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(54) **CAN END FOR USER-FRIENDLY RECLOSING CAN**

(57) A can end (2) is described for a metal beverage can, the can end comprising a cap top (3), arranged in connection to a pull tab (4) configured to remove the cap top from the can end to thereby create a drinking or pouring aperture; a shut-off valve (6), configured to close the drinking or pouring aperture after drinking or pouring; an elastic resilient element (10) for operating the shut-off valve (6); fixing means (50) for attaching the pull tab to the can end; holding means (21) for holding the shut-off valve (6) in an opened position for the drinking or pouring;

wherein the cap top (3) is configured to remain located, after the removal, on top of the shut-off valve (6); and wherein the holding means (21) is configured to release the shut-off valve (6), when in the opened position, by exertion of a force by a user of the can, in a direction of the interior of the can, on the fixing means (50), so as to close the drinking or pouring aperture.

Further, a can including such a can end and a method for opening such a can are described, as well as a method for producing such a can.

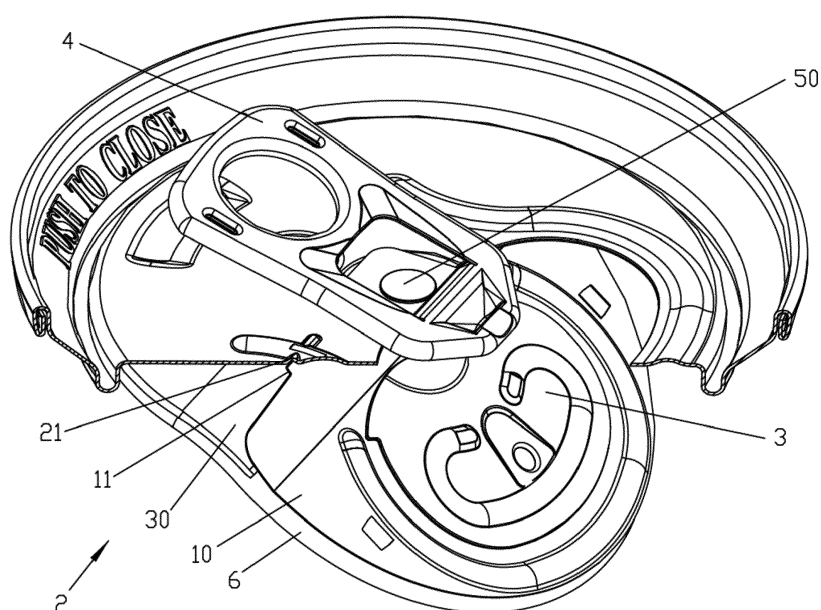


Fig.1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a container such as a can for a food product, especially a beverage, as well as a method of manufacturing the container or can. The container or can is especially suitable for carbonated beverages or drinks. The container or can can be provided with means for easily reclosing after the first opening.

BACKGROUND TO THE INVENTION

[0002] Traditional metal beverage cans usually have a pull tab (working as a lever mechanism) to allow for the opening of the can along a pre-determined shallow groove or score. This design allows venting the excess pressure in the can when it is opened. As the tab is lifted, first a vent score is severed, allowing the gases in the can to be released, and then the aperture score is ruptured, which defines an aperture through which the contents of the beverage can may be dispensed. The groove has the shape of a non-closed loop, so that when pressure is applied by the lever to rip the metal along the groove, the metal tab that is ripped off remains attached to the top of the can, even when the lever is returned to its original position.

[0003] With existing cans, a permanent opening is formed by these manipulations, so that the contents of the can may be drunk, but on the other hand carbon dioxide may escape and spills may occur.

[0004] WO 2012/028694 A1 discloses a reclosing can for a food product, i.e. a can wherein the drinking or pouring aperture can be reclosed after the can is opened for the first time. WO 2014/124992 A1 discloses an intermediate element that may be used in the reclosing can of WO 2012/028694 A1. PCT/EP2015/054328, "Reliable opening can end for reclosing can", filed on 2 March 2015, discloses a very reliable means and a corresponding method to create the drinking or pouring aperture.

SUMMARY OF THE INVENTION

[0005] The present invention provides an alternative container, e.g. a can for food products, especially beverages such as carbonated drinks. The container according to the present invention is reclosing and comprises improvements over the container disclosed in WO 2012/028694, "Reclosing can for food product", which is included herein by reference, in its entirety. An intermediate element as disclosed in WO 2014/124992 A1 may be used in a container according to the present invention. A means and a method to create the drinking or pouring aperture as disclosed in PCT/EP2015/054328, filed on 2 March 2015, may also be used in a container according to the present invention. WO 2014/124992, "Intermediate element for reclosing can", and PCT/EP2015/054328,

"Reliable opening can end for reclosing can", filed on 2 March 2015, mentioned above, are also included herein by reference, in their entirety.

[0006] An advantage of embodiments of the present invention is their user-friendliness, particularly when opening and reclosing the container or can. In embodiments of the present invention, the user can simply push on the central part of the can end to close the can again. Another advantage of embodiments of the present invention is their simplicity.

[0007] One advantage of a container or can according to the invention is that it can easily be produced, and that it is suitable for mass production. In comparison with a traditional can, only the can end is different. Thus, a traditional production line of cans can be modified to produce the container or can, e.g. by replacing the production steps for the traditional can end by the production steps for the can end according to the invention; e.g. by adaptation of the tooling for the production line. The production steps and tooling for the can body and for attaching the can end to the can body can remain unchanged. A can end according to the invention may be made from a sheet of metal; parts such as a pull tab are added. An advantage of a can end in accordance with the invention is that it requires only a small number of parts.

[0008] An advantage of embodiments in accordance with the invention is that the can ends are very well stackable. The can ends may be stacked one on top of the other, so that a stack of can ends requires only little space, just as stacked can ends of traditional cans do.

[0009] Another advantage of embodiments of the present invention is that, before it is opened for the first time, the can is closed in the same way as a traditional can. It is opened by making a rupture through metal, as is the case for a traditional can, and it is thus as tamper-proof and leak-proof as a traditional can. Many other existing re-sealable cans rely on other opening mechanisms, e.g. on opening by a rotation, and they are often not at all as tamper-proof and leak-proof.

[0010] Yet another advantage is that embodiments of the invention can easily and successfully be applied to different types and sizes of can ends as known in the art, such as so-called SuperEnd (SE) can ends, Container Development Limited (CDL) can ends, etc. Embodiments of the invention can easily and successfully be applied to small can ends and to small can ends having large drinking apertures. All embodiments shown in the drawings were tested successfully.

[0011] Still another advantage is related to very good pourability and drinkability of the contents of the can. Compared to a traditional can, in embodiments of cans in accordance with the invention the contents of the can flows more smoothly and also faster out of the can. This is an important advantage, since recently quite some modifications to cans are proposed to improve drinkability and pourability. One advantage of embodiments of the invention, when used for carbonated beverages, is that means may be provided for relieving the internal

pressure in the can. In a carbonated beverage can, pressure is built up in the can because of the gases. If means are provided for relieving the internal pressure before opening, then the can is opened easily since no large force needs to be counteracted.

[0012] Another advantage of embodiments of the invention is that, even if used in large beverage cans of e.g. 0.5l, an opened can remains opened when the contents is drunk or poured very fast; i.e. the reclosing mechanism does not close the can even if a very large flow of beverage is drunk or poured.

[0013] Yet another advantage of embodiments of the invention is that, if the can is dropped from a table or from a height of about 1 m or more, the can recloses automatically, so that the contents is not spilled.

[0014] According to an aspect of the present invention, the present invention provides in one embodiment a can end for a metal beverage can, the can end comprising a cap top, arranged in connection to a pull tab configured to remove the cap top from the can end to thereby create a drinking or pouring aperture; a shut-off valve, configured to close the drinking or pouring aperture after drinking or pouring; an elastic resilient element for operating the shut-off valve; fixing means for attaching the pull tab to the can end; and holding means for holding the shut-off valve in an opened position for the drinking or pouring; wherein the cap top is configured to remain located, after the removal, on top of the shut-off valve; and wherein the holding means is configured to release the shut-off valve, when in the opened position, by exertion of a force by a user of the can, in a direction of the interior of the can, on the fixing means, so as to close the drinking or pouring aperture.

[0015] The can end may comprise an engaging means, wherein the holding means is configured to engage with the engaging means in the opened position and to disengage from the engaging means upon exertion of the force by the user of the can.

[0016] The holding means may have a location such that the exertion of the force by the user causes a deformation of the can end at that location, to disengage the holding means from the engaging means.

[0017] The elastic resilient element may comprise the engaging means.

[0018] The cap top may be arranged in connection to a pull tab configured to remove the cap top from the can end along a pre-defined groove.

[0019] The shut-off valve may be configured to seal the drinking or pouring aperture after drinking or pouring.

[0020] The metal beverage can may be configured for containing a carbonated drink, and the can end may comprise a shut-off valve that includes a first plate-like element, the first plate-like element having a first cut through it and having a first portion adjacent to the first cut, the first cut being configured to form a seal in the shut-off valve in the absence of a force, in a direction of the interior of the can, on the first portion of the first plate-like element, and being configured to form an opening in the

shut-off valve, for relieving the gas pressure originating from the carbonated drink, upon exertion of a force, in the direction of the interior of the can, on the first portion. The can end may further comprise an elastic resilient element that includes a second plate-like element, the second plate-like element having a second cut through it and having a second portion adjacent to the second cut, the second cut being configured to form an opening in the elastic resilient element, for relieving the gas pressure originating from the carbonated drink, upon exertion of the force, in the direction of the interior of the can, on the second portion of the second plate-like element.

[0021] The cap top may comprise means, such as an approximately wedge-shaped embossment below the plane of the can end, for restraining the movement, in a direction away from the interior of the can, of the first portion of the first plate-like element of the shut-off valve and of the second portion of the second plate-like element of the elastic resilient element.

