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(71) Applicant: **SIG Services AG**
8212 Neuhausen am Rheinfall (CH)

(72) Inventors:
- **Hajdari-Redzepi, Valona**
  8212 Neuhausen am Rheinfall (CH)
- **Himmelsbach, Sven**
  8260 Stein am Rhein (CH)
- **Koller, David**
  5442 Fislisbach (CH)

(74) Representative: **Cohausz & Florack**
Patent- & Rechtsanwälte
Partnerschaftsgesellschaft mbB
Bleichstraße 14
40211 Düsseldorf (DE)

(54) RECLOSABLE CAP TO BE MOUNTED ON A SPOUT OF A CONTAINER

(57) Shown and described is a reclosable cap (1) to be mounted on a spout of a container, comprising
- a cylindrical lateral wall (2) extending around an axis (Z) and a top wall (3) positioned at one end of the lateral wall (2),
- a first separating line (SL1) provided circumferentially around the lateral wall (2) to define an anchor ring (8) and a lid (4), wherein the first separating line (SL1) extends between a first end section (12) and a second end section (13), the end sections (12, 13) being spaced apart from each other circumferentially to provide a connection portion (14) connecting the anchor ring (8) and the lid (4), and
- a second separating line (SL2) provided circumferentially around the lateral wall (2) between a first and a second end, substantially parallel to the first separating line (SL1) and located on the anchor ring (8). In order to configure and further develop a reclosable cap (1) with a simple design and cheaper production costs without the risk of breakup of the tether arms (8A) and to achieve an improved force distribution at the ends of the separating lines (SL1 and SL2), the end sections (12, 13) each span an angle $\gamma > 6°$ of the circumference of the lateral wall (2) and define a transition from full wall thickness of the connection portion (14) to the first separating line (SL1), and wherein each end section (12, 13) is bordered axially by reinforcing sections (RS) which have substantially the same lateral wall thickness as the connection portion (14), measured radially.

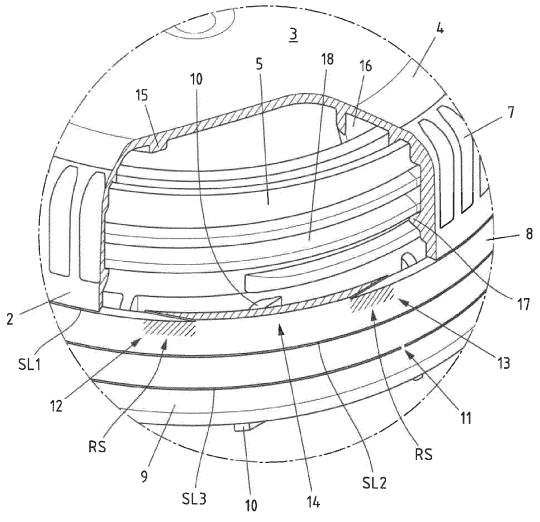

Fig.3

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Description

[0001] The invention relates to a reclosable cap to be mounted on a spout of a container, comprising

- a cylindrical lateral wall extending around an axis and a top wall positioned at one end of the lateral wall,
- a first separating line provided circumferentially around the lateral wall to define an anchor ring and a lid, wherein the first separating line extends between a first end section and a second end section, the end sections being spaced apart from each other circumferentially to provide a connection portion connecting the anchor ring and the lid, and

a second separating line provided circumferentially around the lateral wall between a first and a second end, substantially parallel to the first separating line and located on the anchor ring.

[0002] For the last few years, there has been a need to ensure that small pieces of plastic cannot be released separately into the environment (EU Directive 2019/904). Therefore, plastic lids of containers must be connected to the respective spout element by means of connecting bands in order to reliably avoid separation of such lids.

[0003] Reclosable caps for bottles or as part of pouring elements for containers, e.g., beverage containers, have long been known in many variations. Such pouring elements comprise in general a base element with a flange to be sealed onto the surface of a package, e.g., a carton/polymer-composite package, and a spout with a pouring opening wherein the pouring opening is opened and reclosed by a cap, e.g. a screw cap. These pouring elements additionally have an opening element, e.g., a cutting element, arranged inside the spout. Such an opening element opens the package during the initial opening by means of a reclosable cap.

[0004] The cutting element may be shaped as cutting ring movably guided inside the spout and driven by unscrewing the reclosable cap. The rotation of the cap, generally in an anti-clockwise direction, is used to rotate the cutting ring in the direction onto the surface of the package. In the area of the later opening, a package might comprise a so called "overcoated hole" (OCH) consisting of a hole in the carton material being laminated with a thin plastic layer, e.g., made from polyethylene (PE), on both sides of the carton layer. Other packages may be provided with weakened zones, e.g., perforations, in order to allow an easier cutting of the package material during the initial opening of such packages.

[0005] In order to ensure that the reclosable caps of packages do not enter the environment unintentionally, it is desirable to secure these screw caps to their respective package so that loose plastic parts are reliably avoided even when the package is open.

[0006] Elements which ensure a secure fastening of screw caps to their respective package even in the opened state have long been known from the prior art in the area of closures for commercially available PET bottles. What the known PET bottles have in common is that the cylindrical main body has a bottle neck which is significantly narrower than the main body, so that a screw cap provided with a fastening element can be pivoted away significantly over 120°.

[0007] A closure device for a PET bottle with a ring arranged under the screw cap is known from EP 1 124 734 B1, said ring being connected to the screw cap via a film hinge and preventing the screw cap from being pulled off even in the opened state.

[0008] US 5 215 204 A shows a closure cap for a bottle with a ring arranged under the screw cap, said ring being connected to the screw cap in a materially-bonded manner via two connecting bridges. The ring and the bottle are designed in such manner that the ring cannot be pulled off the bottle.

[0009] Another cap for closing a container is known from WO 2021/014287 A1. This generic cap comprises a side wall and a top wall forming a closure element and a retaining ring to ensure that the cap remains anchored to a neck of a container provided with a spout element being part of or adhered to said container. The cap is separated by a first separating line from the retaining ring wherein a second separating line, arranged substantially parallel to the first separating line, forms connecting bands as part of the retaining ring in order to allow an easier handling during opening and reclosing the cap.

[0010] Since such caps might be opened and reclosed repeatedly, the ends of these separating lines and thus the connection bands may be damaged or even destroyed in case of high and/or repeated forces on the connecting bands. In the past, different solutions have been found in order to minimize the stress in the cut endings, e.g., rounded endings are known from WO 2021/014287 A1. The aforementioned solutions are demanding and complex to produce. Another reclosable container cap is known from EP 3 689 774 A1. However, its design is even more complex than the aforementioned solutions. It also specifically weakens the walls near the ends of the separating lines so that the cap can be opened up to 180° pivot angle more easily.

