the inner surface 175b of the inner portion 174, i.e. from an axial position being arranged at a distance from the axial end position of the end portion 114 of the tubular member 110. The outer radius R1 of the sealing lip 160 is preferably chosen to correspond to the outer radius R2 (shown in Fig. 6) of the cutting elements 50 of the cap 30. Here we measure the outer radii R1 and R2 from the line A running through the center of the cap 30 and spout 20 in the radial direction R towards the outermost surface of the sealing lip and the cutting element 50. This is particularly advantageous because of the fact that it allows for a cleaner separation, as well as it allows the cutting elements 50 to act as wedges during separation of the membrane 150.

[0046] Although the above description has been made with reference to a food packages, it should be readily understood that the general principle of the neck and cap

could be applied to all sorts of packages provided with opening devices.

[0047] Further, the invention has mainly been described with reference to a few embodiments. However, as is readily understood by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended claims.

[0048] All references to "upper", "lower", "upwards", "downwards" etc. are made with respect to a package standing upright.

Claims

1. A cap (30) arranged to interact with a neck (20), said cap (30) comprising an inner wall portion (33) being provided with at least one cutting element (50) projecting radially inwards, said cutting element (50) having a hinge portion (52) connected to the inner wall portion (33), and a cutting portion (53) extending radially inwards from said hinge portion (52), wherein the axial thickness (K2) of the hinge portion (52) is between 35 and 80% of the axial thickness (K1) of the cutting portion (53).
2. The cap (30) according to claim 1, wherein
$$\frac{3}{7} K1 \leq K2 \leq \frac{5}{7} K1.$$
3. The cap (30) according to claim 1 or 2, wherein the axial thickness (K2) of the hinge portion (52) is between 0.3 and 0.5 mm.
4. The cap (30) according to any one of the preceding claims, wherein the total number of cutting elements (50) is between 1 and 7.
5. The cap (30) according to any one of the preceding claims, wherein said cutting elements (50) are configured to separate a membrane (150) from an associated spout (100).
6. An assembly, comprising a cap (30) according to any one of the preceding claims, and a spout (100) having a membrane (150) closing a tubular member (110) of said spout (100).
7. The assembly according to claim 6, wherein said tubular member (100) comprises a main body (112) and an end portion (114) being releasably attached to said membrane (150), and wherein the axial thickness (K1) of the cutting portion (53) of the cutting element (50) is between 200 and 400% of the axial length (L1) of said end portion (114).
8. The assembly according to claim 7, wherein said

membrane (150) comprising a membrane flange (170) having an outer portion (172) extending radially outside said end portion (114) of the tubular member (110),

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9. The assembly according to claim 8, wherein the axial length (L1) of the end portion (114) is between 15-65% of the axial thickness (D1) of the outer portion (172) of the membrane flange (170).

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10. The assembly according to claim 9, wherein the axial length (L1) of the end portion (114) is between 20-50% of the axial thickness (D1) of the outer portion (172) of the membrane flange (170).

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11. The assembly according to claim 8 or 9, wherein the membrane flange (170) further comprises an inner portion (174), said end portion (114) of the tubular member (110) being attached to the interface between the inner and outer portions (172, 174) of the membrane flange (170), wherein the axial thickness (D2) of the inner portion (174) is equal to, or less than the axial thickness (D1) of the outer portion (172).

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12. The assembly according to claim 11, wherein the inner surface (175b) of the inner portion (174) of the membrane flange (170) is arranged at an axial distance (H1) from the inner surface (173b) of the outer portion (172) of the membrane flange (170).

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13. The assembly according to claim 11 or 12, wherein the inner surface (175b) of the inner portion (174) of the membrane flange (170) and the inner surface (173b) of the outer portion (172) of the membrane flange (170) are parallel.

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14. The assembly according to any one of claims 11 to 13, wherein the outer surface (175a) of the inner portion (174) of the membrane flange (170) and the outer surface (173a) of the outer portion (172) of the membrane flange (170) coincide.

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15. The assembly according to any one of claims 6-14, wherein said membrane (150) comprises a sealing lip (160) protruding into said tubular member (110), wherein said sealing lip (160) extends from an axial position being arranged at a distance (H1) from the axial end position of the end portion (114) of the tubular member (110), and wherein the outer radius of the cutting portion (53) of said at least one cutting element (50) corresponds to the outer radius of the sealing lip (160).

