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(54) **Tamper evident closure cap and combination comprising the said closure and a container**

(57) This invention relates to tamper evident closure caps (1;101) comprising a top panel (2) and a cylindrical skirt (3) depending from the periphery of the top panel (2) and to combinations of a closure cap (1;101) and a container (20) According to the invention the closure cap (1;101) comprises a tamper indicating band (4), frangibly connected to the open end (5) of the skirt (3), wherein the tamper evident band (4) at its lower edge (6) comprises at least one hingedly connected retaining element (7), which extends with its distal edge (8) radially inwardly and towards the top panel (2) when the cap (1;101) is in the screwed on position. The retaining element (7) has at least one recess (9), forming a window or a hollow, such that a protruding element on a corresponding container neck may engage in the said recess (9) when the closure is screwed on.

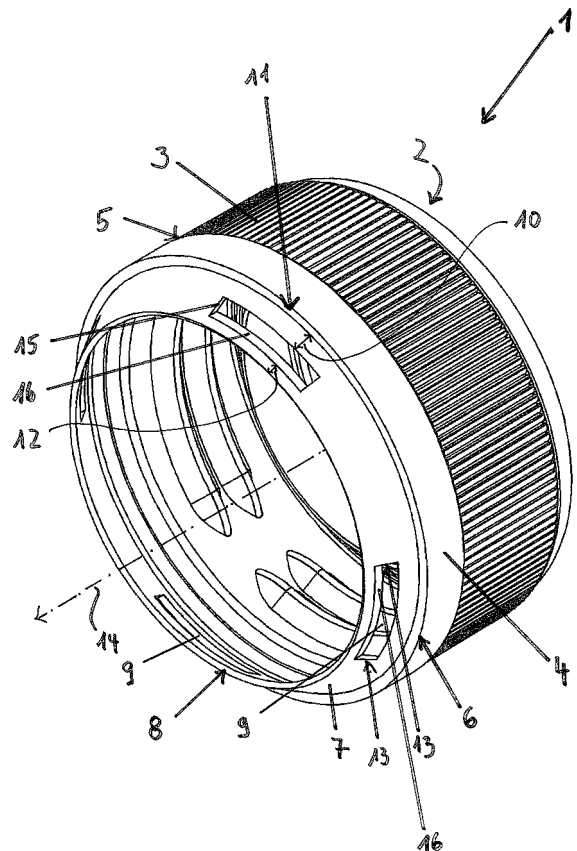


Fig. 1

## Description

**[0001]** This invention relates generally to the field of packaging technology, and in particular to tamper evident closure caps comprising a top panel and a cylindrical skirt depending from the periphery of the top panel and to combinations of a closure cap and a container.

**[0002]** Such tamper evident closure caps for bottles and other resealable containers are provided with some form of tamper-evident feature, which is designed to make it apparent to a consumer that a container has been opened. Many conventional tamper evident closures utilize what is known as a tamper evident band. Commonly, the tamper evident band with its upper edge is frangibly connected to the open end of the skirt portion of the closure by a line of weakness, for example, frangible bridges or a scored line. The tamper evident band is designed to be retained by the container and to rupture or become separated from the consumer removable portion of the closure during initial opening.

**[0003]** Typically the container itself includes a retention structure, for example an annular ring or a rotational locking structure for engaging the tamper indicating band, being located below a threaded section of the container finish. The tamper evident band and the mating retention structure of the container are usually designed so that the tamper evident band slips over the retention structure without damage during the initial application of the closure onto the container at the packaging plant, but the subsequent removal of the tamper evident band from the container will be difficult. After opening the closure the tamper evident band usually rests beneath the retention structure on the container finish.

**[0004]** A retaining element such as a radially inwardly directed band, folded flaps or protruding elements on the interior of the tamper evident band prevents the tamper evident band from being removed due to engagement of the retaining element with the retention structure on the container when the closure is unscrewed for first removal. This means that there is some resistance to unscrewing of the closure, until the line of weakness or bridges fracture, consequently allowing removal of the closure, with the tamper evident band remaining in position below the retention structure and indicating that the closure has been opened.

**[0005]** In another known closure, commonly referred to as a "pig-tail closure", the line of weakness between the tamper evident band and the skirt portion of the closure does not continue around the entire circumference. Consequently, when the consumer unscrews the closure for the first time, the line of weakness fractures and the tamper evident band breaks, allowing removal of the closure with the broken tamper evident band still attached to a section of the skirt portion of the closure.