[0011] Based on this, the object underlying the present invention is to configure and further develop a reclosable cap with a simple design and cheaper production costs without additional risk of breaking the connecting bands. Furthermore, it is desirable to achieve an improved force distribution at the ends of the separating lines so that no force spikes are introduced in these relatively weak areas of the cap.

[0012] These objects are achieved in the case of a reclosable cap element with the features of the preamble of claim 1 in that the end sections each span an angle $\gamma > 6°$ of the circumference of the lateral wall and define a transition from full wall thickness of the connection portion to the first separating line, and in that each end section is bordered axially by reinforcing sections. The reinforcing sections specifically ensure that the forces acting

on this border region will be distributed as evenly as possible. The polymer wall can still deform plastically, but in a more spread-out manner, e.g., along a bigger stretch of the tether arms below the first separating line. This inhibits stress spikes from forming and damaging a single part of or around the tether bands which could lead to tears and complete breakage of the tether. The aforementioned stresswhitening is simply the first step in this process, especially when opening and reclosing the tethered cap several times.

[0013] The end sections have a transition from full wall thickness to a very thin skin, before ending in the first separating line. The transition itself already serves to distribute forces more evenly rather than concentrating them into a single point. Moreover, the mentioned thin skin at the ultimate area of the end zone allows small damage to occur (when opening the cap) in a sort of predetermined breaking point or simply by stretching the skin. The beginnings of such a small crack then gets stuck in the increasing wall thickness of the end zone, rather than branching out and tearing into weaker parts. Again, this gets even more pronounced with the addition of the reinforcing sections which funnel this controlled force propagation along. A short end as it was known in the prior art directs forces introduced during opening straight across the wall of the cap, whereas the present invention allows for such forces to be more spread out and directed partly along the circumferences.

[0014] A further teaching of the invention provides that the reinforcing sections have substantially the same lateral wall thickness as the connection portion, measured radially. This allows for a simplified production where the positioning of the separating lines and the cap itself does not need to be aligned perfectly during production.

[0015] In a particularly preferred configuration of the invention, the end sections each span an angle $\gamma > 8°$ of the circumference of the lateral wall in order to achieve a sufficient force distribution. The longer end zones also guarantee reinforcing sections as these at least span the same length. Preferred angle ranges are $6° < \gamma < 12°$ or $8° < \gamma < 15°$, respectively.

[0016] According to another preferred configuration, the first and the second end sections of the first separating line are formed by a gradual reduction in wall thickness along a circumferentially direction.

[0017] A preferred design of the invention provides that the connection portion spans circumferentially an angle δ of 20 to 40°. This ensures that the connection portion can act as reliable hinge for the cap during pivoting open and later closing thereof. On the other hand, a connection portion that spans at most 40° ensures the flexibility of it and the adjacent reinforcing sections stays high enough that no additional forces are introduced inherent with a bigger and thus stiffer connection portion. Preferably, the ratio of δ/γ is between 2.8 and 3.5. Tests have shown that ratios in this range with a rather small connection portion further increase the advantage detailed above. For example, a ratio of 3 means that the end and reinforcing sections make up 40% of the circumferential distance (delta + 2 gamma). These relatively large end sections direct the resulting forces further away and into the side wall, rather than towards the central axis.

[0018] A further teaching of the invention is characterised in that the first separating line and the second separating line overlap in the circumferential direction and in that the connection portion is arranged substantially in the centre of the second separating line. This allows a symmetric design and an optimized function of the reclosable cap.

[0019] According to a further preferred embodiment of the invention, the parallel ends of both the first separating line and the second separating line define two tether arms in the anchor ring between the connection portion and the wider part of the anchor ring, and in that the distance between the first and second separating lines is constant along the full length of both tether arms. Preferably, the tether arms each span circumferentially an angle of 50 to 75° of the circumference of the lateral wall. Such a solution allows that the tether arms may be twisted during pivoting-open of the cap without undue localised stress. It also ensures that the tether arms outside of the reinforcing sections still offer enough freedom to move and pivot the caps.

[0020] In a particularly preferred configuration of the invention, the connection portion and the reinforcing sections have a stronger lateral wall thickness than the remaining lateral wall of the anchor ring. Due to the reinforcing sections damage and stresswhitening along the axial direction are impeded or prevented and a stress concentration in single weak points is reliably eliminated. Preferably, the reinforcing sections extend along at least half of the length of each tether arm.

[0021] According to a preferred embodiment of the reclosable cap according to the invention, another ring is arranged below the anchor ring, which is connected to the anchor ring via a plurality of material bridges and serves as a tamper-evident seal. The screw cap, the anchor ring and the additional ring serving as a tamper-evident seal are manufactured in one piece in this case. Preferably, the ring can only be twisted to a limited extent by blocking ribs protruding inwards from the ring with locking elements arranged over the circumference of the base element such that it is released from the anchor ring when the screw cap is unscrewed initially by tearing off the material bridges and remains in its position on the base element.

[0022] Another preferred embodiment of a reclosable cap according to the invention provides that the cap in its pivoted-open state is locked at a maximum opening angle of 150° by the connection portion in relation to its closed state, preferably with a minimum of 120°. Such a locking is possible, since the connection portion gets flipped with both tether arms twisted after pivoting open of the cap. In this state, the reclosable cap can no longer pivot back without applying a force externally. This has the great advantage that the cap does not pivot back

automatically during pouring and does not come into contact with the product during the pouring process. Particularly in this stage, the gradually extended end zones serve as reinforcement and reduce stress spikes in the region of the connection portion. While opening angles above 150° may be preferable in many cases, they also lead to even higher forces acting on the end sections. As such, limiting the opening angle to a maximum of 150° allows the reclosable cap more freedom in designing the most critical areas.

[0023] A further teaching of the invention provides that such a cap is radially freely rotatable in its locked opening state. Though the connection portion is flipped over, it is still possible to freely rotate the cap even in this position. This has the great advantage that the screw cap can be turned to a position desired by the user. In the locked position, a slight force must still be applied externally in order to enable rotation, since an increased frictional resistance between the connection portion and the spout results from the fixing of the screw cap in relation to its pivot opening. However, the increased frictional resistance is also desired so that the screw cap does not easily move in the direction of the pouring stream during pouring, caused by the gravitational force.

[0024] In a particularly preferred design of the invention, each single tether arm can withstand forces of at least 12 N. This ensures that even in case of one damaged or destroyed tether arm the lid remains securely at the anchor ring. The forces should be measured according to EN 17665 and the minimum of 12N needs to be reached for a single band with every type of measurement detailed in the norm. This guarantees additional security in that the norm will still be fulfilled even in adverse situations detailed above.

