(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 892 566 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.10.2021 Bulletin 2021/41

(51) Int Cl.:
B65D 41/34 *(2006.01)* ***B65D 55/16*** *(2006.01)*

(21) Application number: **20168466.9**

(22) Date of filing: **07.04.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Büsser, Manuel**
8716 Schmerion (CH)

(72) Inventor: **Büsser, Manuel**
8716 Schmerion (CH)

(74) Representative: **Dittmann, Rolf**
Freigutpartners Baden AG
Hahnrainweg 4
5400 Baden (CH)

(54) **CLOSURE MEMBER**

(57) A closure member (1) comprises a skirt (11), extending in a circumferential and an axial direction. A predetermined rupture line (111) extends on the skirt from a first endpoint (112) to a second endpoint (113), wherein the first and second endpoints are axially offset from each other and the predetermined rupture line extending more than 360° circumferentially. The predetermined rupture line subdivides the closure member into a cap portion (101), a terminal ring portion (102) and a tether portion (103) defined between the circumferentially overlapping portions of the predetermined rupture line. The predetermined rupture line has a first circumferential portion (I) extending from the first endpoint (112) of the predetermined rupture line adjacent the cap portion (101) and extending circumferentially over 360 degrees and a second circumferential portion (II) extending from the first circumferential portion (I) to the second endpoint (113) of the predetermined rupture line adjacent the terminal ring portion (102). The mechanical strength per unit length in the first circumferential portion (I) of the predetermined rupture line (111) is smaller than the mechanical strength per unit length in the second circumferential portion (II) of the predetermined rupture line.

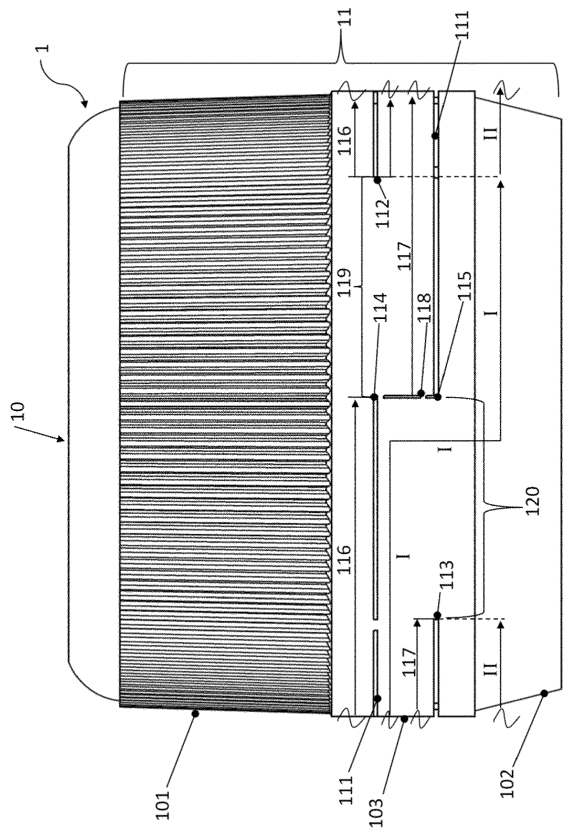

Fig. 1

EP 3 892 566 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a closure member and to a container as set forth in the claims.

BACKGROUND OF THE DISCLOSURE

[0002] Fluid containers, for instance such used for beverages, are frequently provided with screwable closure caps screwed onto the neck of the container body. In particular in beverage industry closure members are used which comprise a tamper ring to which the closure cap is connected when the container is shipped from the production site. The tamper ring is, in essence, a retainer ring engaging in a positive form lock relationship underneath a corresponding feature on the container neck so that the tamper ring cannot be removed from the container neck without destroying the tamper ring. The closure cap is attached to the tamper ring through a predetermined rupture line having reduced mechanical strength. For instance, it is known that the closure cap is attached to the tamper ring only through a number of relatively weak circumferentially distributed bridges. In other embodiments the predetermined rupture line may be provided as a circumferential line having reduced material thickness when compared to the cap and the tamper ring. The predetermined rupture line is intended to act as an intentional breaking line when a tensile force and/or torsional moment is applied between the tamper ring and the closure cap. Hence, when an originally closed container is opened the first time for instance by unscrewing the closure cap, the closure member breaks in the predetermined rupture line between the tamper ring and the closure cap, as the tamper ring is impeded from axial displacement towards the pouring hole of the container, while the cap is axially displaced on the threat. An unbroken connection between the tamper ring and the closure cap warrants an untouched, originally filled container as shipped by the manufacturer, whereas a broken connection, that is a tamper ring which is loosely held on the container, indicates that the container has been opened.

[0003] However, when the cap completely detaches from the tamper ring and consequently has no connection with the container any more, there is a risk of the cap getting lost. This, on the one hand, means that an only partially emptied container cannot be properly closed anymore. On the other hand, the cap can get into the environment as plastic litter. It will hence be appreciated that it is found desirable to retain the closure cap attached to the container. From the art it is known, for instance, to provide lugs connecting the tamper ring and the closure cap, wherein these lugs are intended to maintain the connection when the container is opened. Such solutions are for instance disclosed in US 2009/0236304, US 4,394,918 or US 2018/0370701. Other solutions are for instance described in JP 2017-119538. These, in brief, comprise a tether firmly attached in two end regions to the tamper ring and the cap, respectively. These are provided at closure members having a cap portion comprising a skirt, a tamper ring and a tether portion axially interposed between the cap portion and the tamper ring. In an originally shipped state, the tether extends circumferentially and is attached to the tamper ring and the cap portion by structurally weakened predetermined rupture lines which are intended to detach upon the first unscrewing of the cap portion, while the tether is firmly connected to the skirt of the cap portion and the tamper ring, or, more generically spoken, retainer portion, in limited circumferential regions, at the ends of the tether. CN 201209040Y teaches, essentially, that the portion of the predetermined rupture line located between the tether and the skirt has a lower mechanical strength than the portion of the predetermined rupture line located between the tether and the tamper ring, such that, when opening the closure device, the closure member first detaches between the tether and the skirt, and only subsequently detaches between the tether and the tamper ring. JP 2005-41566 teaches a closure member in which a portion of the predetermined rupture line is provided between the tether and the skirt, a second portion of the predetermined rupture line is provided between the tether and the retainer portion, or tamper ring, respectively, and further an intermediate portion of the predetermined rupture line is arranged to provide a connection between said two portions which are located at different axial locations of the closure member. JP 2005-41566 further teaches that the predetermined rupture line, upon opening the closure member, first detaches between the tether and the skirt and only subsequently detaches between the tether and the retainer portion. The intermediate portion, which is located between the ends of the tether, is open so that no connection exists between the ends of the tether. However, the tether is firmly connected to the cap as well as to the retainer portion of the closure member at circumferentially nearby positions, yielding the risk of displacing the retainer portion beyond the counterpart retainer feature of the container neck. It will be appreciated that, on the one hand to keep the closure member securely attached to the container and on the other hand to fulfill the warranty function, it is desirable to provide the closure member so as to minimize the risk of displacing the retainer portion beyond the counterpart feature on the container neck and to safely retain the retainer portion of the closure member on the container neck.