**[0006]** One type of tamper evident band that is in commercial use includes a first portion that is frangibly connected to the consumer removable portion of the closure and a second retention portion, commonly known as a

J-hook, that is molded so as to angle radially inwardly and upwardly from a lower portion of the tamper evident band in order to engage a retention structure such as an annular ring on the container. During initial application of the closure, the retention portion slips over the retention structure because of the inward and upward angling, but once it slips over the retention structure it locks against the lower side of the retention structure, making it difficult to remove the tamper evident band from the container. An example of such a closure is disclosed in U.S. Pat. No. 5,400,913 to Kelly.

**[0007]** Such closures are valued for their strength and ease of application.

**[0008]** A problem associated with such closures results from the inherent elasticity of some types of plastic materials. If the closure is slowly and carefully slightly unscrewed, it may be possible, particularly at elevated temperatures, to stretch the bridges.

**[0009]** Closures adequate for carbonated beverages usually have short plug seals to the contents of the container. For example for these types of closures it may be possible for the closure seal to be opened prior to the bridges breaking. In some instances it may be possible for a closure even to be removed from the container with the tamper evident band still joined to the closure.

**[0010]** Subsequently returning the closure to its original position would mean that a possible contamination was not evident to the consumer.

**[0011]** Other types of closures have been developed that ensure separation of the tamper evident band from the closure during opening by arresting rotational movement of the tamper evident band with respect to the closure during opening. One example of this would be U.S. Pat. No. 5,040,692 disclosing a tamper indicating closure, in which ratchet teeth are molded into the tamper evident band. These teeth engage similar projections that are molded beneath the finish portion of a container to which the closure is applied. While closures of this type are no doubt effective, they require the molding of a relatively thick tamper evident band, which increases material costs.

**[0012]** There are further types of known closures which combine an axial retention structure with a rotational arresting. These types of closures are very effective, especially with respect to a tamper evidence in case of an improper opening. Nevertheless these closure bear the risk that a regular opening may be too difficult, especially for elderly people or children, because the torque needed for unscrewing is to high.

**[0013]** Thus there is a requirement in the packaging industry to provide some form of tamper evident closures which overcomes the drawbacks of the prior art. It should be difficult if not impossible for the contents of the containers to be manipulated or otherwise tampered without it being immediately apparent to a user. The present invention seeks overcome these drawbacks and to provide a closure in which the line of weakness breaks before the closure is substantially opened, for example before

the sealing is released and which is comfortable to use for a consumer.

**[0014]** In order to achieve this and other objects of the invention according to a first aspect of the invention there is provided a tamper evident closure with the characteristics of claim 1.

**[0015]** The closure cap comprises a top panel, a cylindrical skirt depending from the periphery of the top panel and a tamper indicating band, which is frangibly connected to the open end of the skirt. At its lower edge the tamper evident band comprises at least one hingedly connected retaining element, for example an annular retaining band or a retaining flap, which extends with its distal edge radially inwardly and towards the top panel when the cap is in the screwed on position. The retaining element has at least one recess forming a window or a hollow. The at least one recess is located in a distance from the hinged connection between the lower edge of the tamper indicating band and the retaining element and is further located in a distance from the distal edge of the annular retaining ring.

**[0016]** The recess forms a window or a hollow with an opening facing the central axis of the closure when the closure is in the screwed on position, such that a corresponding element on the container neck may engage in the opening when the closure is screwed on.

**[0017]** An inside surface on a lateral side of the recess may provide a retaining surface in axial and/or rotational direction. The at least one recess hence provides a resistance against rotational and/or axial movement of the tamper indicating band when the closure is unscrewed from the container, which leads to a quick separation of the tamper indicating band from the body portion of the closure.

**[0018]** The distance between the recess and the lower end of the tamper indicating band as well as the distance between the recess and the distal edge of the retaining element provides a certain stability of the retaining element. An improper opening without regularly screwing off the closure is thereby impeded. Due to the stability of the retaining element it is difficult to bend it downwards even with a tool when the closure is in its screwed on position.

**[0019]** Additionally the distal edge of the retaining element, particularly including the part above a recess, may also provide a retaining surface which may lock against the lower side of a retention structure of the container neck.

**[0020]** On the other hand, in particular, when the recess forms a window, the retaining band is flexible enough to at least partly slip over a retention structure on the container neck during initial application to the container.

**[0021]** Since the inside surface of the recess may provide a retaining surface the retaining feature is given by omitting material. There is no need of molding a relatively thick tamper evident band, thus material costs are reduced.

**[0022]** Preferably the lateral inside surfaces of the recess are parallel to the axis of the closure, when the retaining element is in the moulding position, such that demolding is facilitated.

5 **[0023]** In a preferred embodiment of the invention the recess has at least one recess engagement surface adapted to engage a corresponding element on a container neck, particularly in circumferential direction.

10 **[0024]** When the connection of the tamper evident band breaks due to resistance against a rotational force, an opening sequence is possible, wherein first the line of weakness breaks and subsequently the closure is substantially opened. Since there is no need of a substantial axial displacement between the body of the closure and the tamper indicating band to break the line of weakness, the opening sequence is assured even if there is only a short plug seal.