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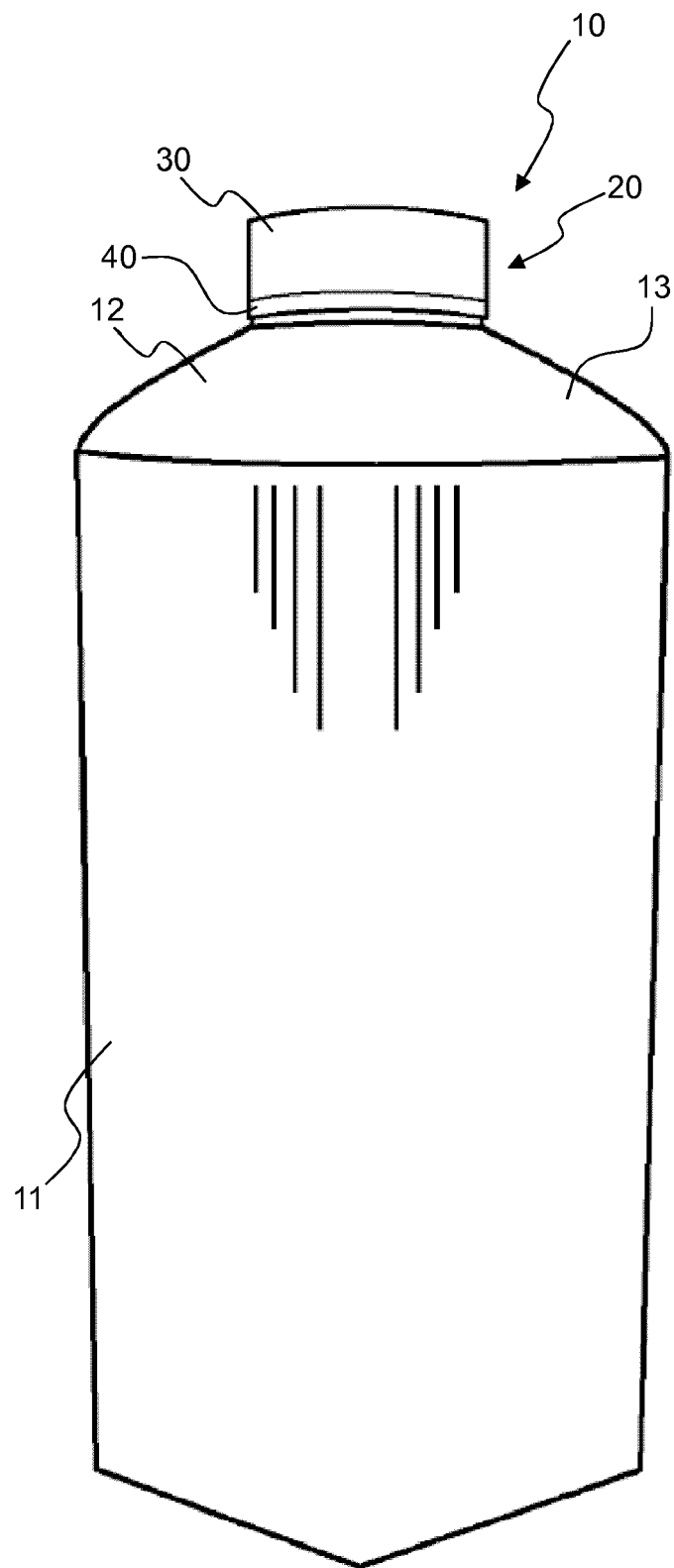
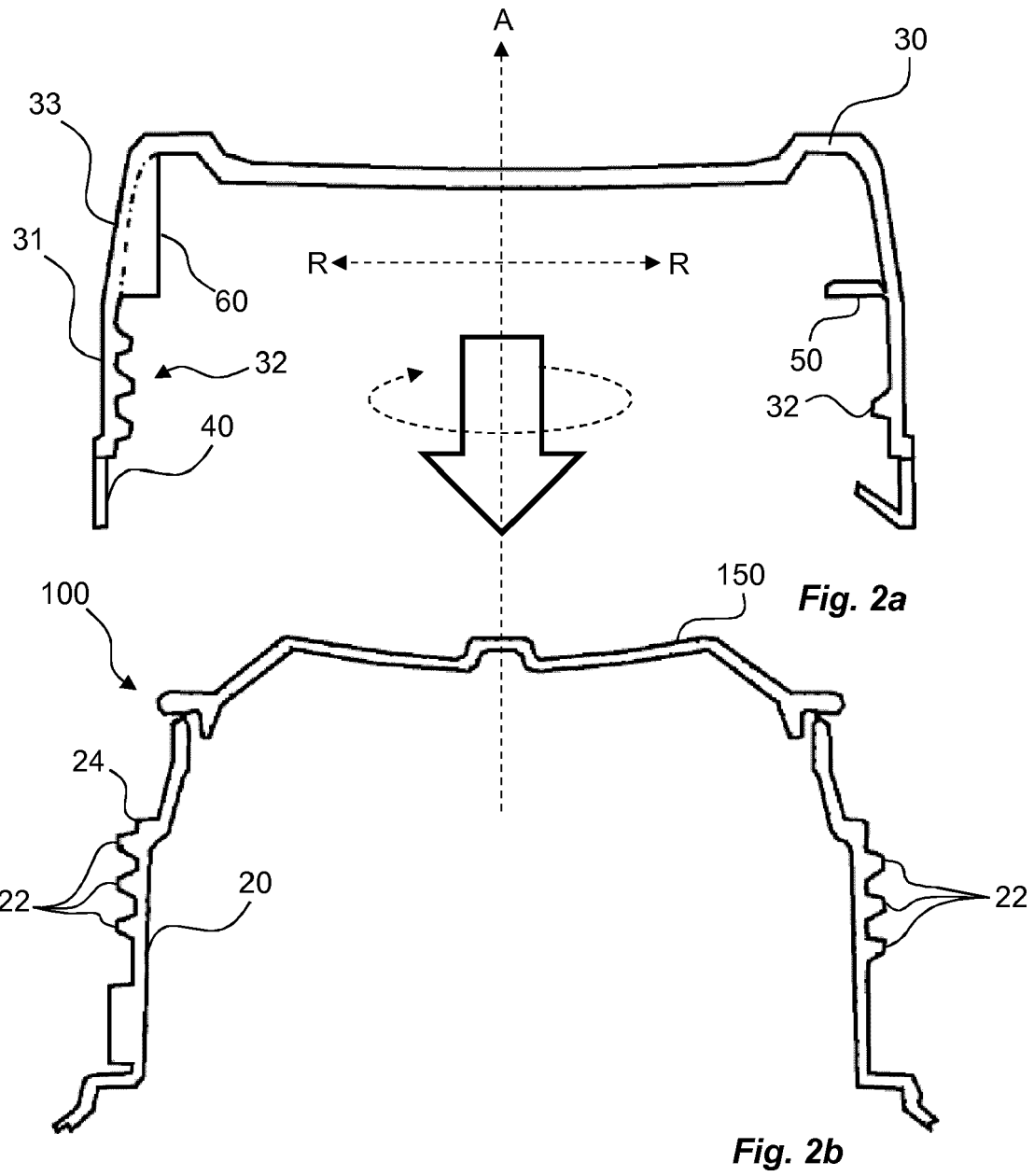