OUTLINE OF THE SUBJECT MATTER OF THE PRESENT DISCLOSURE

[0004] It is an object of the present disclosure to propose a closure member and a container containing the closure member of the kind initially mentioned. In one aspect, it is an object of the present disclosure to propose a closure member and a container containing the closure member improving the art. In a more specific aspect improvements form certain drawbacks of the art noted above shall be achieved. In other aspects, the closure member shall be provided such that the cap remains securely attached to a tamper ring or other tamper indicating appliance, or to the container body, respectively, at least withstanding a minimum threshold detachment force. In still a further aspect, the closure member shall be provided such as to avoid displacement of the tamper indicating device beyond a counterpart device on the container body. In still a further aspect attention shall be paid to a fast, reliable and cheap manufacturability of the closure member.

[0005] This is achieved by the subject matter described in the independent claims.

[0006] Further effects and advantages of the disclosed subject matter, whether explicitly mentioned or not, will become apparent in view of the disclosure provided below.

[0007] Accordingly, disclosed is a closure member comprising a skirt extending in a circumferential and an axial direction. A predetermined rupture line extends on the skirt from a first endpoint to a second endpoint, wherein the first and second endpoints are axially offset from each other and the predetermined rupture line extends more than 360° circumferentially so that portions of the predetermined rupture line overlap in the circumferential direction, whereby the predetermined rupture line subdivides the closure member into a cap portion, a terminal ring portion and a tether portion defined between the circumferentially overlapping portions of the predetermined rupture line and interposed between the cap portion and the terminal ring portion. The terminal ring portion is intended to form a retainer portion of the closure member. The predetermined rupture line has a mechanical strength per unit length which is lower than the mechanical strength per unit length in any other region of the skirt, so that, when a tensile force is applied between the cap portion and the terminal ring portion, the closure member ruptures at the predetermined rupture line. The predetermined rupture line has a first circumferential portion extending from the first endpoint of the predetermined rupture line adjacent the cap portion and extends circumferentially over 360 degrees, and a second circumferential portion which extends from the first circumferential portion to the second endpoint of the predetermined rupture line adjacent the terminal ring portion. It is hence understood that the second circumferential portion of the predetermined rupture line circumferentially overlaps a part of the first circumferential portion of the predetermined rupture line and is axially offset from said part of the first circumferential portion of the predetermined rupture line. The mechanical strength per unit length in the first circumferential portion of the predetermined rupture line is smaller than the mechanical strength per unit length in the second circumferential portion of the predetermined rupture line.

[0008] It is understood that adjacent the first and second endpoint the tether portion of the closure member is joined with the cap portion and the terminal ring portion, respectively, at firm junctions.

[0009] The mechanical strength per unit length may in particular be an ultimate tensile strength per unit length.

[0010] In embodiments, the mechanical strength per unit length in the second portion of the predetermined rupture line increases from the first portion of the predetermined rupture line to the second endpoint.

[0011] It is appreciated that when a container is closed with a closure member of the above-described type, the terminal ring portion locks with a counterpart retainer feature on the neck of the container and is in particular in a positive form lock relationship with the counterpart retainer feature. The terminal ring portion is thus secured against being displaced beyond the counterpart retainer feature towards the opening, or the pouring hole, of the container body. The cap portion is screwedly received on the neck of the container body. When the container is initially opened, the cap portion is axially displaced along the threads of the container neck, thus inducing a tensile force between the cap portion and the terminal ring portion and stretching the material of the predetermined rupture line. The second circumferential portion of the predetermined rupture line is, with respect to the tensile force, arranged in series with a part of the first circumferential portion of the predetermined rupture line. The tensile strength per unit length is smaller in the first circumferential portion of the predetermined rupture line, and hence the closure member breaks in the first portion of the predetermined rupture line while the second portion of the predetermined rupture line remains intact. The force required to rupture the predetermined rupture line in the first portion thereof preferably is sufficiently small so as to avoid disengaging the terminal ring portion form the counterpart feature on the container neck. The first portion of the predetermined rupture line extends over at least 360 degrees, and thus the cap portion, after rupturing the first portion of the predetermined rupture line, is essentially free to displace axially with respect to the terminal ring portion and is now only joined to the terminal ring portion by the relatively flexible tether portion. Thus, the cap portion can be screwed off the container neck and the container neck thus be completely opened while the cap portion remains secured to the container via the tether portion and the terminal ring portion. The closure member may subsequently be broken in the second portion of the predetermined rupture line so as to enlarge the free length of the tether and hence the range of motion for the cap portion.

[0012] Accordingly, disclosed is also a container comprising a container body and a closure member of any herein disclosed type, wherein the container body comprises a neck with a container opening, or pouring hole. The closure member is threadedly received on the neck of the container body. At least one retainer feature is provided on the neck of the container body, wherein at least a part of the terminal ring portion of the closure member engages the retainer feature provided on the neck distant from the container opening so as to lock the terminal ring portion against detaching from the neck of the container body. The terminal ring portion of the closure member and the retainer feature provided on the neck jointly provide a resisting force against the terminal ring portion of the closure member being disengaged from the retainer feature on the neck of the container body, and an integral ultimate tensile strength of the closure member in the first section of the predetermined rupture line over 360 degrees circumference is smaller than the resisting force against the terminal ring portion of the closure member being disengaged from the retainer feature on the neck of the container body.

[0013] The predetermined rupture line may comprise bridges, wherein the bridges extend across the predetermined rupture line and join the tether portion to adjacent rims of the cap portion and the terminal ring portion and are intended to rupture when the predetermined rupture line ruptures. There may be voids and/or material sections with reduced material strength circumferentially between the bridges. In other embodiments, the predetermined rupture line may comprise or be formed as a line of reduced material thickness when compared to neighboring sections of the closure member.