15 **[0025]** The frangible connection between the open end of the skirt and the tamper indicating band may also comprise parts of stronger connection and parts of weaker connection wherein the parts of weaker connection are located near the recess engagement surface of the recess in screw off direction. When the closure is screwed off and the recess engagement surface butts against a corresponding element of the container neck in circumferential direction, the weaker parts of the frangible connection are charged first and do break. After that the whole force is distributed to the stronger parts of the connection which break subsequently. The weaker and stronger parts may be provided for example by thinner and thicker bridges.

20 **[0026]** In a preferred embodiment of the invention the recess has a quadrangular periphery. Thus each recess provides four sides. Respective facing sides may provide a retaining surface for engagement with a corresponding retention structure on the container neck when the closure is opened and a trailing surface for slipping over the retention structure when the closure is applied to the container neck.

30 **[0027]** Preferably two facing sides of the recess are parallel and are running in an axial direction, such that they may engage with a corresponding retention structure in the container neck in circumferential direction.

35 **[0028]** In a favourable embodiment of the invention at least one of the substantially circumferentially running surfaces of the recess defines a ramp to increase the axial and/or rotational force on the weakening line upon opening.

40 **[0029]** When the closure is opened, the corresponding retention structure on the container neck, which engages the recess, is led by the surface which is inclined to define a ramp. Preferably the ramp is designed to lead the retention structure towards a narrower part of the recess, such that a consumer automatically increases the turning force in the moment when it is necessary for breaking the frangible connection.

45 **[0030]** In a further beneficial embodiment of the invention the closure comprises at least two recesses. In this

embodiment, the circumferential distances between the recesses may be chosen to be not equal. Usually on container necks circumferential retention structures are distributed in equal distances, because this design eases the removal of the preform from the mould. If a closure with unequal distances between the recesses is screwed off from such a container neck, there is at least one recess engagement surface which initially abuts against a corresponding circumferential retention structure first. The part of the line of weakness near that recess is charged first. As soon as this part is broken, the next recess engagement surfaces come in contact with the corresponding retention structure. Preferably there are at least two groups of recesses providing an at least two step opening sequence. More preferably in each group the recesses are arranged symmetrically with respect to each other.

**[0031]** According to a further aspect of the invention there is provided in combination a closure cap as described above and a container neck with the characteristics of claim 8.

**[0032]** The container neck comprises at least one rotational locking element with a ratchet surface. When the closure is applied to the container neck the recess engagement surface of at least one recess, forming a window or a hollow, engages a ratchet surface so as to resist rotation with respect to the container when the cap is screwed off.

**[0033]** The rotational locking element further comprises a trailing edge which allows slipping of at least a part of the retaining element over the locking element during initial application.

**[0034]** To provide an opening sequence in which a part of the line of weakness breaks before the rest preferably the distance between neighbouring rotational locking elements may be different from the distance between neighbouring recesses.

**[0035]** Thus not all of the recess engagement surfaces abut against a corresponding rotational locking structure at the same time when the closure is opened. The parts of the line of weakness which are closer to the recesses first coming into contact with a corresponding rotational locking structure break first. Subsequently those parts of the line of weakness break which are close to the recesses coming into contact with a corresponding rotational locking structure next.

**[0036]** In a further advantageous embodiment of the invention the number of rotational locking elements on the container neck is different from the number of recesses on the closure cap, preferably there are more recesses than rotational locking structures.

**[0037]** Since in the screwed on position each locking structure should engage in a recess, there may be more than one angular position of the closure cap with respect to the container neck.

**[0038]** The angular position of the recesses may provide for an opening sequence during breaking of the frangible connection between the body of the closure and the tamper indicating band.

**[0039]** Further benefits and advantages of the present invention will be described in the description and with reference to the following drawings.

5 Brief description of the drawings:

**[0040]**

- Figure 1 is a perspective view of a first example of a closure cap;  
 Figure 2 is a perspective view of a container neck;  
 Figure 3 is a perspective view of a second example of a closure cap;  
 Figure 4 is an enlarged fragmentary perspective view of the retaining band with a recess;  
 Figure 5 is a bottom plan view of a combination of a closure cap and a container neck.

**[0041]** The embodiments described below are merely exemplary and are not intended to limit the invention to the precise forms disclosed. Instead the embodiments were selected for description to enable one of the ordinary skill in the art to practice the invention.