[0025] The invention will be explained in more detail below on the basis of a drawing which represents a preferred exemplary embodiment. In the drawing show

Fig. 1 an exemplary embodiment of a reclosable cap according to the invention in an unopened state (without container) in perspective view,

Fig. 2 the reclosable cap from Fig. 1 in a side view,

Fig. 3 a partially broken view of the enlarged circle III from Fig. 1 in a perspective view,

Fig. 4 the reclosable cap from Fig. 1 in a bottom view into the vertical section along the line IV-IV in Fig. 2,

Fig. 5 the cap element from Fig. 4 in a perspective view from below,

Fig. 6 the reclosable cap from Fig. 1 in a bottom view into the vertical section along the line VI-VI in Fig. 2,

Fig. 7 the cap element from Fig. 6 in a perspective view from below, and

Fig. 8 the reclosable cap from Fig. 1 during pivoting up in a detailed side view, which is partially broken.

[0026] Fig. 1 shows the perspective view of a reclosable cap 1 with a cylindrical (hollow cylinder) lateral wall 2 extending around an axis Z and a top wall 3 positioned at one end of the lateral wall 2. The upper lateral wall 2 and the top wall 3 define a lid 4. The reclosable cap 1 is mounted on a spout element 5 having a pouring tube (not shown) and a flange 6 extending radially around the pouring tube. The flange 6 allows sealing of the spout element 5 on a container, e.g., a carton/plastic-composite package for beverages. In order to facilitate of unscrewing the cap 1, its upper surface in the transition of the lateral wall 2 and the top wall 3 is provided with a corrugation 7.

[0027] A first separating line SL1 provided circumferentially around the lateral wall 2 to define an anchor ring 8. Below the anchor ring 8 a further ring 9 can be seen as part of the lateral wall 2 separated by a third separating line SL3. The ring 9 serves as a tamper-evident element and therefore, can only rotate to a limited extend due to blocking ribs (not shown) protruding inwards from the ring 9 with lateral protrusions 10 arranged over the circumference of the spout element 5. The ring 9 is connected to the anchor ring 8 via a plurality of material bridges 11 which will break during initial of the cap 1. The first separating line SL1 extends between a first end section 12 and second end section 13, which will be shown in Fig. 2, a side view (without spout element) of the cap 1 of Fig. 1 for the sake of clarity. In the area without the first separating line SL1 between the end sections 12 and 13 a connection portion 14 is defined. The end sections 12 and 13 are bordered axially on both sides by reinforcing sections RS, which have been shaded in the figures for clarification. A second separating line SL2 is provided circumferentially around the lateral wall 2 substantially parallel to the first separating line SL1 and between the free edge of the lateral wall 2 and the first separating line SL1. The anchor ring 8 comprises an upper part comprising two tether arms 8A (one shown in Fig. 2) and a lower part 8B. The tether arms 8A have the same height over their full length.

[0028] In the preferred embodiment shown, the first separating line SL1 and the second separating line SL2 overlap in the circumferential direction and it can be seen that the connection portion 14 is arranged in (above) the centre of the second separating line SL2.

[0029] In order to better describe the particularities of the end sections 12 and 13, Fig. 3 shows an enlarged perspective view of the circle III marked in Fig. 1. It can be clearly seen that the first and the second end sections 12 and 13 of the first separating line SL1 are formed by a gradual change in wall thickness wherein the end sections 12 and 13 each span an angle γ = 8.85° of the

circumference of the lateral wall 2 (10.45° in an alternative embodiment not shown in the Figs.).

[0030] The connection portion 14 is horizontally cut between the end sections 12 and 13. The two lower reinforcement sections RS can be seen at the end of the tether arms 8B. The wall thickness measured radially is substantially the same as that of the connection portion 14, whereas the respective wall thickness inside the end sections 12 and 13 gets progressively smaller. Since the spout element 5, which defines the pouring tube, is shown in the broken area, both the top part and the bottom part of the lateral protrusion 10 can be recognized. Even if not shown, there may be also thin material bridges in the separating lines SL1 and SL2.

[0031] Fig. 3 additionally shows that the top wall 3 has a circumferential reinforcing rib 15 and driving elements 16 which will be described in more detail below. Additionally, it can be seen that the lateral wall 2 comprises an internal thread 17. This internal thread 17 acts together with an external thread 18 protruding outside of the lateral wall of the spout element 5.

[0032] Fig. 4 shows the bottom view of the vertical section along the line IV-IV in Fig. 2. It shows exactly the same situation of the first separating line SL1 shown in Fig. 3. In this drawing the gradual circumferential wall thickness reduction of the end sections 12 and 13 are clearly shown. Each of the end sections 12 and 13 span an angle of γ = 8.85° (or 10.45° in a further embodiment, not shown) of the circumference of the lateral wall 2. Moreover, the circular reinforcement 15 inside the cap 1 can be seen which comprises three driving elements 16 being also cut partially along the cutting line IV-IV in Fig. 2. For a better understanding, the bottom view of Fig. 4 is illustrated as a perspective view from below in Fig. 5. This shows only the lid 4 as the view is cut exactly on the height of the first separating line SL1 which defines the lid 4 and the anchor ring 8 as part of the cap 1.

[0033] Fig. 6 shows the reclosable cap from Fig. 1 in a bottom view of the vertical section along the line VI-VI in Fig. 2, i.e., along the second separating line SL2. The lateral wall 2 is interrupted partially by the separating line SL2. In the preferred embodiment, the second separating line SL2 spans an angle δ of appr. 165°. In Fig. 6, the driving elements 16 are shown in full. For a better understanding, the bottom view of Fig. 6 is shown as a perspective view from below in Fig. 7. Here, the driving elements 16 are shown which drive, during the initial opening action, (and not shown) a cutting ring inside the spout element to provide an opening in the package under the pouring tube of the spout element. Obviously, in an alternative embodiment of the reclosable cap 1 both the circular reinforcement 15 and the driving elements 16 may be omitted if no cutting ring is needed for opening the package.

[0034] Finally, Fig. 8 shows the reclosable cap 1 from Fig. 1 during opening of the lid 4 in a detailed side view of the connection portion 14 which is bent inwardly due to the lifting force onto the lid 4 at its free side. Here, the anchor ring 8 is shown with its two elements, the tether arm 8A and the lower part 8B of the anchor ring 8. The gradual circumferential wall thickness reduction at the end section 13 is shown more clearly and, due to the inventive design of this area, stress spikes in the lateral wall 2 in the region of the end section 13 are reliably reduced in order to smoothen the opening and reclosing of the lid 4. This position of the cap 1 also shows the stabilising and stiffening effect of the reinforcing sections RS during opening of the lid 4.