[0014] In order to achieve the different mechanical strengths along the predetermined rupture line, the cumulated cross section of the bridges per unit length of the predetermined rupture line in the second circumferential portion of the predetermined rupture line is, in non-limiting embodiments, larger than the cumulated cross section of the bridges per unit length of the predetermined rupture line in the first circumferential portion of the predetermined rupture line. To this extent, the cross section of an individual bridge in the second circumferential portion of the predetermined rupture line may be larger than the cross section of a bridge in the first circumferential section of the predetermined rupture line. Alternatively, or in addition, the number of bridges per unit length in the second portion of the predetermined rupture line may be larger than the number of bridges per unit length in the first portion of the predetermined rupture line.

[0015] The circumferential extent of the predetermined rupture line may in embodiments account to at least 450 degrees. The circumferential extent of the predetermined rupture line may in embodiments account to at most 690 degrees. The longer the circumferential extent of the predetermined rupture line is, the longer may the free length of the tether be provided.

[0016] The predetermined rupture line may be spirally arranged, i.e. extent as a spiral around the skirt of the closure member.

[0017] In other embodiments the predetermined rupture line may be "staged", that is, one part extending less than 360 degrees circumferentially, and the second part extending less than 360 degrees circumferentially and axially offset to the other part, wherein the two parts are connected by an intermediate part of the predetermined rupture line. That is, the predetermined rupture line may be formed as a first part extending circumferentially, and in particular only circumferentially, from the first endpoint to a first cornerpoint, a second part extending circumferentially, and in particular merely circumferentially, from a second cornerpoint to the second endpoint, and an intermediate part connecting the first and second cornerpoints. The first and second cornerpoints, and in particular the first and second parts of the predetermined rupture line, are, in this non-limiting embodiment, axially offset from each other along an axis of the closure member. The first portion of the predetermined rupture line extends from the first endpoint along the first part, the intermediate part, and partially in the second part

[0018] As implicitly described by the predetermined rupture line having first and second endpoints, the tether section is connected to the cap portion and the terminal ring portion by firm junctions. Those may be provided so as to have an ultimate tensile strength of at least 12 N.

[0019] It is understood that the features and embodiments disclosed above may be combined with each other. It will further be appreciated that further embodiments are conceivable within the scope of the present disclosure and the claimed subject matter which are obvious and apparent to the skilled person.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The subject matter of the present disclosure is now to be explained in more detail by means of selected exemplary embodiments shown in the accompanying drawings. The figures show

- Fig. 1 an embodiment of a closure member of the type herein described;
- Fig. 2 a sectional view of the closure member received on a neck of a container body and used to seal a container;
- Fig. 3 a flat projection of a skirt of a closure member of the herein disclosed type outlining an example of a predetermined rupture line;
- Fig. 4 a closure member of the herein disclosed type with a portion of the predetermined rupture line ruptured; and
- Fig. 5 a closure member of the herein disclosed type upon removing the cap portion from the neck of the container body.

[0021] It is understood that the drawings are highly schematic, and details not required for instruction purposes may have been omitted for the ease of understanding and depiction. It is further understood that the drawings show only selected, illustrative embodiments, and embodiments not shown may still be well within the scope of the herein disclosed and/or claimed subject matter.

EXEMPLARY MODES OF CARRYING OUT THE TEACHING OF THE PRESENT DISCLOSURE

[0022] Figure 1 shows an embodiment of a closure member 1. In the shown exemplary embodiment, closure member 1 comprises a top cover 10 and a skirt 11 extending in an axial direction from top cover 10, and further extending circumferentially around top cover 10. A predetermined rupture line 111 is formed on skirt 11. The predetermined rupture line extends circumferentially more than 360 degrees from a first endpoint 112 to a second endpoint 113, wherein the first and second endpoints 112, 113 are axially offset from each other. Thus, portions of the predetermined rupture line overlap in the circumferential direction. The predetermined rupture line 111 thus subdivides the closure member into a cap portion 101, a terminal ring portion 102, and a tether portion 103 between circumferentially overlapping sections of the predetermined rupture line 111. It is understood that the closure member is hollow, and a thread or thread segments may be arranged on an inner wall of the cap portion so that the closure member may be threadedly received, or screwed, onto a neck of a container. The tether portion is axially interposed between cap portion 101 and terminal ring portion 102. The predetermined rupture line 111 is configured to have a lower mechanical strength than any other part of the skirt so that when an axially acting tensile force is applied between the terminal ring portion 102 and the cap portion 101 the closure member breaks in the predetermined rupture line. The predetermined rupture line, in the shown embodiment, comprises a first part 116 extending from the first endpoint 112 to a first cornerpoint 114, a second part 117 extending from a second cornerpoint 115 to the second endpoint 113, wherein the first and second cornerpoints are axially offset from each other, and an intermediate part 118 connecting the first and second cornerpoints. The predetermined rupture line may thus be said to form a stepped rupture line. While the intermediate portion 118 of the predetermined rupture line is shown to extend merely axially, in other embodiments not shown the intermediate portion 118 may extend obliquely to the axial direction of the closure member. In further embodiments not shown, but easily derivable by the skilled person, the predetermined rupture line extends spirally and essentially continuous between the first and second endpoint. Still further embodiments, like a spiraling predetermined rupture line which is interrupted by a step formed by an intermediate part of the predetermined rupture line, are conceivable. Important, however, is that the predetermined rupture line does never meet itself after a 360 degrees circumferential extend. That way, the tether portion 103 is firmly connected to the cap portion 101 and the terminal ring portion 102 by firm junctions 119 and 120. The firm junctions have a circumferential extent sufficient to guarantee a minimum ultimate tensile strength. Said minimum tensile strength may for instance be 12 N such as to allow to suspend a filled 1 liter bottle from the cap portion of a closure member when the predetermined rupture line is broken. To this extent, the wall of the skirt may be thickened at and axially adjacent the firm junctions.