**[0042]** Figure 1 shows a perspective view of a closure cap 1. The closure cap 1 comprises a top panel 2, a cylindrical skirt 3 depending from the periphery of the top panel 2, and a tamper indicating band 4, frangibly connected to the open end 5 of the skirt 3. The tamper evident band 4 at its lower edge 6 comprises at least one hingedly connected retaining element 7, in this example an annular retaining band, which extends with its distal edge 8 radially inwardly and towards the top panel 2 when the cap 1 is in the screwed on position. The figure shows the cap 1 in its molded position before it is applied to a container neck 20 as shown in the following figure. During initial application of the closure 1 the retention portion 7 will flap inwardly and upwardly.

**[0043]** The annular ring 7 has four recesses 9, each recess forming a window and being located in a distance 10 from the hinged connection 11 between the lower edge 6 of the tamper indicating band 4 and the retaining element 7. Each recess 9 is further located in a distance 12 from the distal edge 8 of the annular retaining ring 7.

**[0044]** Each recess 9 has a quadrangular periphery, whereby two facing sides 13 of the recess are parallel and have an axial direction 14. Each window 9 comprises one recess engagement surface 15 being adapted to engage a corresponding element 22 on a container neck 20 as shown in the following figure.

**[0045]** The inside surfaces 16 of the windows 9 are designed to be parallel to the axis 14 of the closure cap 1 in the moulding position to ease demolding.

**[0046]** Figure 2 shows a perspective view of a container neck 20.

**[0047]** Below a threaded section 21 the container neck 20 comprises four rotational locking elements 22, each having a ratchet surface 23.

**[0048]** The recess engagement surface 15 of a closure

cap 1 as presented in Figure 1 may engage a ratchet surface 23 so as to resist rotation with respect to the container neck 20 when the closure cap 1 is screwed off the container neck 20.

**[0049]** Each rotational locking element 22 further comprises a trailing edge 24 which allows slipping of at least a part of the retaining element 7 over the locking element 22 during initial application of the closure cap 1.

**[0050]** Figure 3 shows a perspective view of a second example of a closure cap 101. The closure cap 101 comprises a retaining element 7 with recesses 9 formed as hollows 9h. The hollows 9h are closed towards the inside 17 of the retaining element 7.

**[0051]** Figure 4 shows an enlarged fragmentary perspective view of the retaining element 7 with a recess 9. The recess has a quadrangular periphery 18. One of the substantially circumferential running surfaces 16 is inclined and defines a ramp 19 to increase the axial breaking force.

**[0052]** When the closure cap is turned in the opening direction D, the rotational locking element 22 (not shown in this figure) is led toward the narrower part 28 of the recess 9 and comes into contact with the ramp 19. Hence the retaining element 7 has no more freedom to move upwards and there is an axial force on the weakening line.

**[0053]** Figure 5 is a bottom plan view of a combination of a closure cap 1 and a container neck 20.

**[0054]** The closure 1 comprises at least four recesses 9 and the circumferential distances 25, 26 between the recesses 9 are not equal.

**[0055]** The circumferential distance 27 between neighbouring rotational locking elements 22 is different from the distances 25, 26 between neighbouring recesses 9. This arrangement allows for an opening sequence wherein the weakening line is burdened successively part after part.

## Claims

### 1. A closure cap comprising

- a top panel (2),
- a cylindrical skirt (3) depending from the periphery of the top panel (2) and
- a tamper indicating band (4), frangibly connected to the open end (5) of the skirt (3),

wherein the tamper evident band (4) at its lower edge (6) comprises at least one hingedly connected retaining element (7), which extends with its distal edge (8) radially inwardly and towards the top panel (2) when the cap (1; 101) is in the screwed on position, the retaining element (7) having at least one recess (9), forming a window or a hollow, the recess (9) being located in a distance (10) from the hinged connection (11) between the lower edge (6) of the tamper indicating band (4) and the retaining element

(7) and being located in a distance (12) from the distal edge (8) of the annular retaining ring (7).

2. A closure cap according to claim 1, wherein the recess (9) has at least one recess engagement surface (15) adapted to engage a corresponding element (22) on a container neck (20), particularly in circumferential direction.
3. A closure cap according to at least one of the preceding claims, wherein the frangible connection (14) between the open end (5) of the skirt (3) and the tamper indicating band (4) comprises parts of stronger connection and parts of weaker connection wherein the parts of weaker connection are located near the recess engagement surface of the recess in screw off direction.
4. A closure cap according to at least one of the preceding claims, wherein the recess (9) has a quadrangular periphery (18).
5. A closure cap according to claim 4, wherein two facing sides (13) of the recess (9) are parallel and have an axial direction (14).
6. A closure cap according to claim 4 or 5, wherein at least one of the substantially circumferentially running surfaces (16) of the recess (9) is inclined with respect to a plane perpendicular to the axis (14) such as to define a ramp (19) to increase the axial force on the weakening line upon opening.
7. A closure cap according to at least one of the preceding claims, wherein the closure (1; 101) comprises at least two recesses (9) and the circumferential distances (25, 26) between the recesses are not equal.
8. A closure cap according to at least one of the preceding claims, wherein the inside surfaces (16) of the at least two recesses (9) are parallel to the axis (14) of the closure cap (1; 101) when the retaining band (7) is in its moulding position.
9. In combination, a closure cap according to one of the previous claims and a container neck, the container neck (20) comprising at least one rotational locking element (22) with a ratchet surface (23), wherein the recess engagement surface (15) of at least one recess (9), forming a window or a hollow, engages a ratchet surface (23) so as to resist rotation with respect to the container (20) when the closure cap (1; 101) is screwed off.
10. Combination according to claim 9, wherein the distance between neighbouring rotational locking elements (22) is different from the distance (25, 26) be-