List of reference signs

[0035]

1	Cap
2	Lateral Wall
3	Top Wall
4	Lid
5	Spout Element
6	Flange
7	Corrugation
8	Anchor Ring
8A	Tether Arm
8B	Lower Part
9	(Tamper Evident) Ring
10	Lateral Protrusion
11	Material Bridge
12	First End Section
13	Second End Section
14	Connection Portion
15	Reinforcing Rib
16	Driving Element
17	Internal Thread
18	External Thread
RS	Reinforcing Section
SL1	Separating Line
SL2	Separating Line
SL3	Separating Line
Z	Vertical Axis

Claims

1. Reclosable cap (1) to be mounted on a spout of a container, comprising

- a cylindrical lateral wall (2) extending around an axis (Z) and a top wall (3) positioned at one end of the lateral wall (2),
- a first separating line (SL1) provided circumferentially around the lateral wall (2) to define an anchor ring (8) and a lid (4), wherein the first separating line (SL1) extends between a first end section (12) and a second end section (13), the end sections (12, 13) being spaced apart from each other circumferentially to provide a

connection portion (14) connecting the anchor ring (8) and the lid (4), and
- a second separating line (SL2) provided circumferentially around the lateral wall (2) between a first and a second end, substantially parallel to the first separating line (SL1) and located on the anchor ring (8),

characterised in that
the end sections (12, 13) each span an angle $\gamma > 6°$ of the circumference of the lateral wall (2) and define a transition from full wall thickness of the connection portion (14) to the first separating line (SL1), and **in that** each end section (12, 13) is bordered axially by reinforcing sections (RS).

2. Reclosable cap according to claim 1
characterised in that
the reinforcing sections (RS) have substantially the same lateral wall thickness as the connection portion (14), measured radially.

3. Reclosable cap (1) according to claim 1 or 2,
characterised in that
the end sections (12, 13) each span an angle $\gamma > 8°$ of the circumference of the lateral wall (2).

4. Reclosable cap (1) according to claim 3,
characterised in that
the angular range is $8° < \gamma < 15°$.

5. Reclosable cap (1) according to any of claims 1 to 4,
characterised in that
the first and the second end sections (12, 13) of the first separating line (SL1) are formed by a gradual reduction in wall thickness along a circumferentially direction.

6. Reclosable cap (1) according to any of claims 1 to 5,
characterised in that
the connection portion (14) spans circumferentially an angle δ of 20 to 40°.

7. Reclosable cap (1) according to claim 6,
characterised in that
the ratio of δ/γ is between 2.8 and 3.5.

8. Reclosable cap (1) according to any of claims 1 to 7,
characterised in that
the first separating line (SL1) and the second separating line (SL2) overlap in the circumferential direction and **in that** the connection portion (14) is arranged in the centre of the second separating line (SL2).

9. Reclosable cap (1) according to any of claims 1 to 8,
characterised in that
the parallel ends of both the first separating line (SL1) and the second separating line (SL2) define two tether arms (8A) in the anchor ring (8) between the connection portion (14) and the wider part of the anchor ring (8), and **in that** the distance between the first and second separating lines (SL1 and SL2) is constant along the full length of both tether arms (8A).

10. Reclosable cap according to claim 9,
characterised in that
the tether arms (8A) each span circumferentially an angle of 50 to 75° of the circumference of the lateral wall (2).

11. Reclosable cap (1) according to claim 9 or 10,
characterised in that
the reinforcing sections (RS) extend along at least half of the length of each tether arm (8A).

12. Reclosable cap (1) according to any of claims 1 to 11,
characterised in that
the connection portion (14) and the reinforcing sections have a stronger lateral wall thickness than the remaining lateral wall (2) of the anchor ring (8).

13. Reclosable cap (1) according to any one of claims 1 to 12,
characterised in that
a further ring (9) is arranged below a third separating line (SL3) under the anchor ring (8) and **in that** the ring (9) is connected to the anchor ring (8) via a plurality of material bridges (11) and serves as a tamper-evident seal.

14. Reclosable cap (1) according to any of claims 1 to 13,
characterised in that
the cap (1) in its pivoted-open state is locked at a maximum opening angle of 150° by the connection portion (14) in relation to its closed state.

15. Reclosable cap (1) according to claim 14,
characterised in that
the cap (1) is radially freely rotatable in its locked opening state.

16. Reclosable cap (1) according to any of claims 1 to 15,
characterised in that
each single tether arm (8A) can withstand forces of at least 12 N.