[0023] Critical to the herein claimed subject matter is that the predetermined rupture line is subdivided into at least two circumferential portions having different mechanical strength per unit length of the predetermined rupture line. The term mechanical strength may in this respect be understood as an ultimate tensile strength against a tensile force applied in an axial direction of the closure member between the terminal ring portion and the cap portion. A first portion I of the predetermined rupture line, starting at the first endpoint 112 extends along the predetermined rupture line 360 degrees of the circumference of the closure member, has a mechanical strength per unit lengths. Said mechanical strength per unit lengths may be the ultimate tensile strength. The mechanical strength per unit length may be defined as the integral mechanical strength of the first portion of the predetermined rupture line divided by the length of the predetermined rupture line as measured in a circumferential direction, i.e., for instance at a 360 degrees extent and a constant diameter of the skirt this corresponds to the circumference of the skirt. A second portion II of the predetermined rupture line extends from the first circumferential portion to the second endpoint. The second portion of the predetermined rupture line has a mechanical strength per unit length which is larger than the mechanical strength per unit length of the first portion of the predetermined rupture line. It goes without saying that the second portion of the predetermined rupture line overlaps a portion of the first portion which is hereinafter referred to as "the overlapping portion of the first portion".

[0024] Upon opening a container which is closed by the herein disclosed closure member the following occurs: Upon unscrewing the closure member, the cap member is displaced in an axial direction away from the terminal ring portion, while the terminal ring portion is locked with a retainer member of the container neck. Thus, the material connecting the tether portion of the closure member to the cap portion and the terminal ring portion, respectively, is strained in the axial direction of the closure member. The strain induces a stress in said material according to the stress-strain diagram of the material used. In the circumferential region where the first and second portions of the predetermined rupture line overlap circumferentially, the material of the second portion of the predetermined rupture line and of the overlapping portion of the first portion of the predetermined rupture line are in a serial arrangement with respect to acting forces, and hence experience the same tensile force. However, as it is provided that the mechanical strength per unit length in the first portion of the predetermined rupture line is lower than in the second portion of the predetermined rupture line, the material in the overlapping portion of the first portion of the predetermined rupture line reaches the ultimate strain prior to that of the second portion of the predetermined rupture line and hence breaks while the second portion of the predetermined rupture line stays intact. Thus, the closure member breaks in the first portion of the predetermined rupture line, which extends over a full circumference, i.e. 360 degrees, and thus enables the cap portion of the closure member to freely displace axially and be removed from the neck of the container. In order to guarantee that the predetermined rupture line breaks first in the first section of the predetermined rupture line the integral mechanical strength - i.e., for instance, ultimate tensile strength, in the second section of the predetermined rupture line is larger than the integral mechanical strength in the overlapping portion of the first portion of the predetermined rupture line.

[0025] As mentioned above, the terminal ring portion of the closure member is intended to engage a retainer feature provided on the neck portion of a container body. The skilled person will appreciate that the resisting force of said engagement against the terminal ring portion of the closure member being disengaged from the retainer feature on the neck of the container body is limited. The skilled person will thus appreciate that the integral ultimate tensile strength of the closure member at the first portion of the predetermined rupture line over 360 degrees circumference must be smaller than the resisting force against the terminal ring portion of the closure member being disengaged from the retainer feature on the neck of the container body so as to avoid the terminal ring portion of the closure member being disengaged from the container body. It will also be appreciated that the material of the first portion of the predetermined rupture line should not be overly unevenly distributed around the circumference so as to avoid segmental detachment of the terminal ring portion from the retainer feature which would have the detrimental effect of fostering complete detachment.

[0026] Fig. 2 shows a closure member 1 used to seal a container. The closure member is threadedly received on the neck 2 of the container by mutually engaging thread or thread means 21 provided on the outside of the neck of the container and 105 inside the cap portion 101 of the closure member. While the closure member is screwed onto the neck 2 of the container, the free rim of terminal ring member 102 (cf. Fig 1) abuts the top of retainer feature 22 provided on the outside of neck 2 and, upon further displacement of closure member 1 towards the container, is folded over inside the closure member and interlocks with retainer feature 22, and hence is form locked against displacement towards the opening of the container. The opening of the container is sealed by suitable sealing features (without reference number) protruding from top cover 10 and into the interior of closure member 1.

[0027] Fig. 3 shows a flat projection of the skirt of an exemplary embodiment of a closure member of the herein described kind. The predetermined rupture line 111 is provided with bridges 131, 132, 133 and 134 extending across predetermined rupture line 111 connecting the rims of the tether portion 103 and of the cap portion 101 and the terminal ring portion 102, respectively, with voids being provided circumferentially between the bridges. The bridges 134 in the second portion II of the predetermine rupture line have larger cross sections and/or are provided with a smaller distance between each other than the bridges 131, 132 and 133 in the first portion I of the predetermined rupture line. It may in embodiments be provided that the bridges 134 in the second portion II of the predetermine rupture line have varying cross sections, such that some of bridges 134 are mechanically weaker and/or stronger than other bridges 134. However, the cumulated cross section of all bridges 134 preferably is larger than the cumulated cross section of all bridges 131 in the first part 116 of the predetermined rupture line. As outlined above, the first portion of the predetermined rupture line and the second portion of the predetermined rupture line circumferentially overlap in circumferential region 125. When opening a container initially, cap member 101 is displaced axially while terminal ring portion 102 is retained by a retainer feature provided on the neck portion of the retained body. Consequently, strain between the terminal ring portion and the cap portion is induced. In circumferential section 125, bridges 131 of the overlapping portion 121 of the first portion of the predetermined rupture line and bridges 134 in the second portion of the predetermined rupture line are arranged in series with respect to the acting force, and, thus, the entirety of all bridges 134 in the second portion of the predetermined rupture line and the entirety of all bridges 131 in the overlapping portion 121 of the first portion of the predetermined rupture line are loaded by essentially the same tensile force. However, as the number of bridges and the cross section of each bridge in the second portion of the predetermined rupture line is larger than in the overlapping portion of the first portion of the predetermined rupture line, stress and strain are larger in the bridges of the overlapping portion of the first portion of the predetermined rupture line, and accordingly the bridges of the overlapping portion of the first portion of the predetermined rupture line fail first, relieving the bridges of the second portion of the predetermined rupture line. Also, all other bridges of the first portion of the predetermined rupture line will break as soon as the displacement of the cap portion of the closure member relative to the terminal ring portion reaches the ultimate strain of the material. It is understood that this displacement is only dependent on the material and the initial, neutral length of the bridges. It is understood that this displacement is not dependent upon the cross section of the bridges. However, the maximum force transmitted by a bridge prior to failing depends also on the breaking stress of the material and the cross section of a bridge. The dimension of the bridges, or, more generally speaking, the mechanical strength of the material bridging at least the first portion of the predetermined rupture line, thus must be chosen such that the maximum transmitted force does not exceed a value at which the terminal ring portion of the closure member is pulled over the retainer feature of the container body. The same applies, mutatis mutandis, to embodiments in which the predetermined rupture line is, for instance, provided as a line of reduced thickness or in which regions of reduced thickness are provided between the bridges rather than voids. In that the first portion of the predetermined rupture line extends circumferentially over 360 degrees, the cap portion of the closure member is essentially free to axially displace away from the terminal ring portion, but remains attached to the terminal ring portion, and thus to the container, through tether portion 103.