tween neighbouring recesses (9).

11. Combination according to claim 9 or 10, wherein the number of rotational locking elements (22) on the container neck is different from the number of recesses (9) on the closure cap (1; 101).

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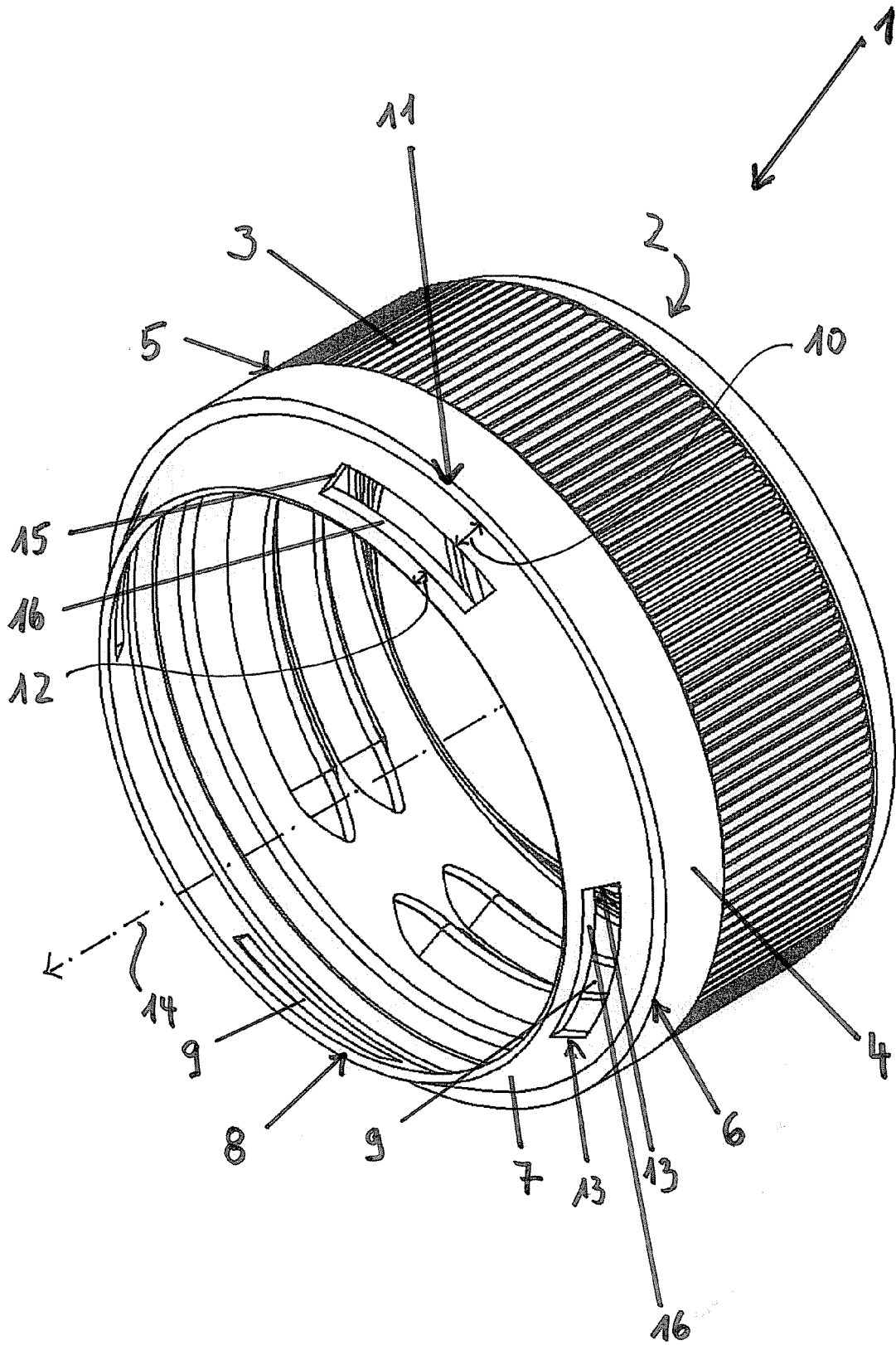