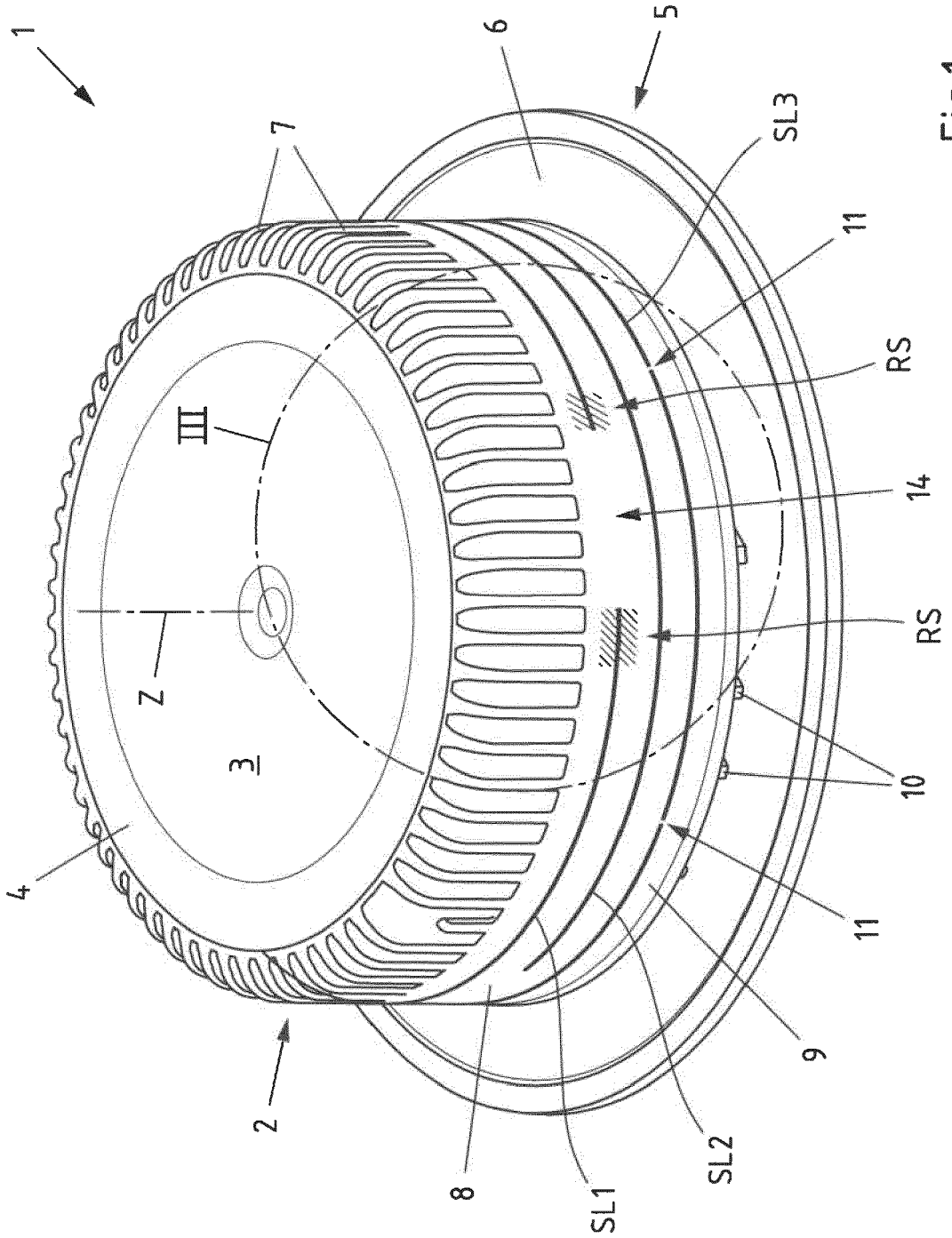

Fig.1

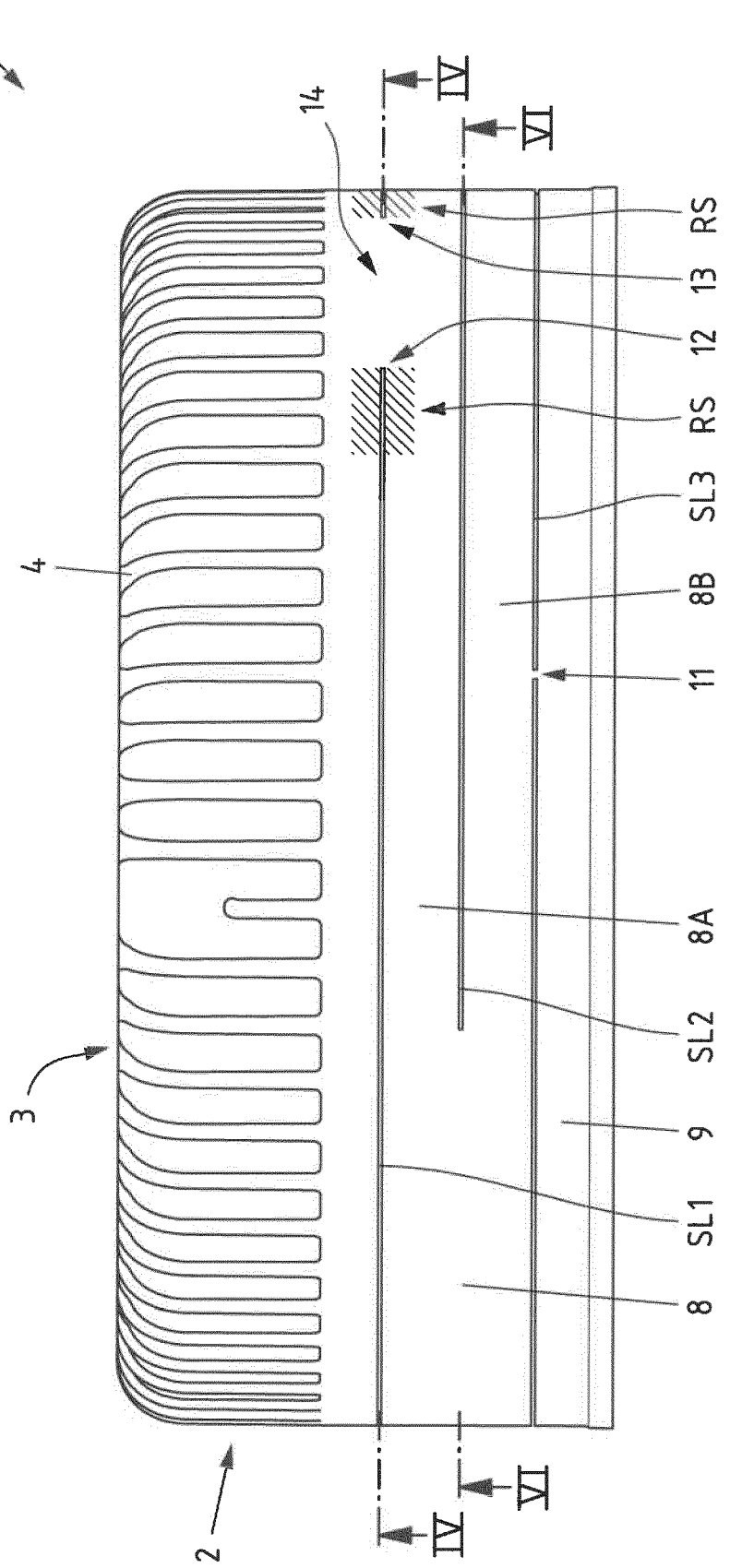

Fig.2

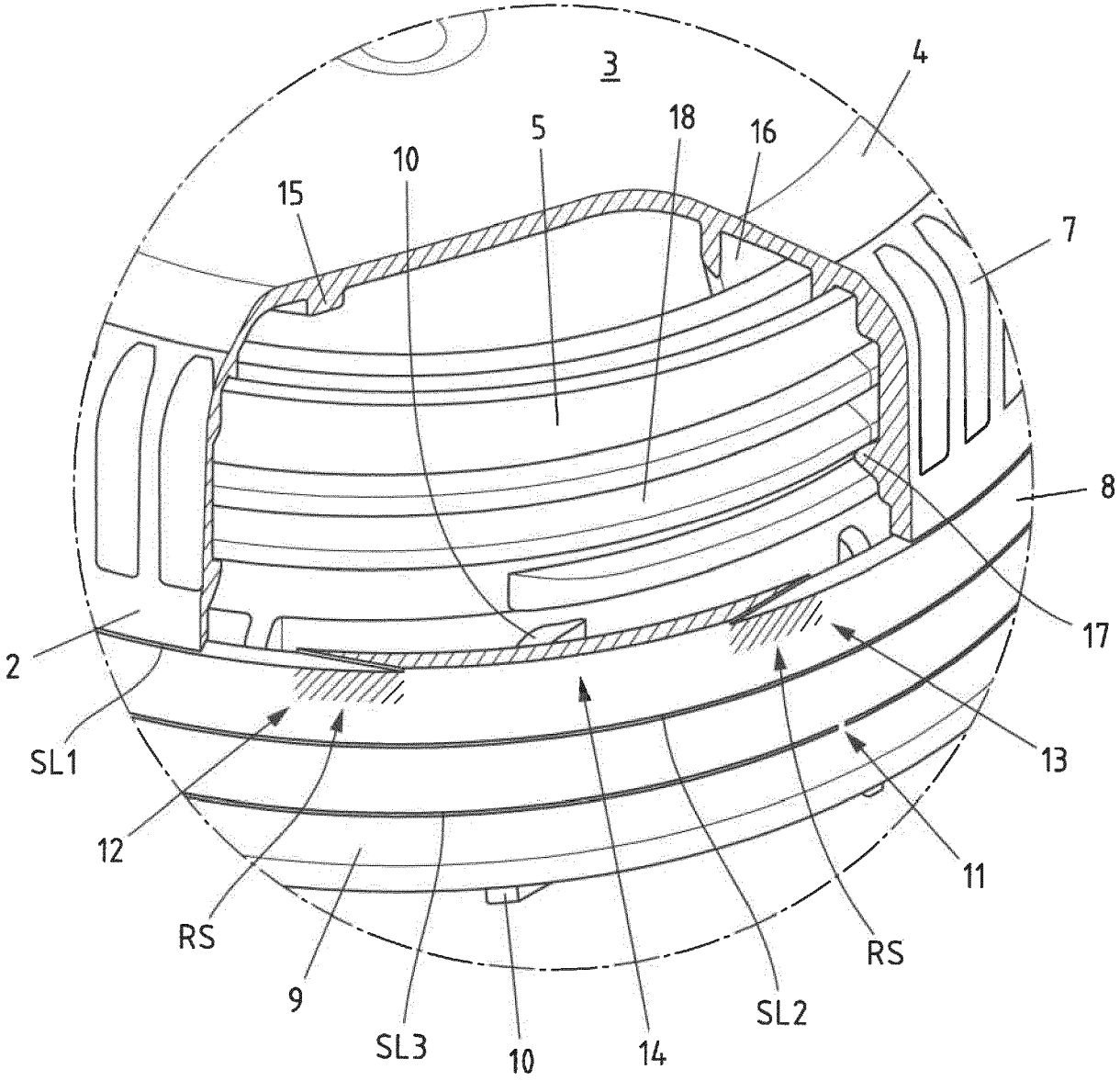

Fig.3

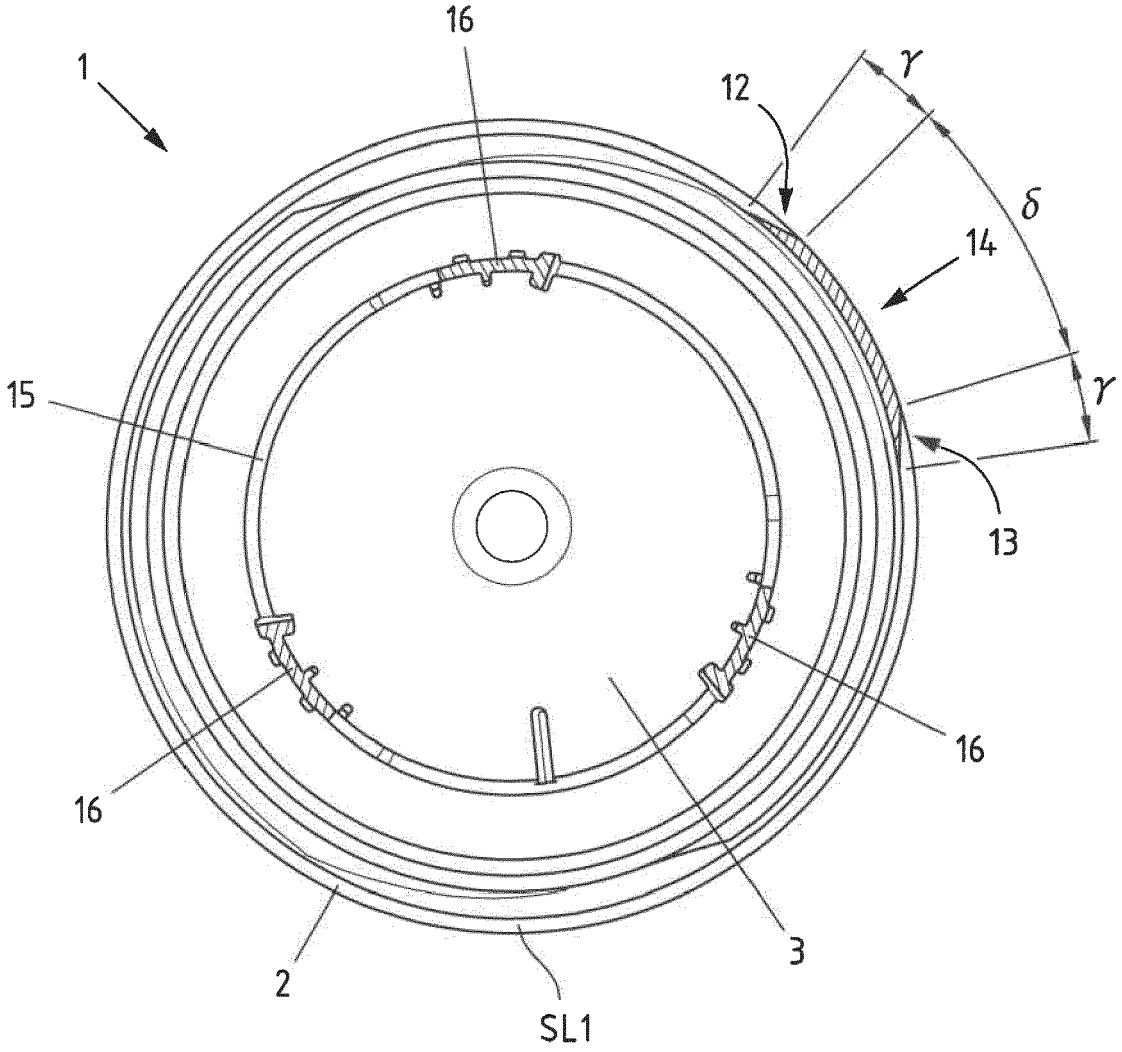

Fig.4

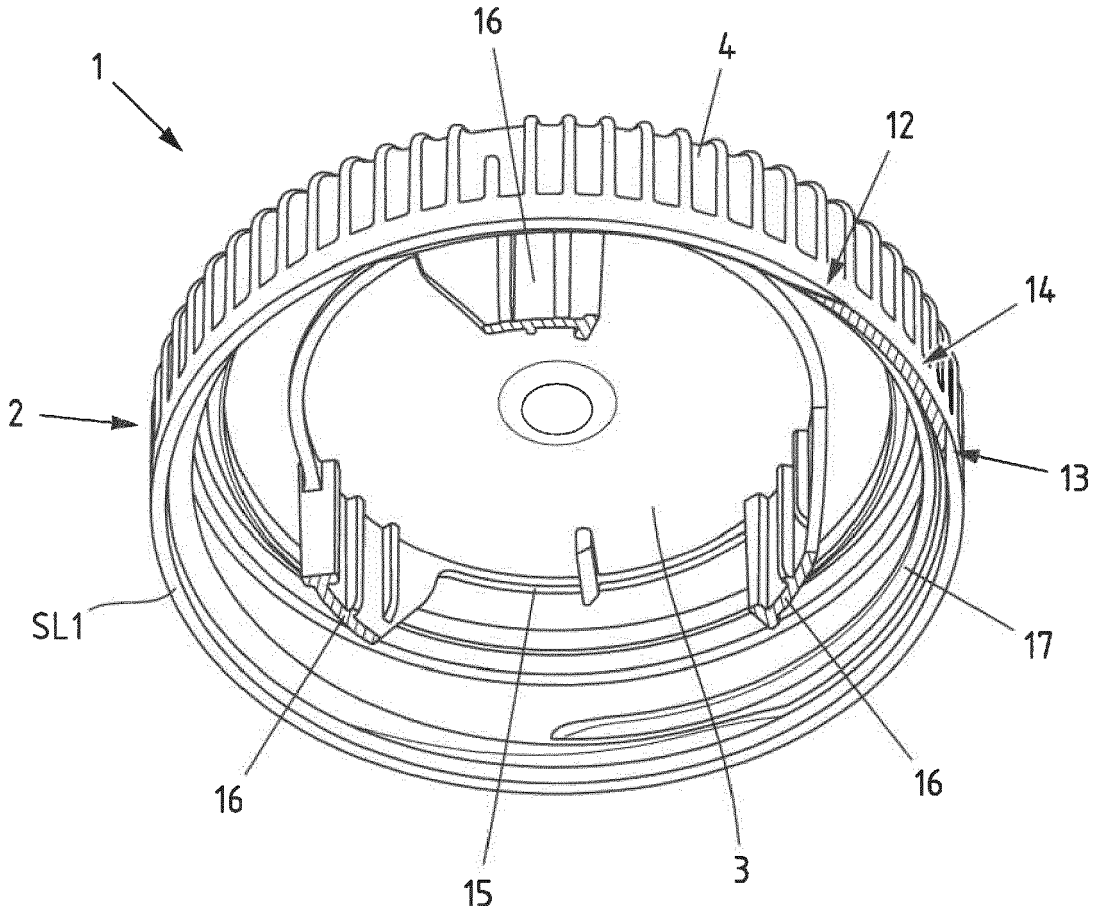

Fig.5