[0028] Fig 4 depicts the situation of a closure member 1 provided on the neck of a container body 2 instantly after rupturing the first portion of the predetermined rupture line. As outlined in connection with figure 2 above, terminal ring portion 102 is folded over inside the closure member and is hardly visible in this state. The tether portion 103 is still connected to the terminal ring portion in the second portion of determined rupture line and at firm junction 120. It is noted that the closure member, including terminal ring portion 102, is free to rotate about an axis of the neck of container body 2. Hence, cap portion 101 of closure member 1 may be further unscrewed from the neck of the container body until the cap portion is detached from the thread members 21 on the neck of the container body, as shown in figure 5. In the situation shown in figure 5 the second part of the predetermined rupture line is also ruptured. This may occur during opening if the container, but may also be effected by the consumer after having removed the cap portion 101 from the container neck to increase the free length of tether portion 103. Terminal ring portion 102 is locked underneath retainer feature 22 of the container body 2. Cap portion 101 remains secured to terminal ring portion 102 through tether portion 103 and firm junctions 119 and 120. Firm junctions 119 and 120 may be configured and dimensioned such as to withstand the force which is caused by the filled container being suspended from cap portion 101. For instance, for a 1 liter PET bottle they may be configured and dimensioned to withstand a force of at least 12 N. It is understood that the locking relationship of terminal ring portion 102 with retainer feature 22 must be adapted and configured to withstand at least the same force pulling the terminal ring portion towards the pouring hole of the neck of container body 2.

[0029] It might be the case that the mechanical strength in the second portion IIof predetermined rupture line 111 may be constant or may in other embodiments gradually increase with increasing distance from the first part I of predetermined rupture line 111.

[0030] Referring again to figure 3, the bridges of said embodiment may for example be provided as follows: bridges 131 may have the same or different cross sectional area. Preferably, the width, in circumferential direction, of an individual bridge should not be smaller that 0.2 mm. It may be provided that the bridges in the overlapping portion 121 of the first portion of the predetermined rupture line are configured and dimensioned so as to break essentially at the same axial displacement as other bridges 131. It will be appreciated that, in the circumferential sector 125 of the closure member where the first and second portion of the predetermined rupture line overlap, the axial displacement of the cap portion relative to the terminal ring portion is shared between bridges 131 and 134, and hence, at a certain axial displacement of cap portion 101 relative to terminal ring portion 102, the strain of bridges 131 in overlapping portion 121 is smaller than that of other bridges 131. It may thus be provided that bridges 131 in the overlapping portion have a smaller cross-sectional area and/or have a larger distance from each other than other bridges 131. The cross-sectional area of bridges 133 may in embodiments not exceed the cross-sectional area of the strongest bridge 131. The one or more bridges 132 which are optionally provided in the intermediate part of the first section of rupture line 111 inherit the particularity that they are subject to shear stress. The cross-sectional area of bridges 133 may in embodiments not exceed the cross-sectional area of the strongest bridge 131. The aggregate cross-sectional area of all bridges 134 in the second portion II of predetermined rupture line 111 may in embodiments exceed the aggregate cross-sectional area of all bridges 131, 132 and 133 in the first portion I of predetermined rupture line 111. As mentioned, it may be provided that the cross sectional area of bridges 134 in the second section of the predetermined rupture line may increase and/or the distance between the bridges 134 may decrease with increasing distance from the first part of the predetermined rupture line. The different cross-sectional areas and hence mechanical strengths of the individual bridges are selected such that and serve to avoid detachment of the terminal ring portion 102 of the closure member from the retainer feature of the container body. It may in embodiments be provided that the bridges 134 have different strengths. For an instance, it may be provided that a bridge 134 having a relatively high mechanical strength, e.g. cross section, hereinafter referred to as a "relatively strong bridge", is interposed between bridges 134 having a relatively low mechanical strength, e.g. cross section, hereinafter referred to as a "relatively weak bridge". It may moreover and more in particular be provided that the bridge 134 closest to the first circumferential portion I of the predetermined rupture line is a bridge having a relatively large mechanical strength. The result, in use, is as follows: If a consumer initially opens the closure member, first bridges 131, 132 and 133 are broken. However, once the predetermined rupture line is torn open from the first endpoint 112 to said first of the bridges 134, said first, relatively strong one of the bridges 134 exerts an enhanced resistance against further tearing of the predetermined rupture line, resulting in a tactile signal to the consumer. The consumer can then decide upon releasing an extended part of the tether section in exerting a force sufficient to break said first relatively strong one of the bridges 134, and further breaking one or more subsequent relatively weak bridges. However, if the process of tearing open the predetermined rupture line reaches a subsequent relatively strong bridge, the consumer once again receives a tactile signal and may decide whether to release even more of the tether portion in breaking the relatively strong bridge and subsequent relatively weak bridges. This may be repeated until the entire predetermined rupture line is torn open up to second endpoint 113 and the tearing up process is stopped by firm junction 120.

[0031] While the subject matter of the disclosure has been explained by means of exemplary embodiments, it is understood that these are in no way intended to limit the scope of the claimed invention. It will be appreciated that the claims cover embodiments not explicitly shown or disclosed herein, and embodiments deviating from those disclosed in the exemplary modes of carrying out the teaching of the present disclosure will still be covered by the claims.

Claims

1. A closure member (1) comprising a skirt (11), the skirt extending in a circumferential and an axial direction,
   a predetermined rupture line (111) extending on the skirt from a first endpoint (112) to a second endpoint (113), wherein the first and second endpoints are axially offset from each other and the predetermined rupture line extending more than 360° circumferentially so that portions (121, 125) of the predetermined rupture line overlap in the circumferential direction, whereby the predetermined rupture line subdivides the closure member into a cap portion (101), a terminal ring portion (102) and a tether portion (103) defined between the circumferentially overlapping portions of the predetermined rupture line and interposed between the cap portion and the terminal ring portion,
   wherein the predetermined rupture line has a mechanical strength per unit length which is lower than the mechanical strength per unit length in any other region of the skirt, so that, when a tensile force is applied between the cap portion and the terminal ring portion, the closure member ruptures at the predetermined rupture line,
   wherein the predetermined rupture line has a first circumferential portion (I) extending from the first endpoint (112) of the predetermined rupture line adjacent the cap portion (101) and extending circumferentially over 360 degrees and a second circumferential portion (II) extending from the first circumferential portion (I) to the second endpoint (113) of the predetermined rupture line adjacent the terminal ring portion (102),
   wherein the mechanical strength per unit length in the first circumferential portion (I) of the predetermined rupture line (111) is smaller than the mechanical strength per unit length in the second circumferential portion (II) of the predetermined rupture line.