Fig. 1

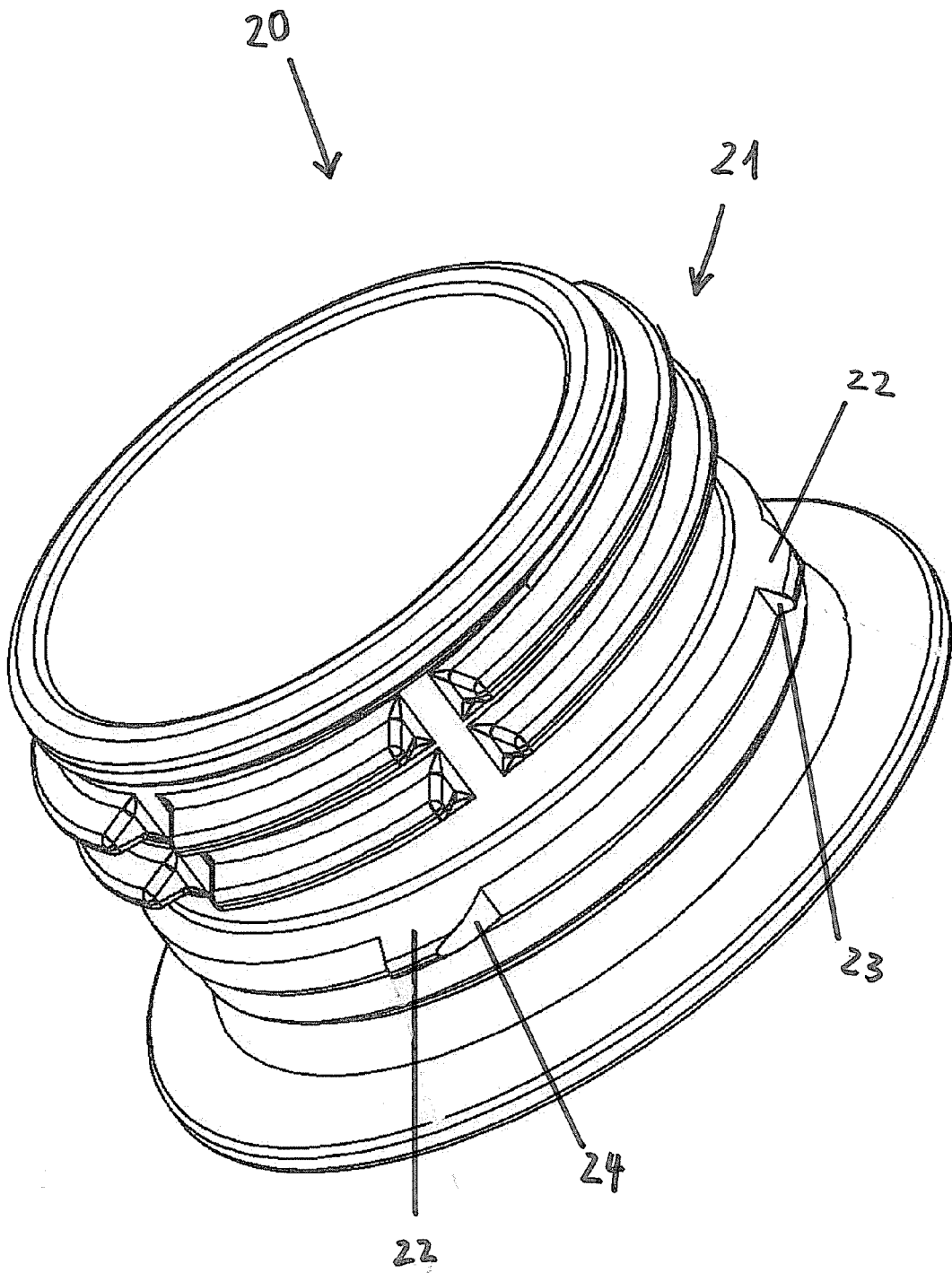


Fig. 2



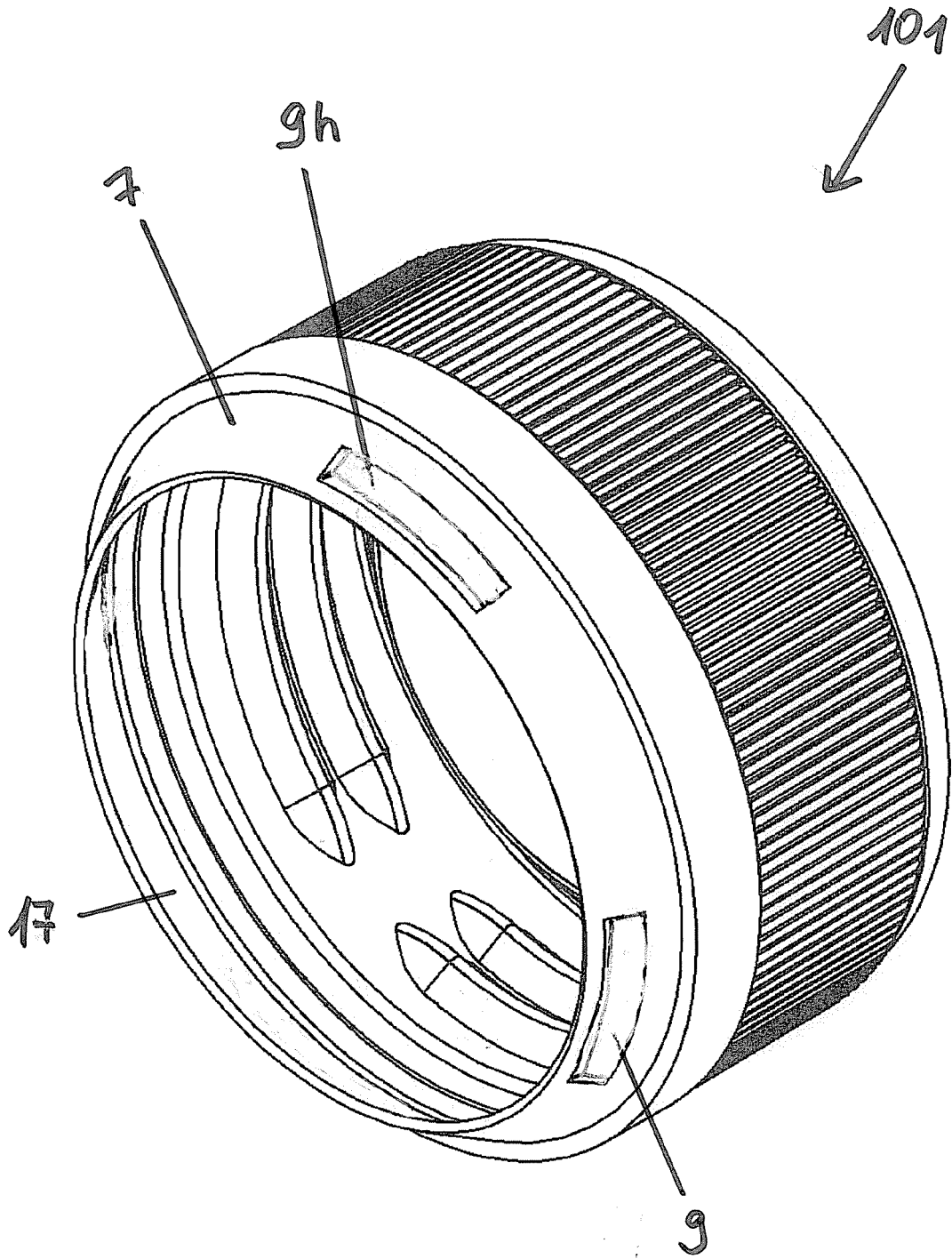


Fig. 3

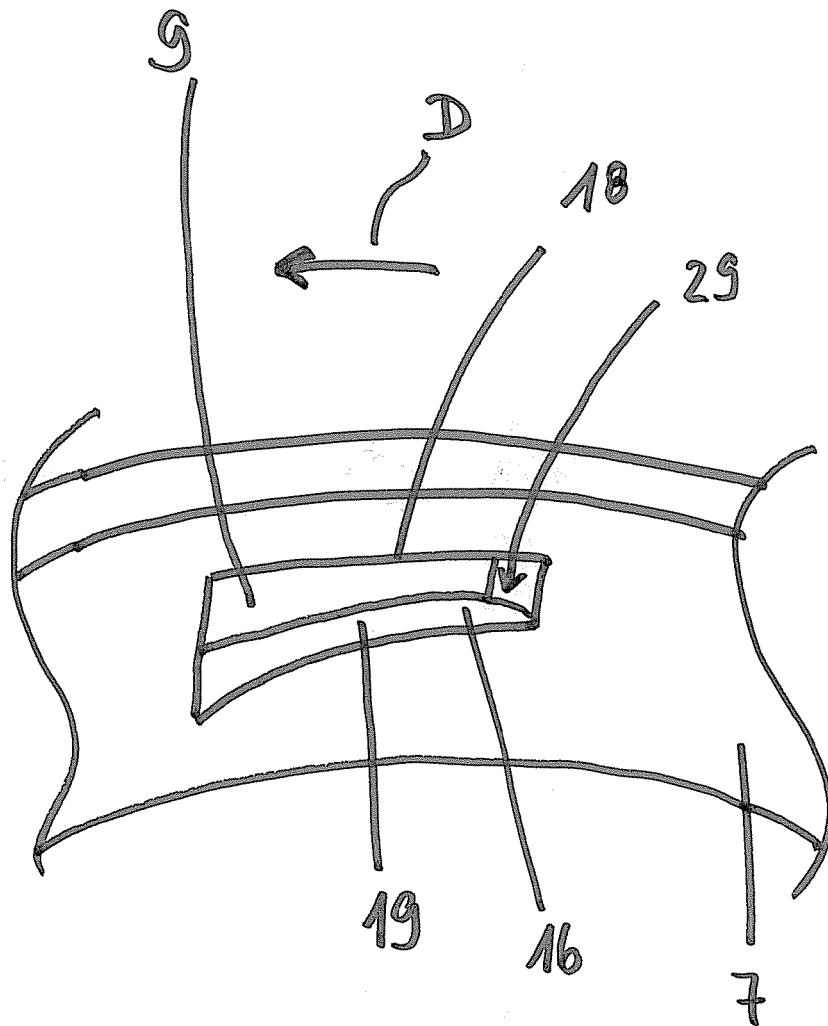


Fig. 4