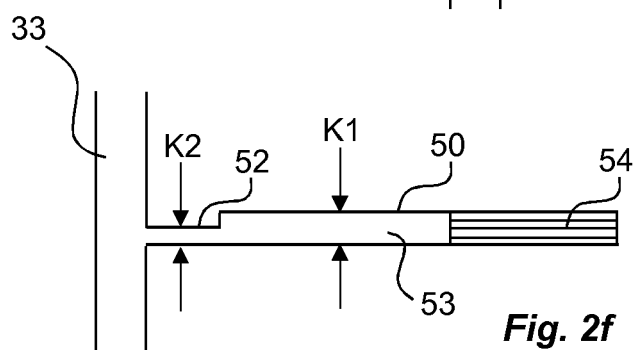
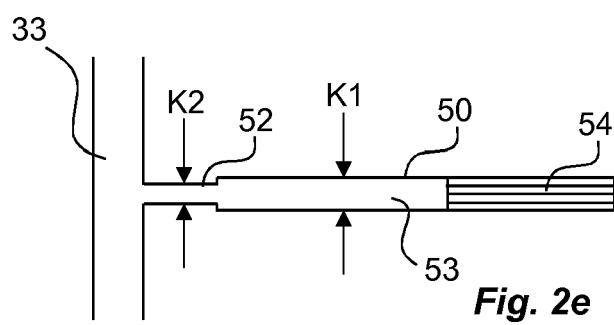
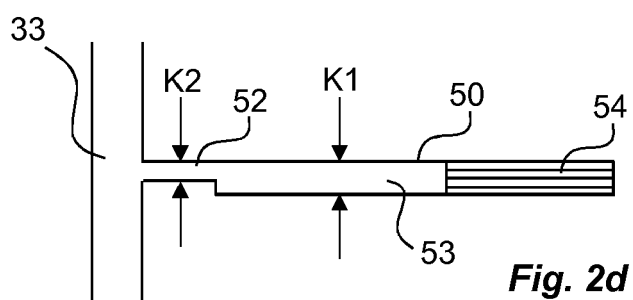
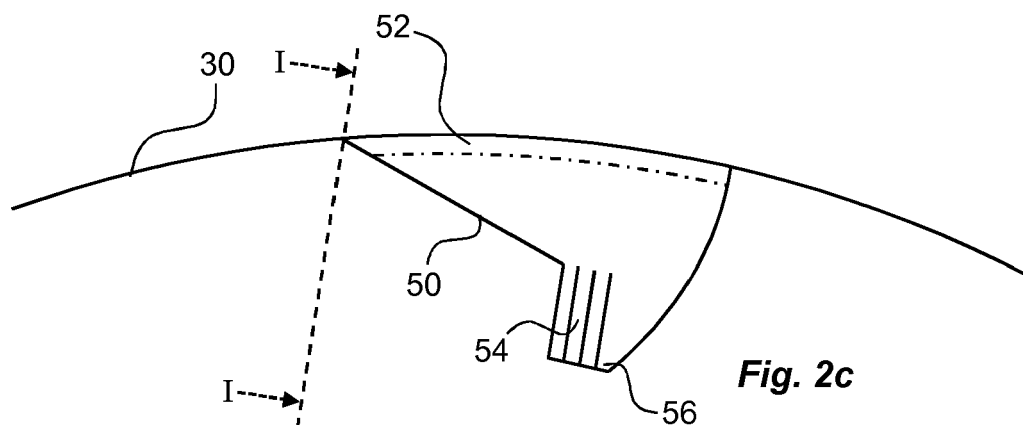