2. The closure member according to the preceding claim, wherein the mechanical strength per unit length is an ultimate tensile strength per unit length.

3. The closure member according to any of the preceding claims, wherein the mechanical strength per unit length in the second portion (II) of the predetermined rupture line increases from the first portion (I) of the predetermined rupture line to the second endpoint (113).

4. The closure member according to any of the preceding claims, wherein the predetermined rupture line comprises bridges (131, 132, 133, 134), wherein the bridges join the tether portion (103) to adjacent rims of the cap portion (101) and the terminal ring portion (102).

5. The closure member according to the preceding claim, wherein the cumulated cross section of the bridges (134) per unit length of the predetermined rupture line in the second circumferential portion (II) of the predetermined rupture line is larger than the cumulated cross section of the bridges (131, 132, 133) per unit length of the predetermined rupture line in the first circumferential portion (I) of the predetermined rupture line.

6. The closure member according to the preceding claim, wherein the cross section of an individual bridge (134) in the second circumferential portion (II) of the predetermined rupture line is larger than the cross section of a bridge (131. 132. 133) in the first circumferential portion (I) of the predetermined rupture line.

7. The closure member according to any of the two preceding claims, wherein the number of bridges (134) per unit length in the second portion (II) of the predetermined rupture line is larger than the number of bridges (131, 132, 133) per unit length in the first portion (I) of the predetermined rupture line.

8. The closure member of any of the three preceding claims, wherein there are voids between the bridges.

9. The closure member according to any of the preceding claims, wherein the predetermined rupture line (111) comprises a line of reduced material thickness when compared to neighboring sections of the closure member.

10. The closure member according to any preceding claim, wherein the circumferential extent of the pre-

determined rupture line (111) accounts to at least 450 degrees.

11. The closure member according to any preceding claim, wherein the circumferential extent of the predetermined rupture line (111) accounts to at most 690 degrees.

12. The closure member according to any preceding claim wherein the predetermined rupture line (111) is spirally arranged.

13. The closure member according to any preceding claim, wherein the predetermined rupture line (111) is formed as a first part (116) extending circumferentially from the first endpoint (112) to a first cornerpoint (114), a second part (117) extending circumferentially from a second cornerpoint (115) to the second endpoint (113), and an intermediate part (118) connecting the first and second cornerpoints (114, 115), wherein the first and second cornerpoints of the predetermined rupture line are axially offset from each other along an axis of the closure member and the first portion (I) of the predetermined rupture line (111) extends from the first endpoint (112) along the first part (116), the intermediate part (118), and partially in the second part (117) of the predetermined rupture line.

14. The closure member according to any of the preceding claims, wherein the tether portion is connected to the cap portion and the terminal ring portion by firm junctions, wherein each of the firm junctions has a ultimate tensile strength of at least 12 N.

15. A container comprising a container body and a closure member according to any of the preceding claims, wherein the container body comprises a neck with a container opening,
wherein the closure member is threadedly received on the neck of the container body,
at least one retainer feature being provided on the neck of the container body, wherein the at least a part of the terminal ring portion of the closure member engages the retainer feature provided on the neck distant from the container opening so as to lock the terminal ring portion against detaching from the neck of the container body,
wherein the terminal ring portion of the closure member and the retainer feature provided on the neck jointly provide a resisting force against the terminal ring portion of the closure member being disengaged from the retainer feature on the neck of the container body,
wherein an integral ultimate tensile strength of the closure member in the first portion of the predetermined rupture line over 360 degrees circumference is smaller than the resisting force against the terminal ring portion of the closure member being disengaged from the retainer feature on the neck of the container body.

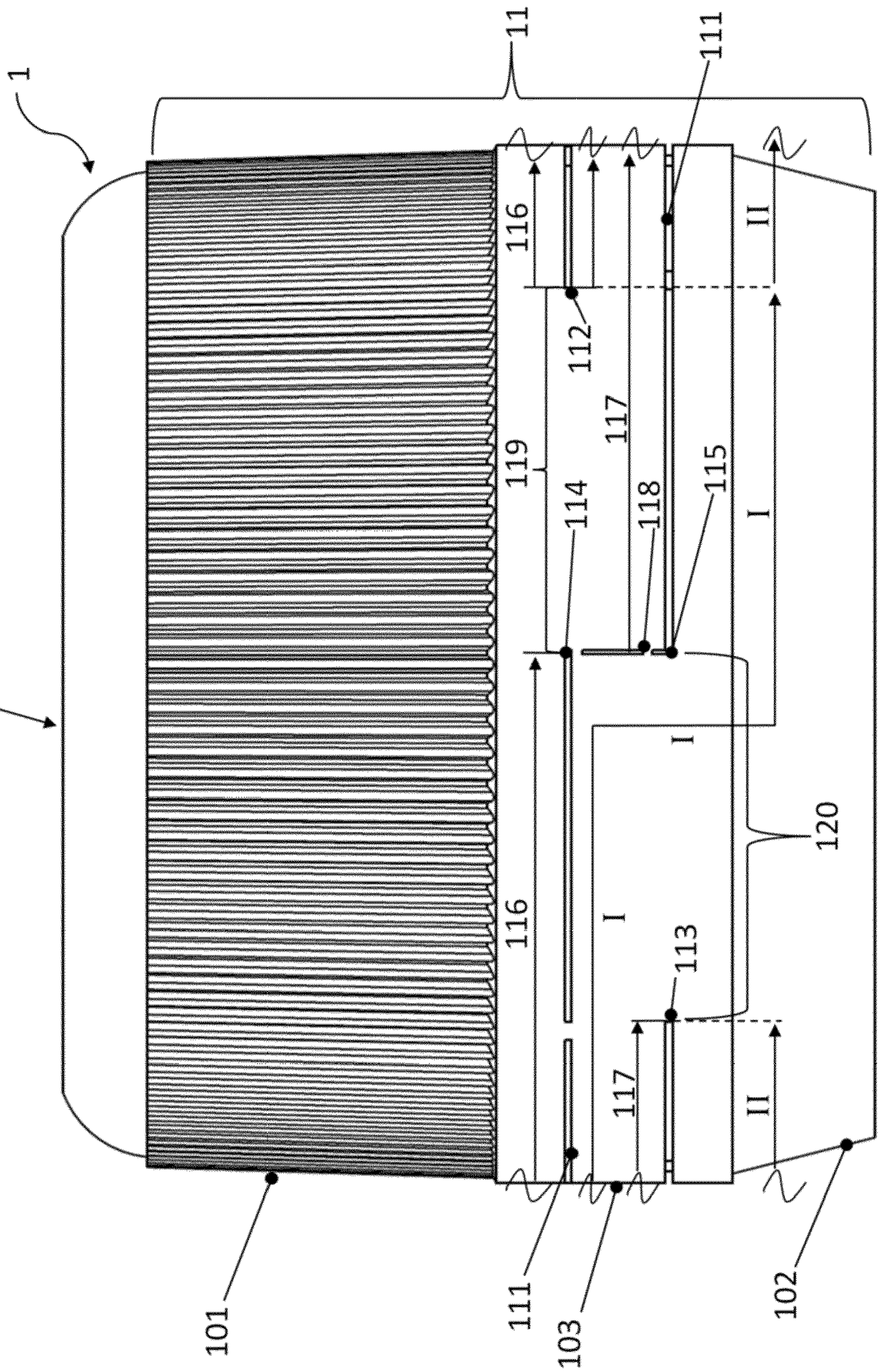
1
10
11
101
102
103
111
111
112
113
114
115
116
116
117
117
118
119
120
I
I
I
II
II