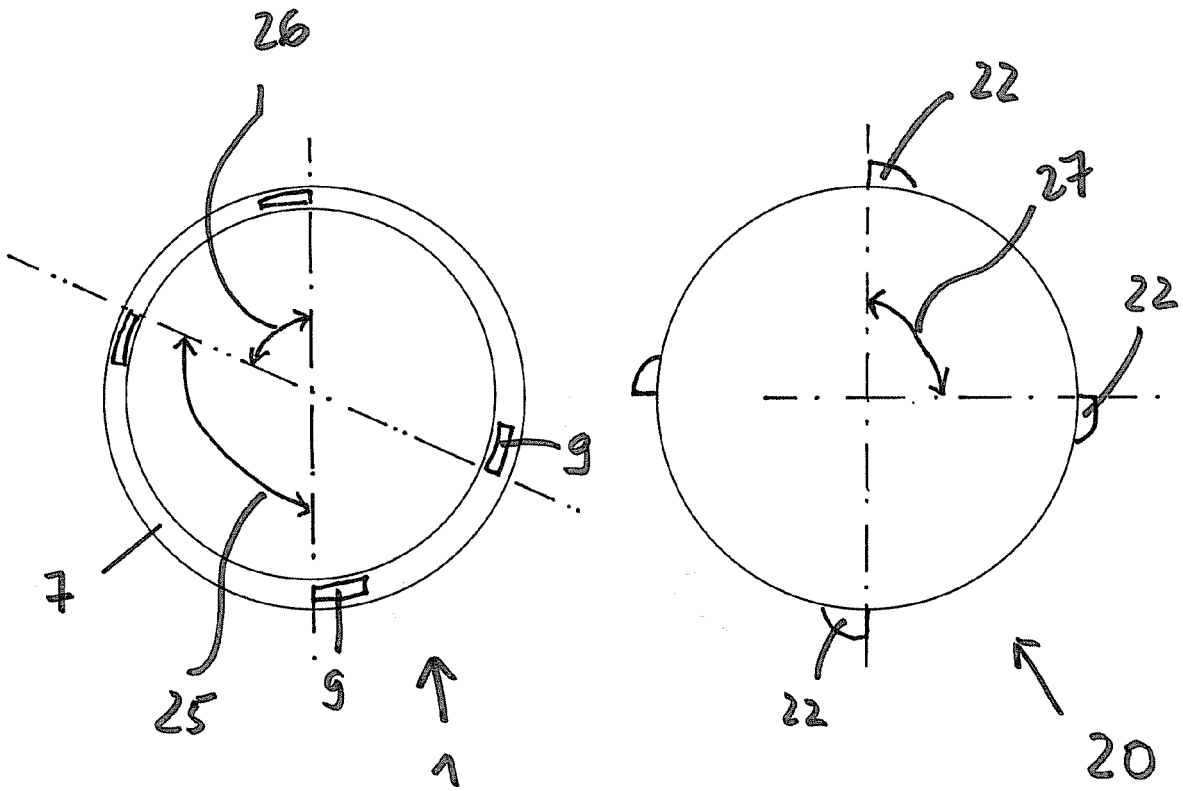


Fig. 5



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The present search report has been drawn up for all claims				
Place of search Munich		Date of completion of the search 2 July 2008	Examiner Segerer, Heiko	
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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