[0022] The cap top may comprise means for weakening its rigidity near the location where the pull tab touches the cap top when the can is opened; these means for weakening may comprise an interruption of an embossed ridge on the cap top.

[0023] The can end may comprise a supporting element for increasing the resilience of the elastic resilient element.

[0024] The can end may comprise an intermediate element for shielding the can end circumferentially from the interior of the can.

[0025] The can end may have a first side and a second side opposite to the first side, wherein the second side is adapted for receiving a first side of an identical can end for forming a stack of can ends.

[0026] The present invention also includes a metal beverage can comprising a can body and a can end in accordance with the invention.

[0027] The present invention further includes a method for producing a can, embodiments of the method comprising producing a can end in accordance with the invention, producing a can body, and attaching the can end to the can body.

[0028] Embodiments of the present invention also include a method for opening and reclosing a metal beverage can, the can comprising a can body and a can end, the method comprising the steps of actuating a pull tab of the can end, thus removing a cap top of the can end, thereby creating a drinking or pouring aperture; resiliently opening, by the actuating the pull tab, a shut-off valve configured to close and seal the drinking or pouring aperture after drinking or pouring; holding the shut-off valve in an opened position for the drinking or pouring; and exerting a force by a user of the can, in a direction of the interior of the can, on a fixing means for attaching the pull tab to the can end, so as to close the drinking or pouring aperture.

[0029] In an embodiment wherein the metal beverage can is configured for containing a carbonated drink, the

method may further comprise the steps of exerting a force, by actuating the pull tab, on a portion of a plate-like element of the shut-off valve, wherein the portion is adjacent to a cut through the plate-like element; and forming an opening in the shut-off valve for relieving gas pressure originating from the carbonated drink.

[0030] According to another aspect of the present invention, the present invention provides in one embodiment a can end for a metal beverage can for a carbonated drink, the can end comprising means for creating a drinking or pouring aperture; and a shut-off valve, configured to close the drinking or pouring aperture after drinking or pouring; wherein the shut-off valve comprises a first plate-like element, the first plate-like element having a first cut through it and having a first portion adjacent to the first cut, the first cut being configured to form a seal in the shut-off valve in the absence of a force, in a direction of the interior of the can, on the first portion of the first plate-like element, and being configured to form an opening in the shut-off valve, for relieving the gas pressure originating from the carbonated drink, upon exertion of a force, in the direction of the interior of the can, on the first portion. The can end may further comprise an elastic resilient element for operating the shut-off valve, wherein the elastic resilient element includes a second plate-like element, the second plate-like element having a second cut through it and having a second portion adjacent to the second cut, the second cut being configured to form an opening in the elastic resilient element, for the relieving the gas pressure originating from the carbonated drink, upon exertion of the force, in the direction of the interior of the can, on the second portion of the second plate-like element. The can end may comprise means for restraining the movement, in a direction away from the interior of the can, of the first portion of the first plate-like element of the shut-off valve and of the second portion of the second plate-like element of the elastic resilient element.

[0031] In accordance with this other aspect of the present invention, embodiments of the present invention also include a metal beverage can comprising a can body and a can end in accordance with the invention; and embodiments of the present invention further include a method for producing a can, embodiments of the method comprising producing a can end in accordance with the invention, producing a can body, and attaching the can end to the can body.

[0032] In accordance with this other aspect of the present invention, embodiments of the present invention also include a method for opening a metal beverage can configured for containing a carbonated drink, the can comprising a can body and a can end, the method comprising exerting a force on a portion of a plate-like element of a shut-off valve of the can end, wherein the portion is adjacent to a cut through the plate-like element; and thereby forming an opening in the shut-off valve for relieving the gas pressure originating from the carbonated drink. The force may be exerted by actuating a pull tab

of the can end. The method may further comprise operating the shut-off valve resiliently by an elastic resilient element of the can end; exerting the force on another portion of another plate-like element of the elastic resilient element, wherein the other portion is adjacent to another cut through the other plate-like element; and thereby forming another opening in the elastic resilient element for relieving the gas pressure originating from the carbonated drink.

[0033] In this document, that an element is at least substantially made of at least one specified material, e.g. of at least one metal, or e.g. of at least one plastic material, means that the element is made of at least 70% of the specified material, preferably of at least 80% of the specified material, more preferably of at least 90% of the specified material and most preferably of at least 95% of the specified material, wherein the percentages are percentages by volume.

[0034] Further, in this document a plate-like element means a thin, flat piece of metal, of plastic, or of another material.

[0035] A cut means, in this document, a thin opening as if made by a sharp knife; starting point and endpoint of the cut are different from each other, i.e. a cut is not a hole. A cut passes completely through the material in which the cut is made, in this document.

[0036] The container or can will be described below especially when used for beverages, particularly carbonated drinks. It will be clear from the description however that the can may also be used for other food products, such as instant soup, instant coffee, oil, honey, sauces, dairy products such as milk or yoghurt, et cetera.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] The invention will be described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 shows a 3D view of an embodiment of a can end, wherein the shut-off valve is held in its opened position for drinking or pouring;

Fig. 2 shows a top view of an embodiment of a can end, based on a SuperEnd can end;

Fig. 3 shows a bottom view of the embodiment of the can end of Fig. 2;

Fig. 4 shows a cross section of the embodiment of the can end of Fig. 2, when the can is not yet opened;

Fig. 5 shows a 3D top view of the embodiment of the can end of Fig. 2, in a first phase when the can is opened for the first time;

Fig. 6 shows a detailed view of a portion of Fig. 5, wherein the pull tab is omitted for clarity;

Fig. 7 shows a cross section of the embodiment of the can end of Fig. 5;

Fig. 8 shows a detailed view of a portion of Fig. 7;

Fig. 9 shows a 3D top view of the embodiment of the can end of Fig. 2, in a subsequent phase when the

can is opened for the first time and wherein the cap top is removed along its entire circumference from the can end;

Fig. 10 shows a cross section of the embodiment of the can end of Fig. 9;

Fig. 11 shows a 3D top view of the embodiment of the can end of Fig. 2, in a further subsequent phase when the can is opened for the first time and wherein the pull tab is moved towards its original position, to allow for easy drinking or pouring, after the phase wherein the cap top was removed along its entire circumference from the can end;

Fig. 12 shows a cross section of the embodiment of the can end of Fig. 11;

Fig. 13 shows a cross section of the embodiment of the can end of Fig. 2, wherein the shut-off valve is held in its opened position for drinking or pouring;

Fig. 14 shows a detailed view of a portion of Fig. 13;

Fig. 15 shows a combination of a 3D side view and cross section of the embodiment of the can end of Fig. 2, wherein part of the can end is cut away for clarity, and wherein the can is being reclosed;

Fig. 16 shows a detailed view of a portion of Fig. 15;

Fig. 17 shows a 3D top view of the embodiment of the can end of Fig. 2 when reclosed;

Fig. 18 shows a detailed view of a portion of Fig. 17, wherein the pull tab is omitted for clarity;

Fig. 19 shows a cross section of the embodiment of the can end of Fig. 17;

Fig. 20 shows an embodiment of the can end of Fig. 2 when reclosed, wherein the pull tab is turned over approximately 180°;

Fig. 21 shows a cross section of the embodiment of the can end of Fig. 20;

Fig. 22 shows a stack of embodiments of the can ends of Fig. 2;

Fig. 23 shows a 3D top view of the embodiment of the can end of Fig. 2 wherein the pull tab is moved to an extreme position;

Fig. 24 shows a cross section of the embodiment of the can end of Fig. 23;

Fig. 25 shows a cross section of the embodiment of the can end of Fig. 2;

Fig. 26 shows a detailed view of a portion of Fig. 25;

Fig. 27 shows the embodiment of Fig. 25 in a subsequent phase, illustrating an embodiment of a means for relieving a pressure in the can;

Fig. 28 shows a detailed view of a portion of Fig. 27;

Fig. 29 shows an exploded view of the embodiment of the can end of Fig. 2;

Fig. 30 shows an embodiment of an elastic resilient element used in the embodiment of the can end of Fig. 2;

Fig. 31 shows an embodiment of a shut-off valve used in the embodiment of the can end of Fig. 2;

Fig. 32 shows an embodiment of a supporting element used in the embodiment of the can end of Fig. 2;

Fig. 33 shows a top view of an embodiment of a can end, based on a CDL can end;

Fig. 34 shows a cross section of the embodiment of the can end of Fig. 33, when the can is not yet opened;

Fig. 35 shows a cross section of the embodiment of the can end of Fig. 33 when reclosed;

Fig. 36 shows a cross section of the embodiment of the can end of Fig. 33, wherein the shut-off valve is held in its opened position for drinking or pouring;

Fig. 37 shows a 3D top view, wherein half of the can end is cut away for clarity, of the embodiment of the can end of Fig. 36;

Fig. 38 shows an exploded view of the embodiment of the can end of Fig. 33;

Fig. 39 shows a stack of embodiments of the can ends of Fig. 33;

Fig. 40 shows a top view of an embodiment of a can end, based on a CDL can end, and comprising another embodiment of a pull tab;

Fig. 41 shows an embodiment of the can end of Fig. 40 when reclosed, wherein the pull tab is turned over approximately 180°;

Fig. 42 shows a cross section of an embodiment of a shut-off valve used in the embodiment of the can end of Fig. 33 and illustrating an embodiment of a means for relieving a pressure in the can;

Fig. 43 shows a cross section of an embodiment of an elastic resilient element and a shut-off valve used in the embodiment of the can end of Fig. 33 and illustrating an embodiment of a means for relieving a pressure in the can;

Fig. 44 shows a cross section of an embodiment of the can end of Fig. 33 illustrating an embodiment of a means for relieving a pressure in the can;

Fig. 45 shows a detailed view of a portion of Fig. 44;

Fig. 46 shows a cross section of an embodiment of a can end, based on a SuperEnd can end and comprising an intermediate element;

Fig. 47 shows a bottom view of the intermediate element used in the can end of Fig. 46;

Fig. 48 shows a 3D cross section of an intermediate element comprising a sealing element;

Fig. 49 shows an exploded view of the embodiment of the can end of Fig. 46;

Fig. 50 shows a stack of embodiments of the can ends of Fig. 46;

Fig. 51 shows a top view of an embodiment of a can end, based on a CDL can end;

Fig. 52 shows a bottom view of the embodiment of the can end of Fig. 51;

Fig. 53 shows a cross section of the embodiment of the can end of Fig. 51.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0038] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn to scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

[0039] Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

[0040] Moreover, the terms top, bottom, over, under and the like in the description and the claims are used for descriptive purposes and not necessarily for describing relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other orientations than described or illustrated herein.