Fig. 1





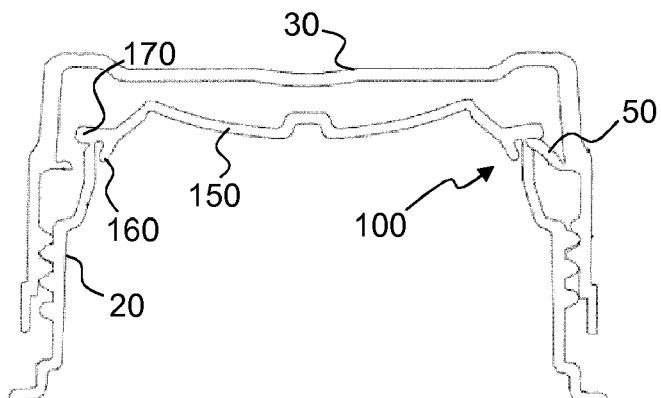


Fig. 3

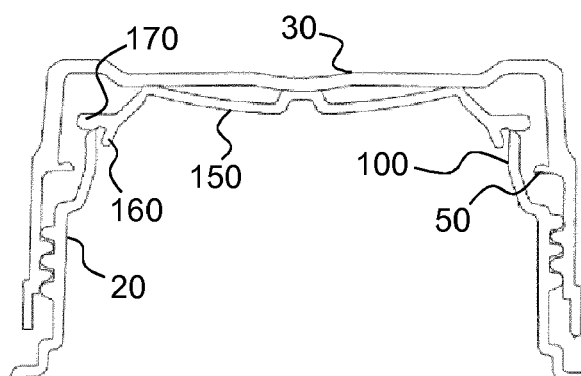


Fig. 4

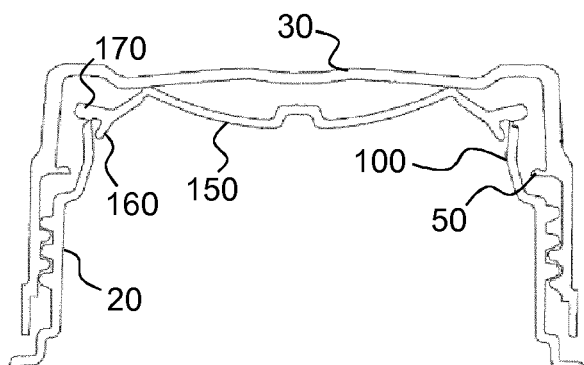


Fig. 5