Fig. 1

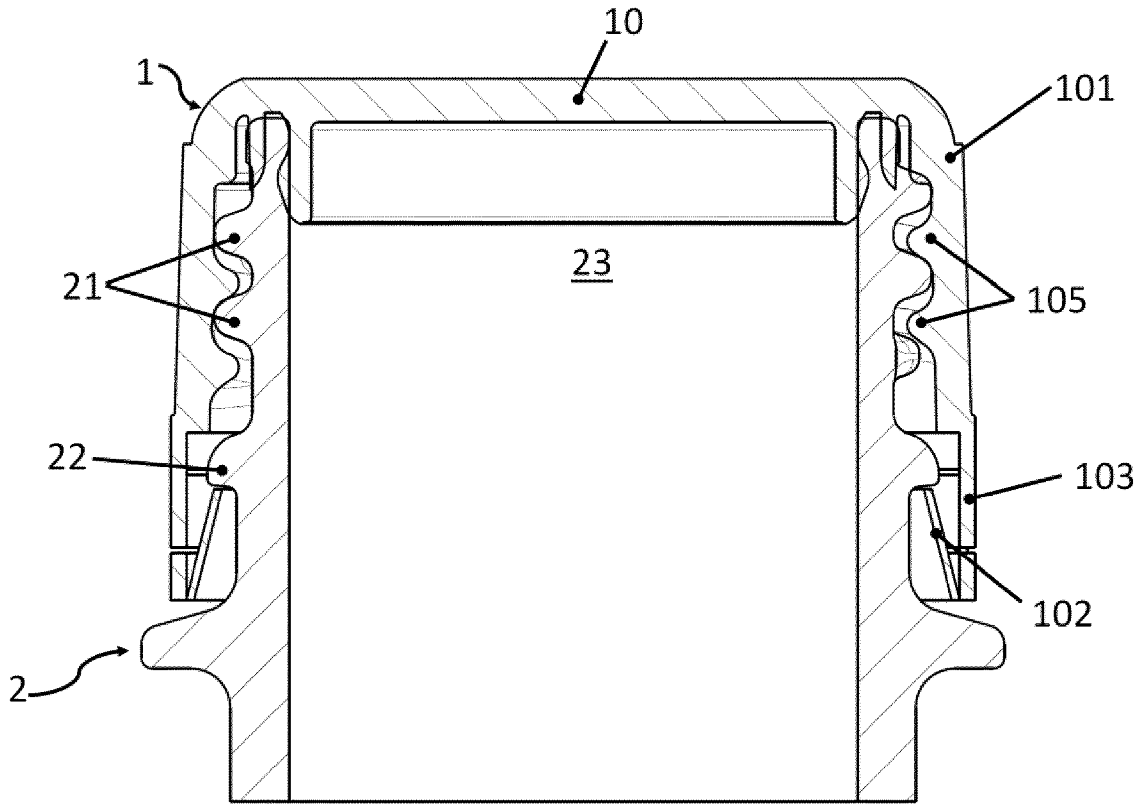
10
1
101
21
23
105
22
103
102
2

Fig. 2

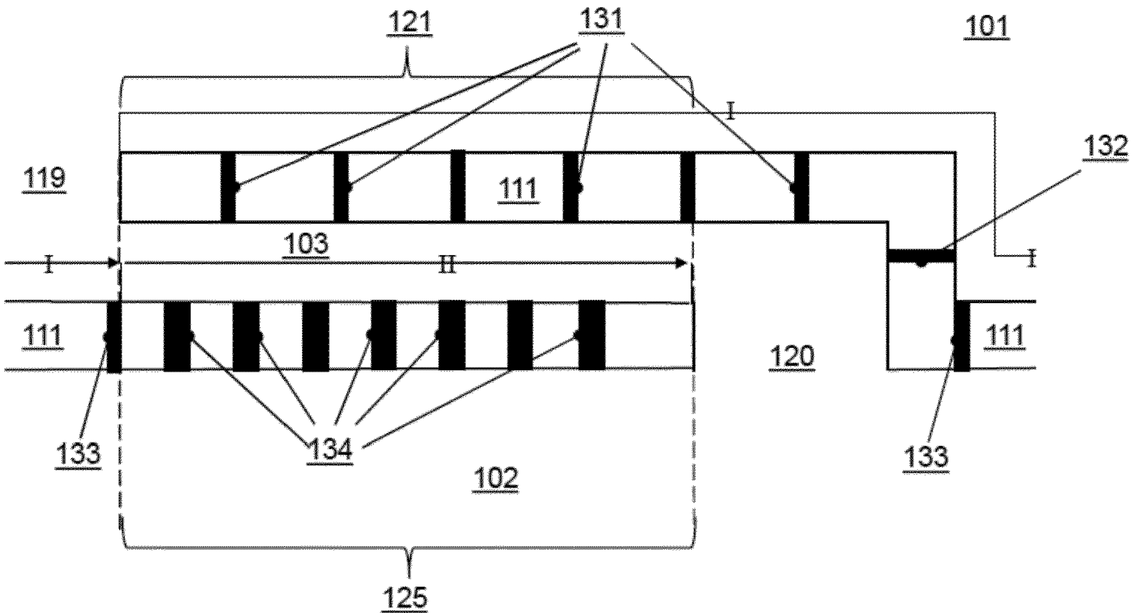
121
131
101
I
119
111
132
103
I
II
I
111
120
111
133
134
102
133
125