[0041] It is to be noticed that the term "comprising", used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, integers, steps or components as referred to, but does not preclude the presence or addition of one or more other features, integers, steps or components, or groups thereof. Thus, the scope of the expression "a device comprising means A and B" should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

[0042] Fig. 1 shows an embodiment of a can end 2 for a metal beverage can comprising a shut-off valve 6 configured to close the drinking or pouring aperture when the can is reclosed. In Fig. 1, the shut-off valve 6 is held in its opened position for drinking or pouring. How the beverage can is opened will be described hereinafter. Opening the can for the first time involves removing cap top 3 from can end 2, e.g. along a pre-defined groove, and thereby creating the drinking or pouring aperture. Pull tab 4 is attached to the can end by fixing means 50 such as a rivet.

[0043] Shut-off valve 6 is resiliently operated by elastic resilient element 10. In the opened position shown in Fig. 1, engaging means 11 of the elastic resilient element 10, such as a protrusion of the elastic resilient element, fits into holding means 21 of can end 2 (such as a groove

protruding above the plane of the can end), so that the shut-off valve 6 is held in its opened position. By exertion of a force by the user of the can, in the direction of the interior of the can ("Push to Close"), on the fixing means 50, the elastic resilient element 10 is disengaged and the shut-off valve 6 is released, thereby reclosing the drinking or pouring aperture; this will be described in detail further below. That the force is exerted, in the direction of the interior of the can, on the fixing means, means the following in the present document. The force has a component in the direction of the interior of the can (thus, it is not a force purely parallel to the plane of the can end; moreover, it is not a force pulling at the fixing means, i.e. in the direction away from the interior of the can). Further, the force may be exerted by the user of the beverage can either directly, by pushing on the fixing means 50 itself, or indirectly, by applying a force to e.g. pull tab 4 so that a force is exerted on fixing means 50 resulting from the force applied by the user. Further, in Fig. 1, the shown embodiment comprises a supporting element 30; the purpose of this element is described hereinafter.

[0044] Fig. 2 shows a top view of an embodiment of a can end 2 of a reclosing can that is based on a traditional SuperEnd can end, and Fig. 3 shows a bottom view of can end 2. Subsequent phases of opening a can comprising can end 2 for the first time will now be described.

[0045] As in a traditional can, the central part of the can end 2 has a tear panel or cap top 3. In the embodiment shown in Fig. 2, cap top 3 can be torn off along a pre-formed shallow groove 9 or other form of mechanical weakness, by actuating pull tab 4, which works as a lever. Pull tab 4 is attached to can end 2 by a fixing device 50 such as a rivet. Can end 2 may comprise an embossment 18, protruding below the plane of the can end, to allow for easy access of pull tab 4. As disclosed in WO 2012/028694, "Reclosing can for food product" (mentioned hereinbefore), the cap top 3 is torn completely from the can end, i.e. removed from the can end, along the pre-defined groove 9, thus creating a drinking or pouring aperture. After tearing off the cap top 3, the cap top 3 remains located on top of a shut-off valve 6 (shown in Fig. 4), which is configured to close the drinking or pouring aperture after drinking or pouring. Shut-off valve 6 may be attached to the can end 2 by fixing means 15 such as a rivet. In the shown embodiment, can end 2 comprises a first embossed ridge 16 and a second embossed ridge 17; both ridges protrude above the plane of the can end, as known in the art. Embossed ridge 16 may be interrupted at location 16a so that a weakness is formed in the can end 2 near the location where pull tab 4 touches cap top 3 when the can is opened. Because of the presence of such a weakness in can end 2, and specifically in the cap top, when opening the can the deformation of the can end near the weakness will be larger, and this additional deformation helps in relieving the pressure in the can when it is opened for the first time; relieving the pressure in the can is discussed further below. Figs. 2 and 3 also show holding means 21 for holding

the shut-off valve in an opened position for drinking or pouring, as discussed already in connection with Fig. 1. Further, the shown embodiment of can end 2 comprises fixing means 12 such as a rivet to attach cap top 3 to the elastic resilient element and cap top 3 comprises an approximately wedge-shaped embossment 14 below the plane of the can end 2. The elastic resilient element 10, shown in Fig. 4, is used to operate the shut-off valve 6 and to close it when it is being released. Fig 4, which shows a cross section of the embodiment of the can end 2 of Fig. 2, further illustrates that embossment 14 prevents elastic resilient element 10 from contacting the bottom surface of the can end 2 over a large area. In fact, the elastic resilient element 10 does not touch the bottom surface of the can end 2 in the area between embossment 14 and fixing means 50 and it can move towards the bottom surface of the can end in this area. This plays a role in relieving the pressure in the can when the can is opened, which will be discussed further below, in connection with Figs. 25-29. In the embodiment of Fig. 4, the can end 2 comprises a supporting element 30. In this embodiment, the supporting element 30 is located between the shut-off valve 6 and the bottom surface of the can end, and between the shut-off valve 6 and the elastic resilient element 10, in the half of the can end that does not contain the cap top. The supporting element interacts with the elastic resilient element 10 and increases its resilience. It keeps the elastic resilient element against the bottom surface of the can end. The supporting element may be at least substantially made of at least one plastic material, e.g. PET (polyethylene terephthalate). In another embodiment, the supporting element is at least substantially made of at least one metal, e.g. a stainless steel. The metal, e.g. the stainless steel, may be coated. In one embodiment, the supporting element is made of PET and has a thickness of 0.3 mm. Further, in the embodiment of Fig. 4, the shut-off valve 6 has an edge 6a abutting the edge of can end 2, to seal the interior of the can from the drinking or pouring aperture. The shut-off valve may have a thickness of e.g. 0.3 mm and its edge may have a thickness of at least 0.05 mm. The shut-off valve may be at least substantially made of at least one plastic material, e.g. PET (polyethylene terephthalate). In another embodiment, the supporting element is at least substantially made of at least one metal, e.g. a coated stainless steel. The elastic resilient element may be at least substantially made of at least one metal. In one embodiment, the elastic resilient element is made of a coated stainless steel and has a thickness of 0,15 mm. In another embodiment, the elastic resilient element is at least substantially made of at least one plastic material.

[0046] In Figs. 2 - 4, the can was not yet opened. When the can is opened for the first time, in a first phase, shown in Figs. 5 and 6, pull tab 4 pushes against can end 2 onto cap top 3, and thereby groove 9 is opened at location 9a. Fig. 7 shows a cross section of can end 2 in this phase and Fig. 8 shows a detailed view of a portion of Fig. 7, with the opening of groove 9 at location 9a. Fig. 7 also

shows the can body 1 to which the can end 2 is attached. In the shown embodiment, the can contains a carbonated beverage, and carbon dioxide bubbles 41, enlarged in the drawing for clarity, start to escape from the beverage, through an opening, or cut 42, in shut-off valve 6, an opening, or cut 43, in elastic resilient element 10, and the opening in groove 9 at location 9a. Cut 42 makes an angle 44 with the plane that passes through the shut-off valve in its position before the can is opened. In one embodiment, angle 44 is an angle of 45°. Cuts 42 and 43 are part of an embodiment of a means for relieving the pressure in the can when it is opened. The detailed operation of such a means for relieving the pressure in the can is discussed further below, in connection with Figs. 25 to 29.

[0047] When pull tab 4 is actuated further, cap top 3 is removed along its entire circumference from can end 2, as is shown in Fig. 9. Fig. 10 shows a cross section of the embodiment of Fig. 9, illustrating the position of shut-off valve 6, elastic resilient element 10 and supporting element 30.

[0048] The can is now opened completely and a drinking or pouring aperture is formed; Fig. 11 and Fig. 12, which is a cross section of the embodiment of Fig. 11, show a subsequent phase wherein pull tab 4 is now moved towards its original position so that the pull tab is out of the way of the drinking or pouring aperture, for drinking or pouring the contents of the can.

[0049] Fig. 13 and Fig. 14, which is a detailed view of a portion of Fig. 13, show an embodiment of a means to hold shut-off valve 6 in its opened position for drinking or pouring. Figs. 13-14 show the same phase of opening the can as Figs. 11-12, but Figs. 13 and 14 show a cross section of can end 2 viewed from another side (so that these drawings are mirrored with respect to Figs. 11 and 12). During the movement of pull tab 4 towards its original position, to move it out of the way for drinking or pouring, engaging means 11 (see Figs. 13 and 14) of the elastic resilient element 10, which is in this embodiment a protrusion of the elastic resilient element, moves over holding means 21, which is in this embodiment a groove, of can end 2, so that the protrusion gets stuck in the groove. In this way, elastic resilient element 10 is fixed in the position shown in Fig. 13 and shut-off valve 6 is held in the opened position for drinking or pouring. Thus, in the shown embodiment, holding means 21 is activated to hold shut-off valve 6 in the opened position for drinking or pouring by moving pull tab 4 to open the can and subsequently moving pull tab 4 back towards its original position.