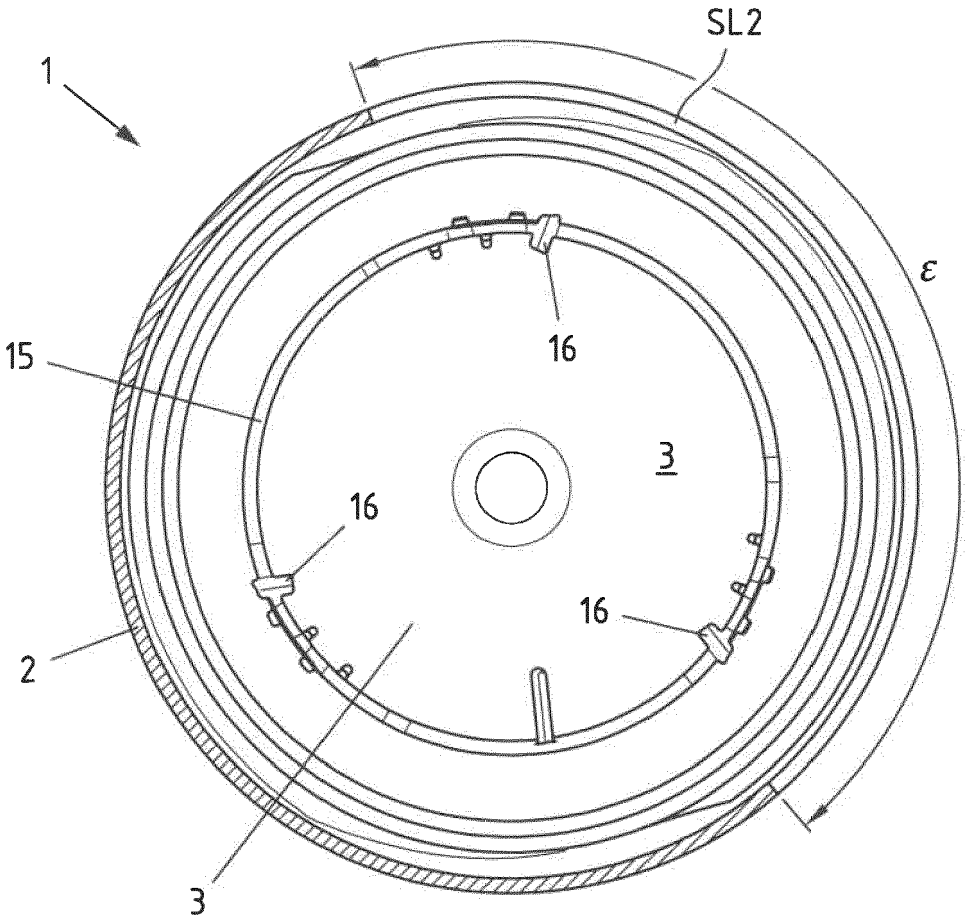

Fig.6

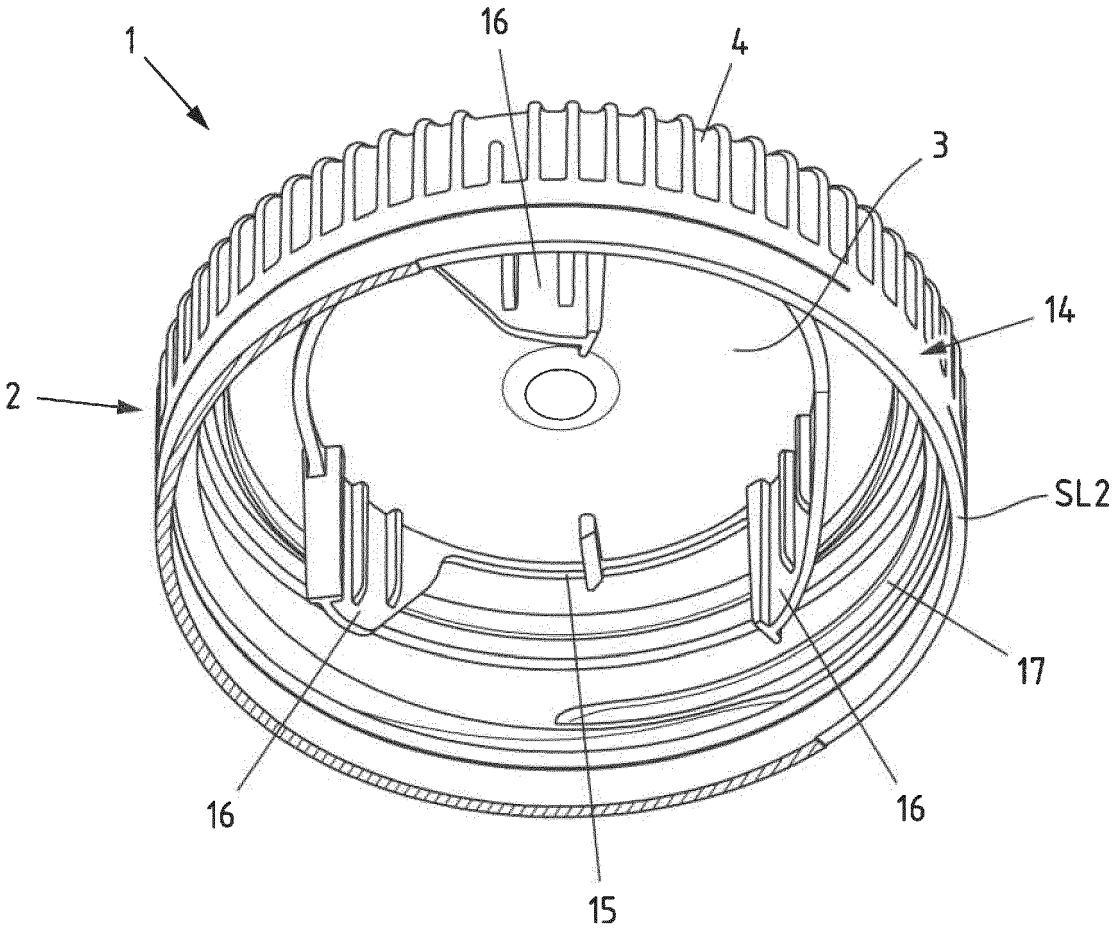

Fig.7

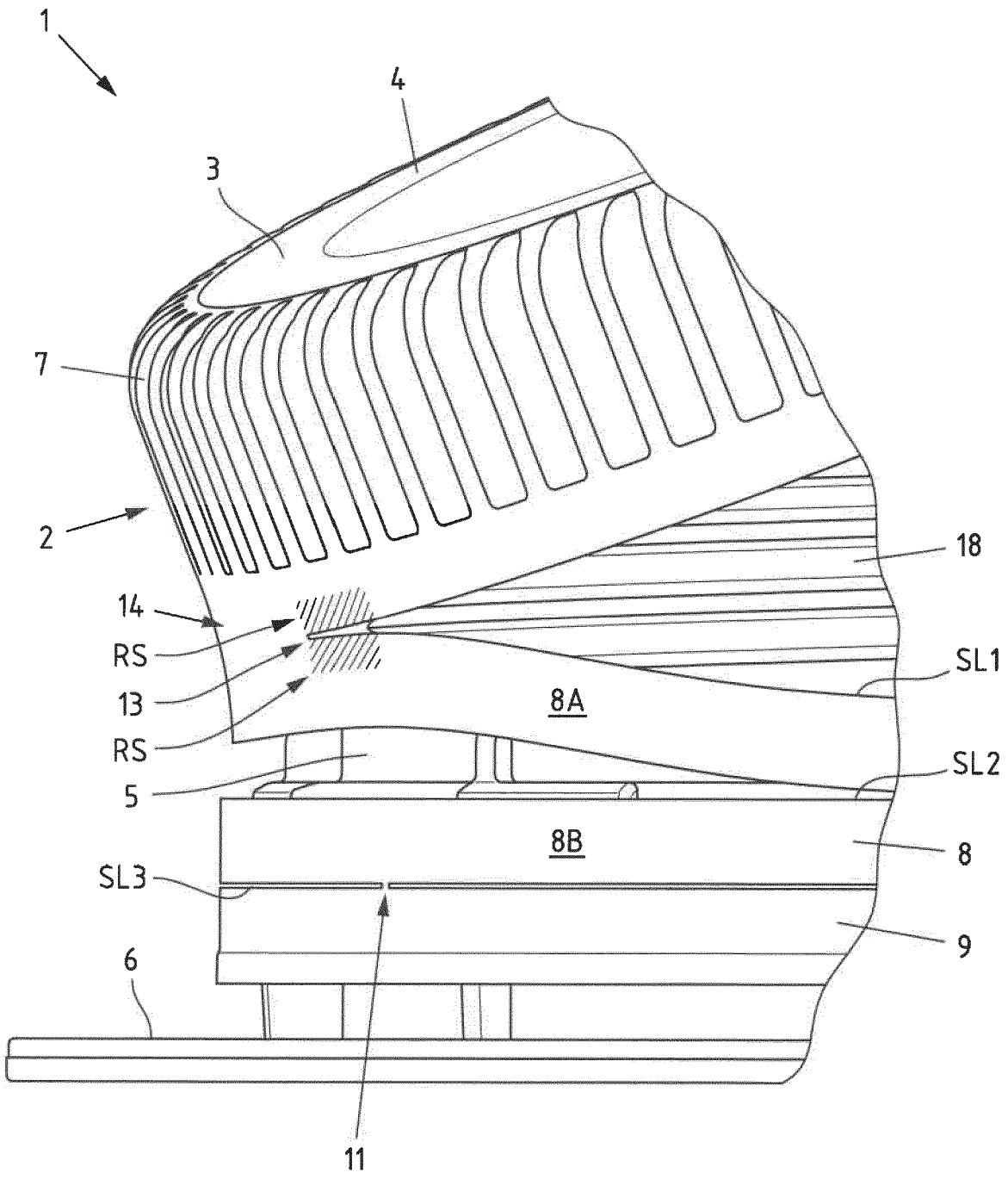

Fig.8

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 7008

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	WO 2023/073449 A1 (NOVEMBAL USA INC [US]) 4 May 2023 (2023-05-04) * the whole document *	1-5,8,9, 11,15	INV. B65D55/16
A	WO 2021/204863 A1 (BUESSER MANUEL [CH]) 14 October 2021 (2021-10-14) * the whole document *	1-16	
A	WO 2021/001433 A1 (ELOPAK SYSTEMS [CH]) 7 January 2021 (2021-01-07) * figures 1-12 *	1-16	
			TECHNICAL FIELDS SEARCHED (IPC) B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 September 2023	Le Bihan, Nicolas

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