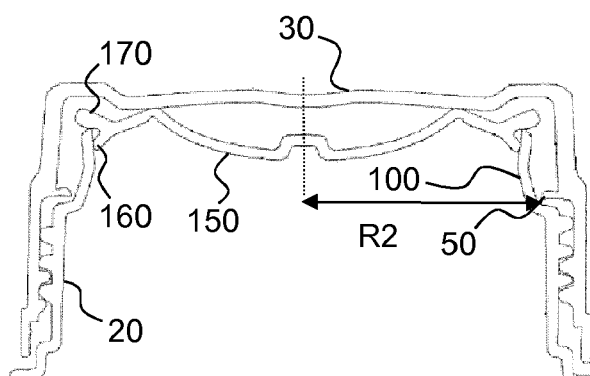
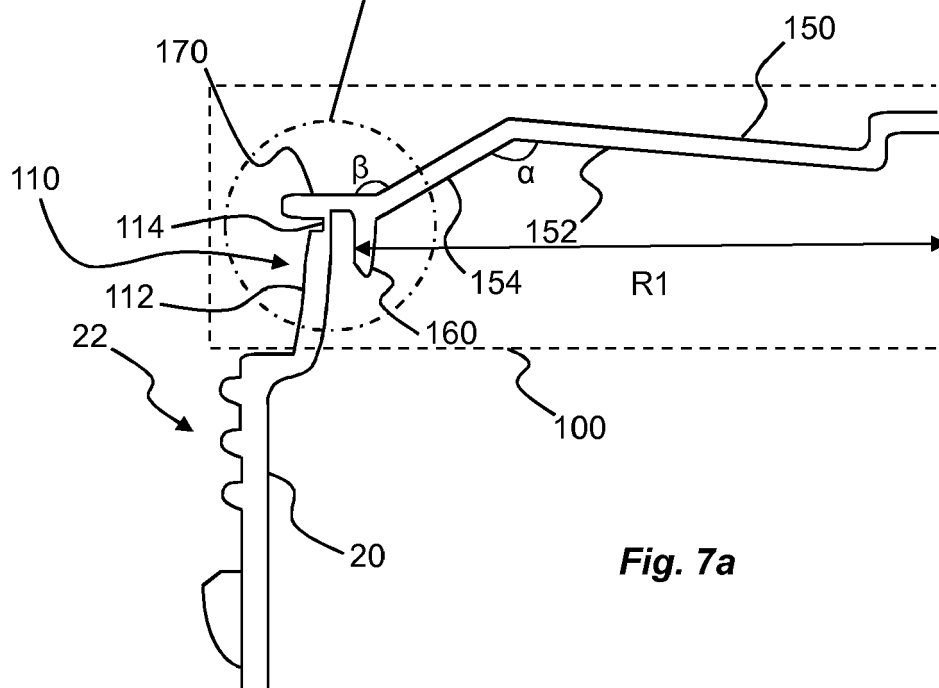
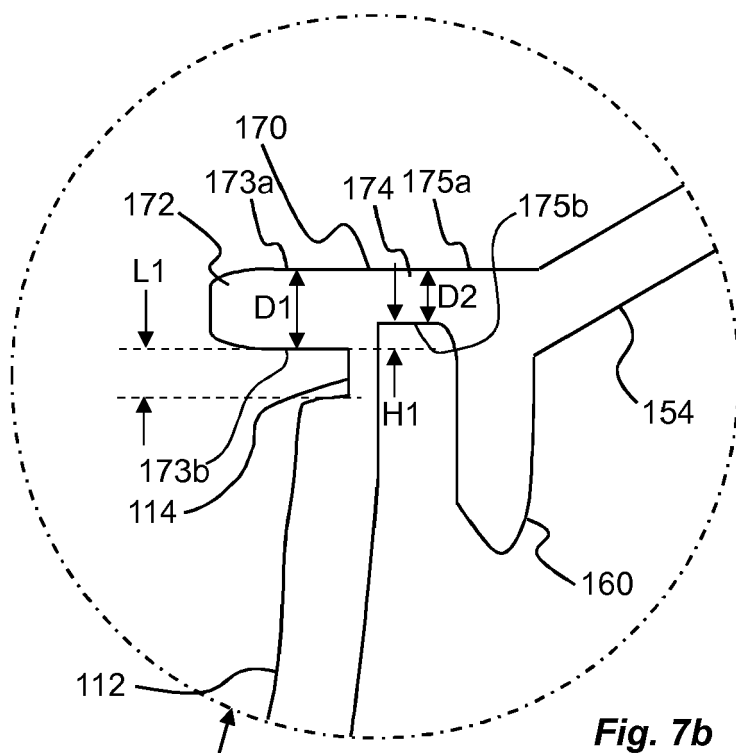


Fig. 6





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