[0050] Holding means 21 (see Fig. 14) is configured to release shut-off valve 6, when in the opened position, by exertion of a force on fixing means 50 by the user of the can as discussed above. In the embodiment shown in Figs. 13 and 14, when such a force is exerted by pushing on fixing means 50, engaging means 11 disengages from holding means 21, so that elastic resilient element 10 moves towards its original position, i.e. its position

when the can was not yet opened. Shut-off valve 6 moves together with elastic resilient element 10 so that the drinking or pouring aperture is closed. That shut-off valve 6 is released upon the exertion of a force on fixing means 50, either directly or indirectly, is especially due to the properties of holding means 21, such as its geometry and its material properties, and to the relative position of holding means 21 and fixing means 50. In the embodiment shown in Fig. 14, holding means 21 is positioned on can end 2 near fixing means 50, so that, by the exertion of a small force on fixing means 50, can end 2 is deformed near fixing means 50. Can end 2 is also deformed at the location of holding means 21, and engaging means 11 (which is in this embodiment a protrusion of elastic resilient element 10) will start to move with respect to holding means 21 (which is in this embodiment a groove in can end 2). When the exerted force increases, the deformation at the location of the groove in the can end becomes large enough that the protrusion of the elastic resilient element pops out of the groove, and that the elastic resilient element moves towards its original position, because of its resilient properties; thus, shut-off valve 6 is released and closes the drinking or pouring aperture. When the protrusion of the elastic resilient element pops out of the groove, this may make an audible click, signaling to the user that the can is being closed.

[0051] In the embodiment illustrated by Figs. 13 and 14, elastic resilient element 10 comprises engaging means 11 for engaging with holding means 21. In another embodiment, elastic resilient element 10 does not comprise such engaging means, but instead shut-off valve 6 comprises engaging means for engaging with holding means 21; such an embodiment is discussed further below, in connection with Figs. 51 to 53.

[0052] The embodiment shown in Figs. 13-14 comprises a supporting element 30 (see Fig. 13) that assists elastic resilient element 10 in disengaging from holding means 21. In another embodiment, not shown, no supporting element is present, and shut-off valve 6 is attached to can end 2 in such a way that it keeps the elastic resilient element against the bottom surface of the can end. In yet another embodiment, also not shown, the holding means comprises a ridge having a length of e.g. 3 mm and protruding below the plane of the can end (instead of a groove protruding above the plane of the can end) and the elastic resilient element comprises a V-shaped notch (instead of a protrusion), such that the ridge fits in the notch when the shut-off valve is in the opened position for drinking or pouring.

[0053] Fig. 15 shows a combination of a 3D side view and cross section of the embodiment of the can end of Fig. 2, wherein part of the can end is cut away for clarity, and wherein the can is being reclosed, so that elastic resilient element 10 is moving towards its original position (its position when the can was not yet opened) and shut-off valve 6 is released and will close the drinking or pouring aperture. Fig. 16, which is a detailed view of a portion of Fig. 15, shows that engaging means 11 is no longer

held by holding means 21. Further, the embodiment of the elastic resilient element 10 shown in Fig. 15 comprises two openings 10a, 10b that are used to attach the shut-off valve 6 and the elastic resilient element 10 to each other, as will be discussed further below, in connection with Figs. 29-32.

[0054] Fig. 17 shows a 3D top view and Fig. 19 a cross section of the embodiment of the can end of Fig. 2, wherein the can is now completely reclosed. Fig. 18 shows a detailed view of a portion of Fig. 17, wherein the pull tab is omitted for clarity. There is still a small opening in groove 9 at location 9a, but shut-off valve 6 closes and seals the can, by the action of the elastic resilient element.

[0055] An additional safety measure is shown in the embodiment of Figs. 20 and 21 (which is a cross section of the embodiment of Fig. 20). In this embodiment, pull tab 4 is rotated over an angle of about 180° around an axis through fixing means 50 and perpendicular to the plane through can end 2. In this way, the can is locked in the shown position, and it cannot be opened unintentionally. This may be useful e.g. if the can is taken away in a bag and another object in the bag could, without this safety measure, cause the cap top 3 to open so that the contents of the can would be spilled. In one embodiment, disclosed in WO 2012/028694, "Reclosing can for food product", mentioned hereinbefore, can end 2 has at least one small groove, and pull tab 4 has at least one protuberance fitting in this at least one groove, so that pull tab 4 is firmly locked in its rotated position shown in Fig. 20.

[0056] Fig. 22 shows a stack of embodiments of the can ends of Fig. 2; an advantage of this embodiment is that the can ends are very well stackable, as discussed already above.

[0057] Fig. 23 shows a 3D top view of the embodiment of the can end of Fig. 2 wherein the pull tab 4 is moved to an extreme position and Fig. 24 shows a cross section of the embodiment of Fig. 23. In this position, pull tab 4 is moved far beyond the position to which it is normally moved when opening the can. An advantage of the shown embodiment is that, even when moving pull tab 4 to such an extreme position, the can end 2 is not damaged and after moving pull tab 4 back to its position for drinking or pouring, everything functions normally, so that the can can still be closed, opened again, reclosed again, etc.

[0058] Figs. 25 to 28 illustrate, together with Fig. 29, an embodiment of a means for relieving the pressure in a can that contains a carbonated beverage. Fig. 25 shows a cross section of the embodiment of the can end of Fig. 2; Fig. 26 shows a detailed view of a portion of Fig. 25; Fig. 27 shows the embodiment of Fig. 25 in a subsequent phase; and Fig. 28 shows a detailed view of a portion of Fig. 27. Further, Fig. 29 shows an exploded view of the embodiment of the can end of Fig. 2.

[0059] In the embodiment of Figs. 25-28 (see especially Fig. 28), shut-off valve 6 comprises a cut 42 and elastic resilient element 10 comprises a cut 43, and both cuts are located near the location where pull tab 4 contacts

can end 2 when the can is opened. In this embodiment, these cuts pass completely through the shut-off valve respectively the elastic resilient element, and they have approximately the shape of an arc of a circle that may have an angle between 90° and 180° , e.g. an angle of about 120° . As is shown in the exploded view in Fig. 29, the shape of cut 42 more or less resembles the tip of a finger, and the same holds for cut 43. As discussed already above, in connection with Fig. 8, cut 42 makes an angle with the plane that passes through the shut-off valve in its position before the can is opened that may have a value of e.g. 45° . These cuts 42, 43 are part of an embodiment of a means 40 for relieving a pressure in the can; they are illustrated in detail in Figs. 42 and 43. In this embodiment, cut 43 in elastic resilient element 10 makes an angle of about 90° with the plane that passes through the elastic resilient element in its position before the can is opened. These cuts may form a seal, or, alternatively, they may form openings, e.g. when a slight force is exerted on them in the direction of the interior of the can, such as by actuation of the pull tab.

[0060] Figs. 25 and 26 show the situation immediately after the attachment of can end 2 to can body 1 (customarily, the attachment operation is performed by seaming). The can contains a carbonated beverage, and pressure in the can is starting to build up against can end 2, which was just attached; carbon dioxide bubbles 41 are shown (these are enlarged in the drawing for clarity). The succeeding situation is shown in Figs. 27 and 28; pressure in the can has built up and due to this pressure a portion of shut-off valve 6, in the drawing the portion at the right-hand side of cut 42 in shut-off valve 6 (i.e. at the side of the fixing means 50 attaching pull tab 4 to can end 2) is moved upwards, i.e. away from the interior of the can, thus creating an opening in shut-off valve 6 (remark: angle 44 shown in Fig. 8 is oriented in such a way that the portion of shut-off valve 6 at the right-hand side of cut 42 can move upwards; if the angle 44 were e.g. 135° , the portion of the shut-off valve at the right-hand side of cut 42 would be blocked by the portion at the left-hand side of cut 42 and would not be able to move upwards). The portion of shut-off valve 6 at the other side, i.e. the portion at the left-hand side of cut 42 (which has the shape of a fingertip as shown in Fig. 29), cannot move upwards because in this embodiment cap top 3 of can end 2 comprises an embossment 14, below the plane of the can end, restraining the movement of elastic resilient element 10 and of shut-off valve 6. Likewise, a portion of elastic resilient element 10, in the drawing at the right-hand side of cut 43 in the elastic resilient element, moves upwards and creates an opening in elastic resilient element 10. Carbon dioxide can thus move through the openings in shut-off valve 6 and elastic resilient element 10, as indicated in Figs. 27 and 28 by the bubbles 41 near fixing means 50, so that the pressure at both sides of shut-off valve 6 will equalize and the openings near cuts 42 and 43 will close. The carbon bubbles 41 that passed the opening in the shut-off valve now "sit ready" to leave the

can when it will be opened; see Fig. 28 and see Fig. 8 wherein groove 9 is opened at location 9a by a user actuating pull tab 4. The carbon bubbles "sitting ready" before the opening can now escape to the outside through the opening at location 9a, and as a result the pressure will drop at the side of the shut-off valve that faces fixing means 50 and the exterior of the can. Due to the higher pressure in the interior of the can, a portion of shut-off valve 6, in the drawings at the right-hand side of cut 42 in shut-off valve 6, will again move upwards, and the same holds for the elastic resilient element 10 with respect to cut 43, so that the openings in the shut-off valve and in the elastic resilient element are created again (this is the situation shown in Fig. 8). Carbon dioxide escapes through these openings and through the opening in the groove at location 9a, and hence the internal pressure in the can is relieved, so that the can is opened easily since no large force needs to be counteracted.

[0061] When the can is opened, the cap top is removed along its entire circumference from the can end and remains attached to elastic resilient element 10 (as shown e.g. in Fig. 10; in the embodiment of Figs. 8 and 28 the attachment is done by fixing means 12); the cap top can thus move freely together with the elastic resilient element. Hence, in a reclosed can, embossment 14, which is part of the cap top, can freely move with elastic resilient element 10, and thus no longer restrains the movement of elastic resilient element 10 and of shut-off valve 6.

[0062] After reclosing the can, the internal pressure in the can builds up again due to the carbonated beverage remaining in the can. Since embossment 14 no longer restrains the movement of elastic resilient element 10 and of shut-off valve 6, the internal pressure causes the shut-off valve and the elastic resilient element to move upwards, both at the left-hand side and at the right-hand side of cut 42 and of cut 43, and no openings will be formed near these cuts, so that the shut-off valve closes and seals the can.