Fig. 3

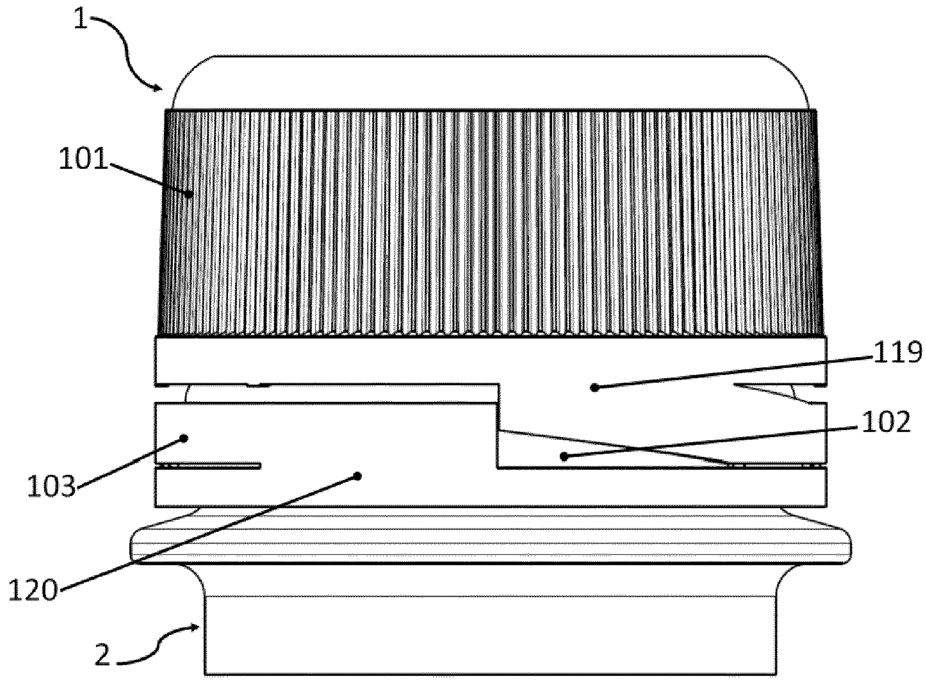

Fig. 4

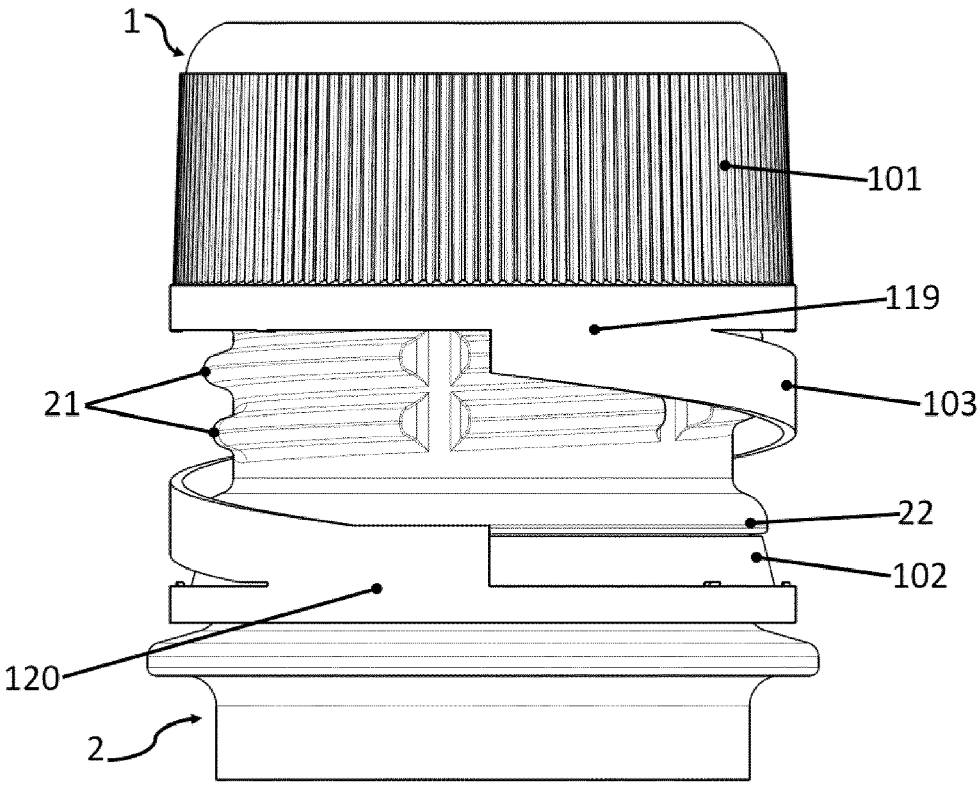

Fig. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 16 8466

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	EP 1 961 669 A2 (BERMAN RONALD H [US]) 27 August 2008 (2008-08-27) * paragraphs [0017], [0018]; figures *	1-6,8, 10-12,15 7,9,13 14	INV. B65D41/34 B65D55/16
Y,D	CN 201 209 040 Y (LU RUIYING [CN]) 18 March 2009 (2009-03-18) * the whole document *	7	
Y	US 4 805 792 A (LECINSKI JR FRANK H [US]) 21 February 1989 (1989-02-21) * column 3, lines 20-32; figures 2,6-7 *	9,13	

TECHNICAL FIELDS SEARCHED (IPC)

B65D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	23 September 2020	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

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 8466

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-09-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1961669 A2	27-08-2008	EP 1961669 A2 US 2008197135 A1	27-08-2008 21-08-2008
CN 201209040 Y	18-03-2009	NONE	
US 4805792 A	21-02-1989	NONE	

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20090236304 A **[0003]**
- US 4394918 A **[0003]**
- US 20180370701 A **[0003]**
- JP 2017119538 A **[0003]**
- CN 201209040 Y **[0003]**
- JP 2005041566 A **[0003]**