[0063] When reopening the can, by actuating pull tab 4, embossment 14 no longer plays a role in relieving the pressure in the can. The internal pressure is now relieved because openings are formed at the location of cuts 42 and 43 due to the local deformation of the can end at the location where pull tab 4 contacts the can end (and, specifically, the cap top) when it is actuated. This is discussed in detail further below, in connection with Figs. 44 and 45 which illustrate an embodiment wherein the embossment 14 is absent.

[0064] Figs. 29 to 32 show respectively an exploded view of the embodiment of the can end of Fig. 2 and individual parts, namely an elastic resilient element 10, a shut-off valve 6 and a supporting element 30. In the shown embodiment, cap top 3 of can end 2 is attached to elastic resilient element 10 via fixing means 12, such as a rivet. Elastic resilient element 10 comprises an opening 10c for fixing means 12. Further, elastic resilient element 10 comprises two openings 10a and 10b that each comprise an edge that fits into a corresponding slit 6d,

6c of shut-off valve 6. This ensures that shut-off valve 6 and elastic resilient element 10 are attached to each other in such a way that, during opening and closing of the can, the rotational movement of elastic resilient element 10 on the one hand, and the rotational movement of shut-off valve 6 on the other hand, do not hinder each other - in fact, both rotational movements occur around non-identical rotation axes, since shut-off valve 6 is attached to can end 2 via fixing means 15 (which may be a rivet). Shut-off valve 6 comprises an opening 6b for fixing means 15. In this embodiment, shut-off valve 6 comprises a cut 42 and elastic resilient element 10 comprises a cut 43 for relieving the pressure in the can, as discussed already above. Further, supporting element 30 comprises an opening 30c for fixing means 15 and an opening 30d for embossment 18 (can end 2 may comprise such an embossment to allow easy access to the pull tab). The embodiment of elastic resilient element 10 shown in Fig. 30 comprises embossments 10d and 10e to accommodate respectively embossed ridges 17 and 16 of can end 2.

[0065] Fig. 33 shows a top view of an embodiment of a can end, based on a CDL can end, and Fig. 34 shows a cross section of the embodiment of Fig. 33. This embodiment is quite similar to the embodiment shown in Figs. 2 to 4 that is based on a SuperEnd can end. A first difference is that in the embodiment shown in Figs. 33 and 34, cap top 3 is attached to the elastic resilient element 10 (shown in Fig. 34) by two fixing means 12 and 12a (shown in Fig. 33); these fixing means may be rivets. Another difference is that embossment 14, below the plane of the can end 2, is absent in this embodiment. How the shut-off valve 6 abuts along its circumference against the edge of can end 2, to seal the interior of the can from the drinking or pouring aperture, is yet another difference. As is shown in Fig. 4, the edge of the can end 2, based on a SuperEnd can end, against which edge 6a of shut-off valve 6 abuts, has a shape that is different from the shape of the edge of the can end shown in Fig. 34. To ensure good sealing properties at its circumference, the embodiment of shut-off valve 6 shown in Fig. 4 has a rounded edge 6a, while in the embodiment shown in Fig. 34 shut-off valve 6 has an edge that is rather flat.

[0066] While in the embodiment of Fig. 34 the can is not yet opened, Fig. 35 shows a cross section of the embodiment of the can end of Fig. 33 when it is reclosed.

[0067] Fig. 36 shows a cross section of the embodiment of Fig. 33 wherein the shut-off valve 6 is held in its opened position for drinking or pouring by holding means 21 of can end 2. Elastic resilient element 10 comprises engaging means 11 for engaging with holding means 21. Fig. 37 shows a 3D top view, wherein half of the can end is cut away for clarity, of the embodiment of Fig. 36.

[0068] Fig. 38 shows an exploded view of the embodiment of the can end of Fig. 33.

[0069] Fig. 39 shows a stack of embodiments of the can ends of Fig. 33; an advantage of this embodiment is that the can ends are very well stackable, as discussed

already above.

[0070] Fig. 40 shows a top view of an embodiment of a can end 2, based on a CDL can end, and comprising another embodiment of a pull tab 4. Fig. 41 shows an embodiment of the can end of Fig. 40 when reclosed, wherein the pull tab 4 is rotated over an angle of about 180° as an additional safety measure, as discussed already above in connection with Figs. 20 and 21.

[0071] Figs. 42 and 43 illustrate an embodiment of a means 40 for relieving a pressure in the can, comprising a cut 42 in shut-off valve 6 and a cut 43 in elastic resilient element 10.

[0072] Fig. 44 shows a cross section of an embodiment of the can end of Fig. 33 illustrating another embodiment of a means for relieving a pressure in the can, and Fig. 45 shows a detailed view of a portion of Fig. 44. This embodiment can be compared to the one discussed above in connection with Figs. 25-28 and Fig. 8. Here, in the embodiment illustrated by Figs. 44 and 45, there is no embossment 14 to restrain the movement of elastic resilient element 10 and of shut-off valve 6. As a result, before the can is opened, shut-off valve 6 and elastic resilient element 10 remain closed the whole time. When the can is opened by a user by actuating pull tab 4, on the one hand groove 9 is opened at location 9a as discussed already above in connection with Figs. 5 - 8, and on the other hand a force is exerted on the can end 2 at the location where pull tab 4 contacts can end 2, causing a local deformation of the can end. As discussed already above, in connection with Fig. 2, this local deformation may be increased by providing the cap top with means 16a for weakening its rigidity near the location where the pull tab touches the cap top when the can is opened; these means 16a for weakening may comprise an interruption of embossed ridge 16 on the cap top. As a result of this local deformation of the can end, more specifically of the cap top, elastic resilient element 10 and shut-off valve 6 are deformed near this same location, which causes openings to be formed at cuts 42 and 43. Carbon dioxide now escapes through these openings and through the opening in the groove at location 9a, relieving the internal pressure in the can. In one embodiment, the elastic resilient element 10 is made of stainless steel and has a higher stiffness than the shut-off valve 6 that is made of plastic, in this one embodiment. When the can is opened and pull tab 4 is actuated, as shown in Fig. 45, the portion of the elastic resilient element 10 at the left-hand side of cut 43 will push the portion of the shut-off valve 6 at the left-hand side of cut 42 downwards, due to the higher stiffness of the elastic resilient element, so that the opening formed at cut 43 will be larger than if the elastic resilient element would not be present.

[0073] This embodiment of a means for relieving a pressure in the can was discussed here as part of an embodiment of a can end based on a CDL can end, but this embodiment may also be used in an embodiment of a can end based on a SuperEnd can end. Vice versa, the embodiment of a means for relieving a pressure in

the can discussed further above in connection with Figs. 25 to 28 may also be used in an embodiment of a can end based on a CDL can end.

[0074] In the embodiment illustrated by Figs. 44 and 45, the cuts 42 and 43 may each have a shape resembling the shape of a fingertip. However, it is clear that another shape of cut 42 in shut-off valve 6 will work as well, as long as the cut is shaped so as to form a seal in the shut-off valve in the absence of a force, in the direction of the interior of the can, on the portion of the shut-off valve at the left-hand side of cut 42 (in Fig. 45) and adjacent to cut 42, and so as to form an opening in the shut-off valve, upon exertion of a force on that portion, in the direction of the interior of the can.

[0075] In one embodiment, shut-off valve 6 is a plate-like element that comprises cut 42. In another embodiment, the shut-off valve comprises a plate-like element comprising cut 42, and cut 42 is configured to form a seal in the shut-off valve in the absence of a force, in the direction of the interior of the can, on the portion of the plate-like element of the shut-off valve at the left-hand side of cut 42 (in Fig. 45) and adjacent to cut 42, and configured to form an opening in the shut-off valve, upon exertion of a force on that portion, in the direction of the interior of the can.

[0076] The force may be caused by the user actuating the pull tab of the can.

[0077] These embodiments of a means for relieving the pressure in the can may also be applied to other embodiments of cans than the ones discussed above. The drinking or pouring aperture may be created by other means than a pull tab and a cap top, arranged in connection to the pull tab configured to remove the cap top from the can end.

[0078] In another embodiment, a can end, for a metal beverage can for a carbonated drink, comprises means for creating a drinking or pouring aperture; and a shut-off valve, configured to close the drinking or pouring aperture after drinking or pouring; wherein the shut-off valve (6) comprises a first plate-like element, the first plate-like element having a first cut (42) through it and having a first portion adjacent to the first cut (42), the first cut (42) being configured to form a seal in the shut-off valve in the absence of a force, in a direction of the interior of the can, on the first portion of the first plate-like element, and being configured to form an opening in the shut-off valve (6), for relieving the gas pressure originating from the carbonated drink, upon exertion of a force, in the direction of the interior of the can, on the first portion.

[0079] Fig. 46 shows a cross section of an embodiment of a can end, based on a SuperEnd can end and comprising an intermediate element 80 as disclosed in WO 2014/124992. The embodiment of the intermediate element 80 shown in Fig. 46 is attached to the can end by seaming. It shields the can end circumferentially from the interior of the can. In this embodiment, the intermediate element also interacts with the elastic resilient element 10 and increases its resilience. Further, it keeps the elas-

tic resilient element against the bottom surface of the can end.

[0080] Fig. 47 shows a bottom view of the intermediate element 80 used in the can end of Fig. 46. In this embodiment, the intermediate element has an opening 80d for embossment 18 of can end 2 and an opening 80e for movement of elastic resilient element 10 and shut-off valve 6. Further, elastic resilient element 80 has a position 80c for attachment of shut-off valve 6, as discussed below in connection with Fig. 49.

[0081] Fig. 48 shows a 3D cross section of an intermediate element comprising a sealing element 81; the sealing element may e.g. be made of silicone.

[0082] The intermediate element may be at least substantially made of at least one plastic material, e.g. polyacetal. In another embodiment, the intermediate element is at least substantially made of at least one metal, e.g. aluminum. The aluminum may have a thickness of less than 0.2 mm.

[0083] Fig. 49 shows an exploded view of the embodiment of the can end of Fig. 46. In the shown embodiment, shut-off valve 6 is not attached to can end 2 by fixing means 15, as in the embodiment of Fig. 2, but, instead, shut-off valve 6 is attached to intermediate element 80. The shut-off valve may be attached to the intermediate element by a fixing means, such as a rivet, through opening 6e in shut-off valve 6. In another embodiment, shut-off valve 6 is attached to intermediate element 80 by means of an adhesive, in position 80c of the intermediate element. There is no supporting element in this embodiment.

[0084] Fig. 50 shows a stack of embodiments of the can ends of Fig. 46; an advantage of this embodiment is that the can ends are very well stackable, as discussed already above.

[0085] Fig. 51 shows a top view of an embodiment of a can end, based on a CDL can end. This embodiment of can end 2 comprises another embodiment of a second embossed ridge 17; second embossed ridge 17 has another shape, such that the ridge is positioned more closely to groove 9. An advantage of this embodiment is that the rigidity of the can end is improved, especially in the area near fixing means 50.

[0086] Fig. 52 shows a bottom view of the embodiment of the can end of Fig. 51, and Fig. 53 shows a cross section of the embodiment of the can end of Fig. 51.

[0087] Because of the improved rigidity of the can end, in this embodiment another embodiment of a shut-off valve may be used, namely a shut-off valve that does not abut along its circumference against the edge of can end 2, as in the embodiment illustrated by Fig. 34, but a shut-off valve 6 that is smaller and only a little bit larger than the cap top 3; such a smaller shut-off valve is shown in the embodiment illustrated by Fig. 5 of patent application WO 2012/028694 A1, mentioned already above (remark: the cap top 3 and the shut-off valve 6 are indicated in this patent application by the same reference numbers); such a smaller shut-off valve may comprise a seal, made e.g.

of silicone or another suitable material (such a seal is indicated by reference number 19 in Fig. 5 of WO 2012/028694 A1). This smaller shut-off valve may comprise engaging means, as discussed above, for engaging with holding means of the can end in its opened position for drinking or pouring and for disengaging from said holding means upon exertion of a force by a user of the can to reclose the can.

[0088] The present invention is not limited to the embodiments described above. Further, while advantages of embodiments of the present invention have been described above, not all embodiments need necessarily exhibit such advantages to fall within the scope of the present invention. The scope of the present invention is defined by the appended claims.

Claims

1. A can end (2) for a metal beverage can, said can end comprising:

- a cap top (3), arranged in connection to a pull tab (4) configured to remove said cap top from said can end to thereby create a drinking or pouring aperture;
- a shut-off valve (6), configured to close the drinking or pouring aperture after drinking or pouring;
- an elastic resilient element (10) for operating said shut-off valve (6);
- fixing means (50) for attaching said pull tab to said can end;
- holding means (21) for holding said shut-off valve (6) in an opened position for said drinking or pouring;

wherein said cap top (3) is configured to remain located, after said removal, on top of said shut-off valve (6);

characterized in that said holding means (21) is configured to release said shut-off valve (6), when in said opened position, by exertion of a force by a user of the can, in a direction of the interior of the can, on said fixing means (50), so as to close said drinking or pouring aperture.

2. Can end according to claim 1, wherein the metal beverage can is configured for containing a carbonated drink, and wherein said shut-off valve (6) comprises a first plate-like element, said first plate-like element having a first cut (42) through it and having a first portion adjacent to said first cut (42), said first cut (42) being configured to form a seal in said shut-off valve in the absence of a force, in a direction of the interior of the can, on said first portion of said first plate-like element, and being configured to form an opening in said shut-off valve (6), for relieving gas

pressure originating from said carbonated drink, upon exertion of a force, in said direction of the interior of the can, on said first portion.

3. Can end according to claim 2 wherein said elastic resilient element (10) comprises a second plate-like element, said second plate-like element having a second cut (43) through it and having a second portion adjacent to said second cut (43), said second cut (43) being configured to form an opening in said elastic resilient element (10), for said relieving said gas pressure originating from said carbonated drink, upon exertion of said force, in said direction of the interior of the can, on said second portion of said second plate-like element.
4. Can end according to claim 3 comprising means (14) for restraining a movement, in a direction away from the interior of the can, of said first portion of said first plate-like element of said shut-off valve (6) and of said second portion of said second plate-like element of said elastic resilient element (10).
5. Can end according to any one of claims 1 to 4 further comprising an engaging means (11) and wherein said holding means (21) is configured to engage with said engaging means in said opened position and to disengage from said engaging means upon said exertion of said force.
6. Can end according to claim 5 wherein said holding means has a location and wherein said location is such that said exertion of said force causes a deformation of said can end at said location, to disengage said holding means (21) from said engaging means (11).
7. Can end according to claim 5 or claim 6 wherein said elastic resilient element (10) comprises said engaging means (11).
8. Can end according to any one of claims 1 to 7 further comprising a supporting element (30) for increasing a resilience of said elastic resilient element.
9. Can end according to any one of claims 1 to 8 wherein said cap top (3) comprises means (16a) for weakening a rigidity of said cap top at a location where said pull tab (4) touches said cap top upon opening of said can.
10. Can end according to any one of claims 1 to 9 further comprising an intermediate element (80) for shielding said can end circumferentially from the interior of said can.
11. Can end according to any one of claims 1 to 10 wherein said can end has a first side and a second

side opposite to said first side, wherein said second side is adapted for receiving a first side of an identical can end for forming a stack of can ends.

12. A metal beverage can comprising a can body (1) and a can end according to any one of claims 1 to 11. 5

13. A method for producing the can according to claim 12, the method comprising the steps of:

- producing a can end (2) according to any one of claims 1 to 11;
- producing the can body (1);
- attaching the can end to the can body.

14. A method for opening and reclosing a metal beverage can, said can comprising a can body (1) and a can end (2), the method comprising the steps of:

- actuating a pull tab (4) of said can end (2), thus removing a cap top (3) of said can end, thereby creating a drinking or pouring aperture;
- resiliently opening, by said actuating said pull tab, a shut-off valve (6) configured to close and seal said drinking or pouring aperture after drinking or pouring;
- holding said shut-off valve (6) in an opened position for said drinking or pouring;

characterized in that the method further comprises exerting a force by a user of the can, in a direction of the interior of the can, on a fixing means (50) for attaching said pull tab (4) to said can end (2), so as to close said drinking or pouring aperture.

15. Method according to claim 14, wherein the metal beverage can is configured for containing a carbonated drink, the method further comprising the steps of:

- exerting a force, by said actuating said pull tab (4), on a portion of a plate-like element of said shut-off valve (6), wherein said portion is adjacent to a cut (42) through said plate-like element;
- thereby forming an opening in said shut-off valve (6) for relieving gas pressure originating from said carbonated drink.

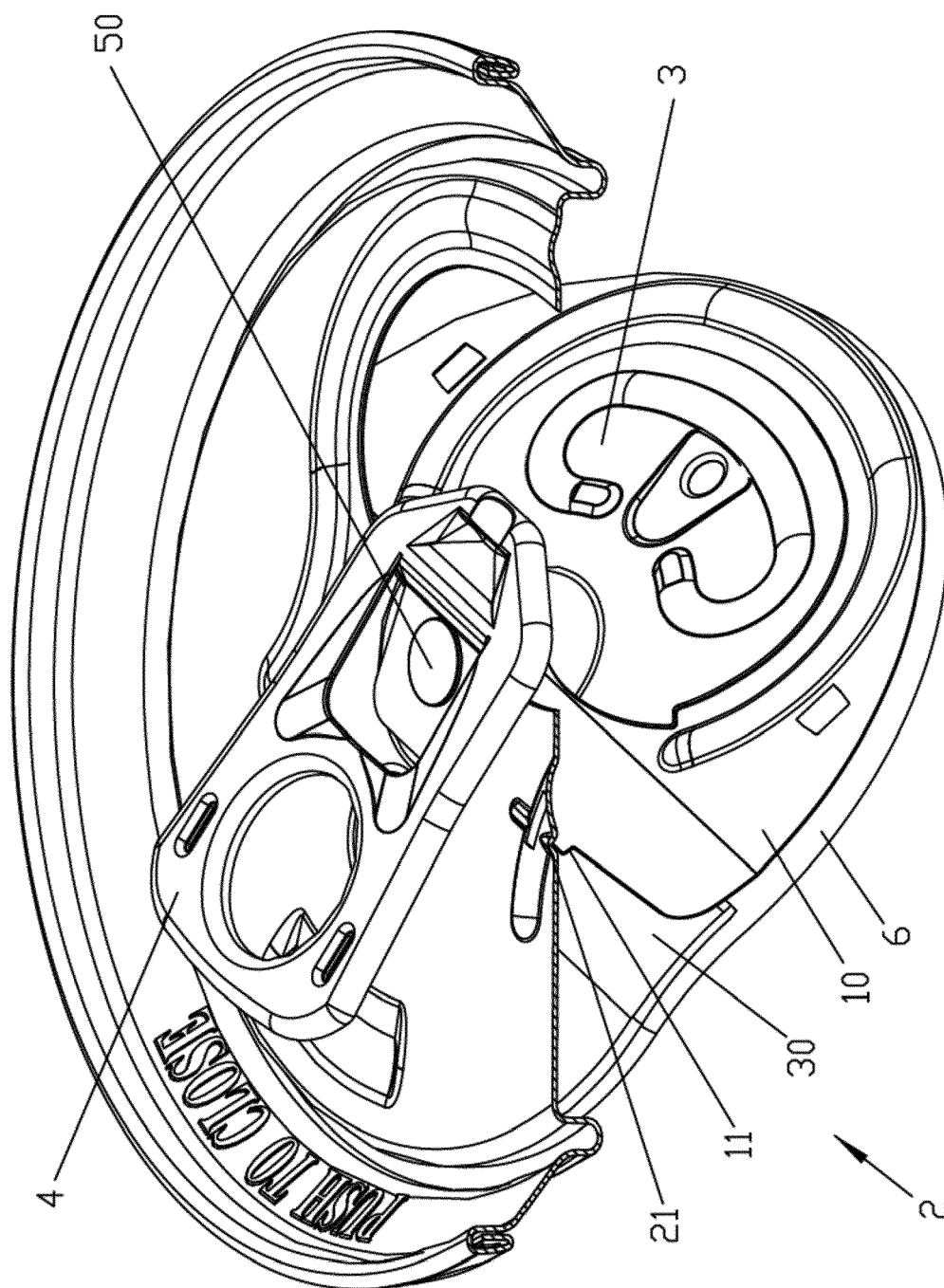


Fig. 1

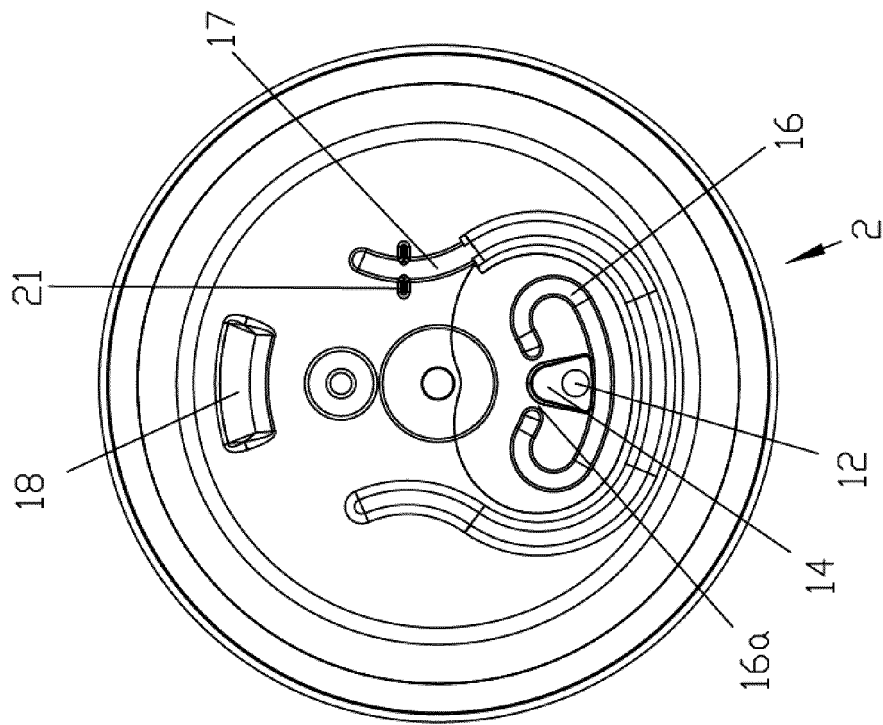


Fig.3

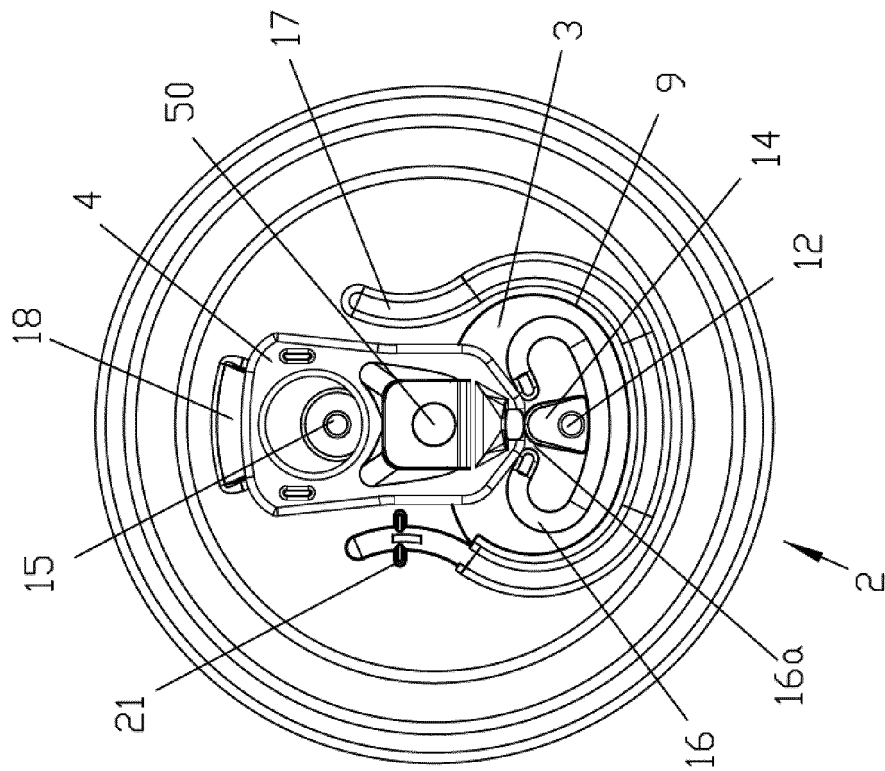


Fig.2

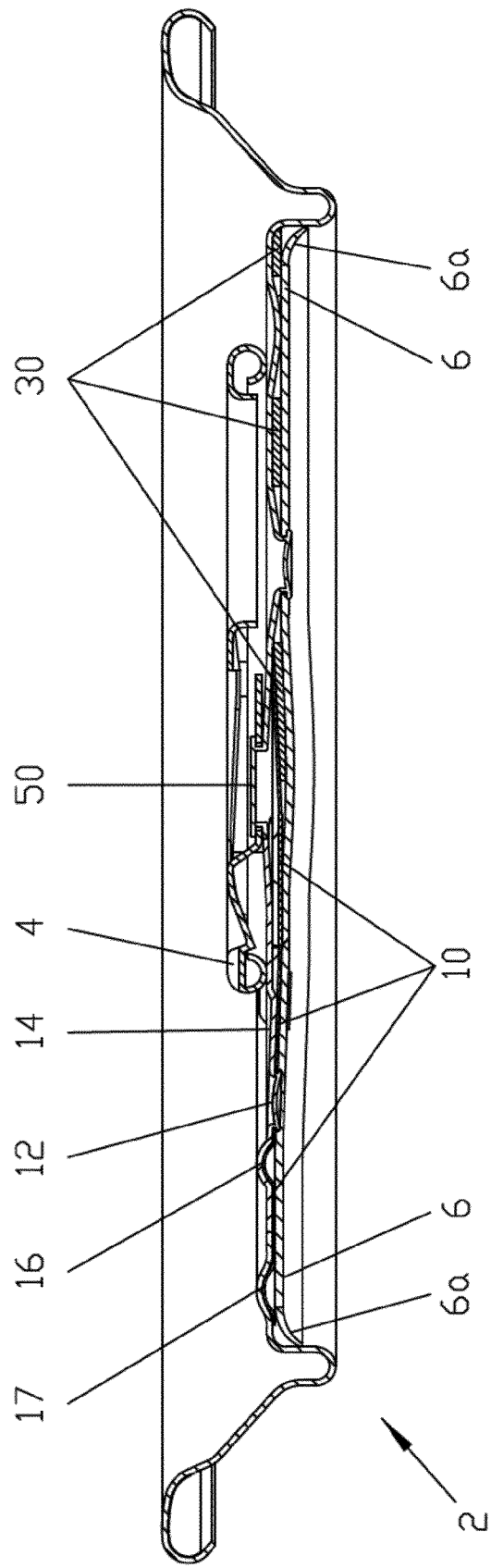


Fig. 4

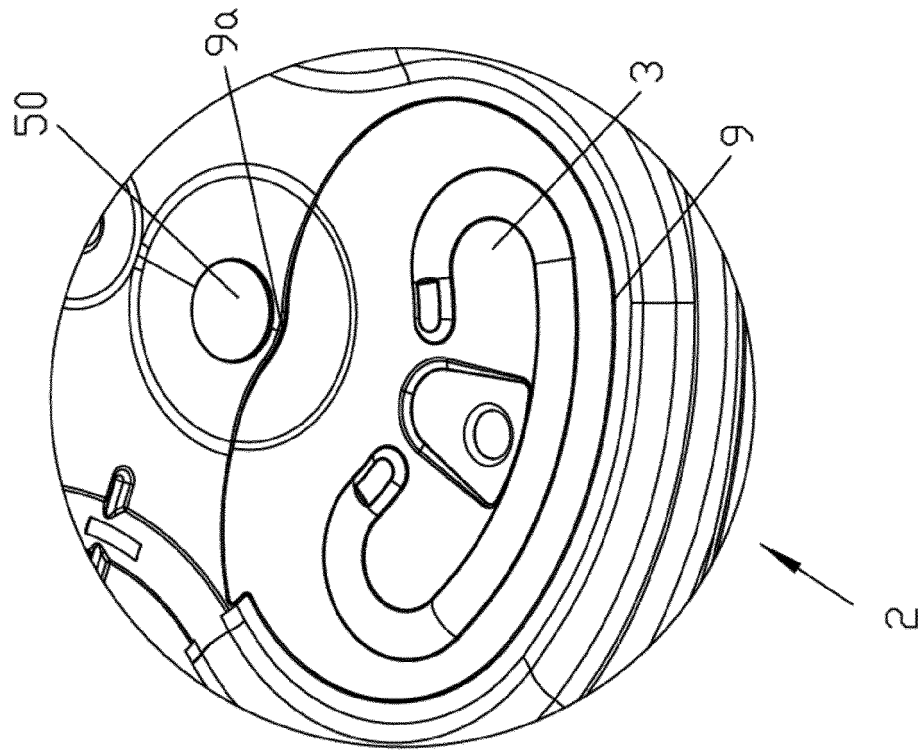


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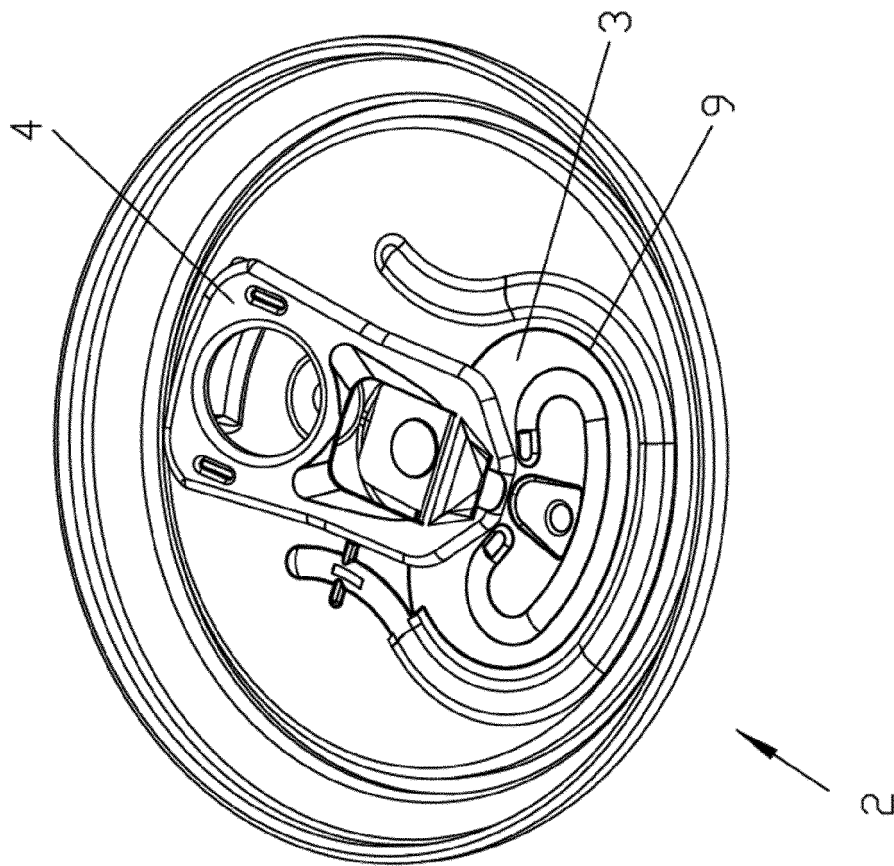
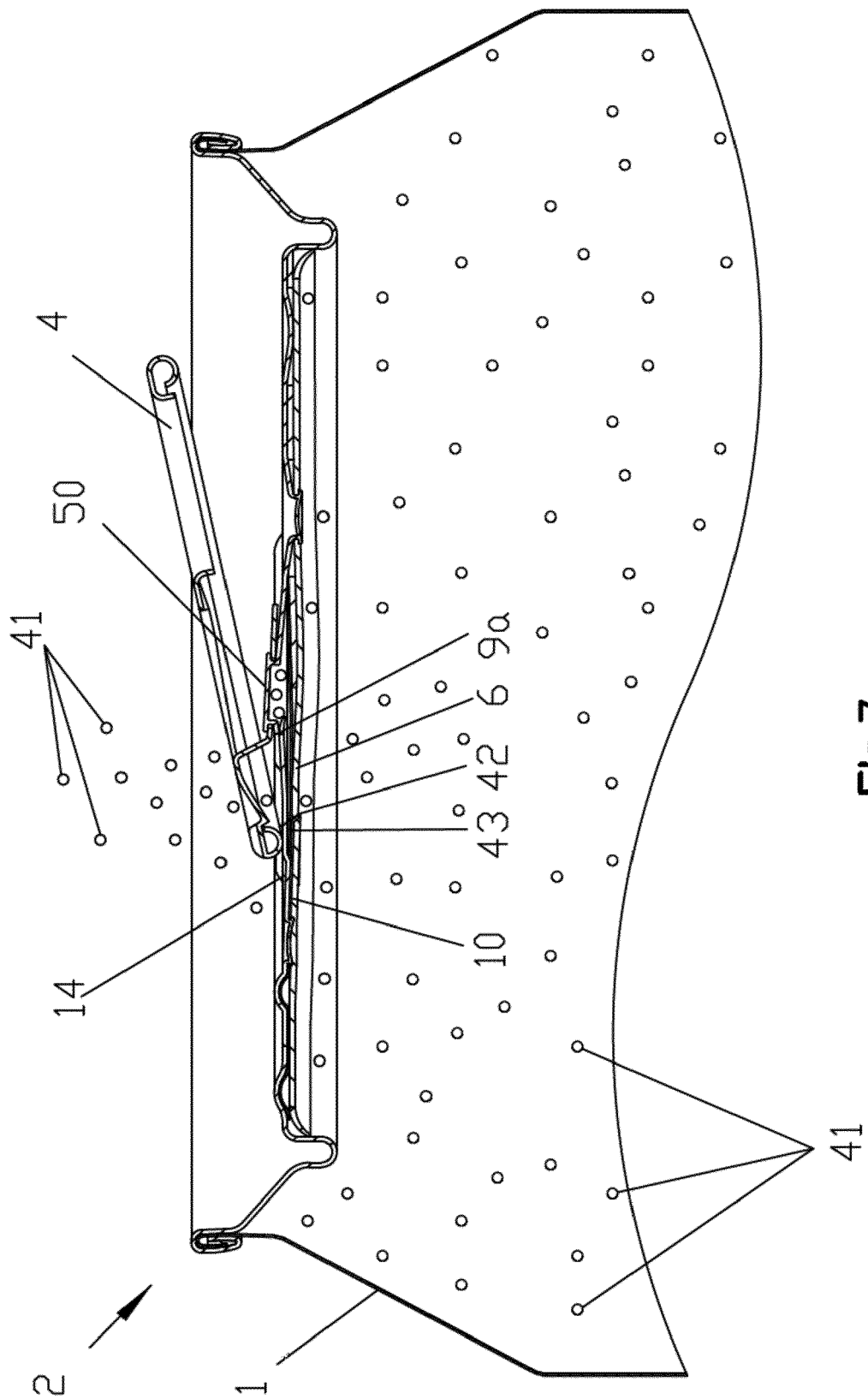


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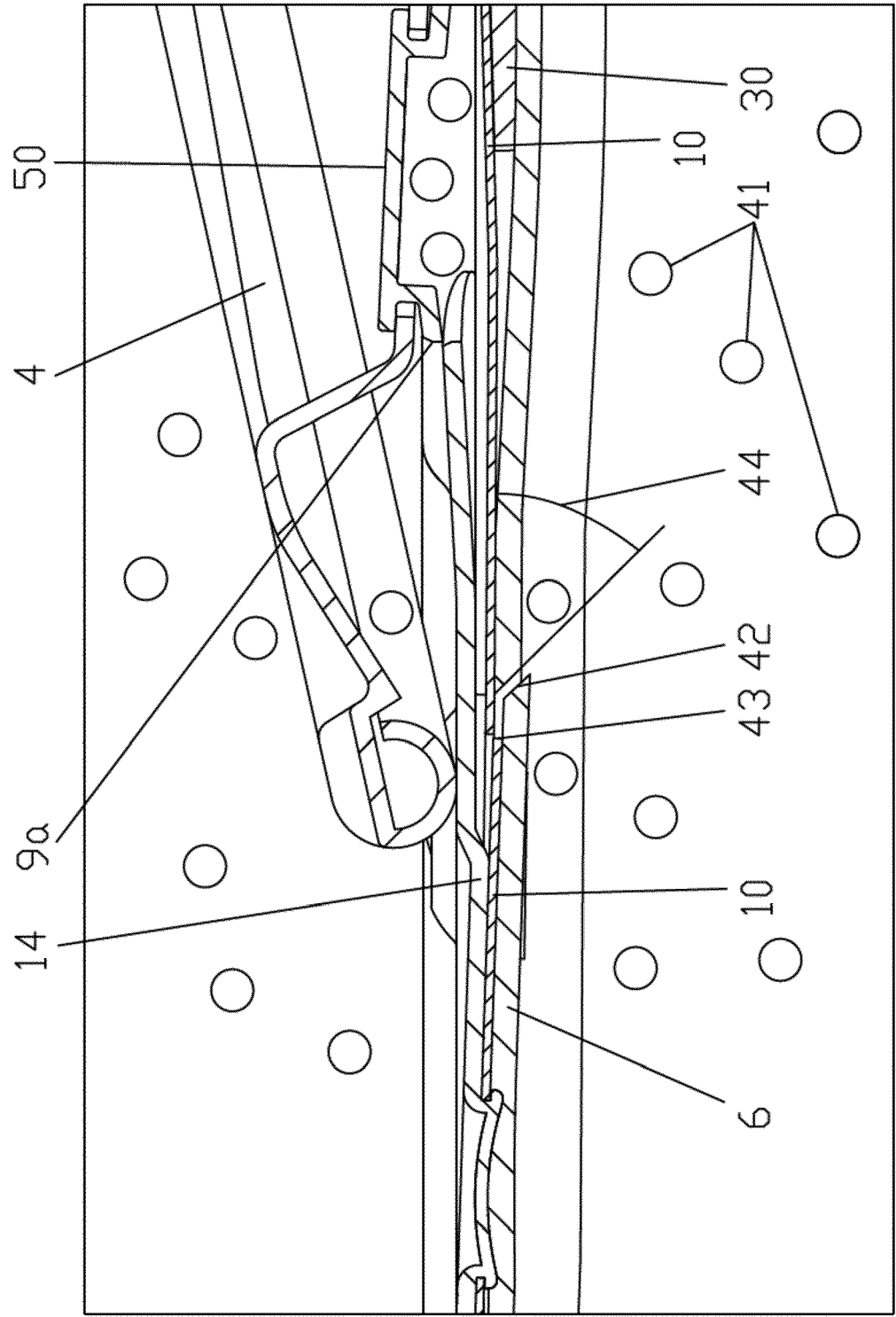


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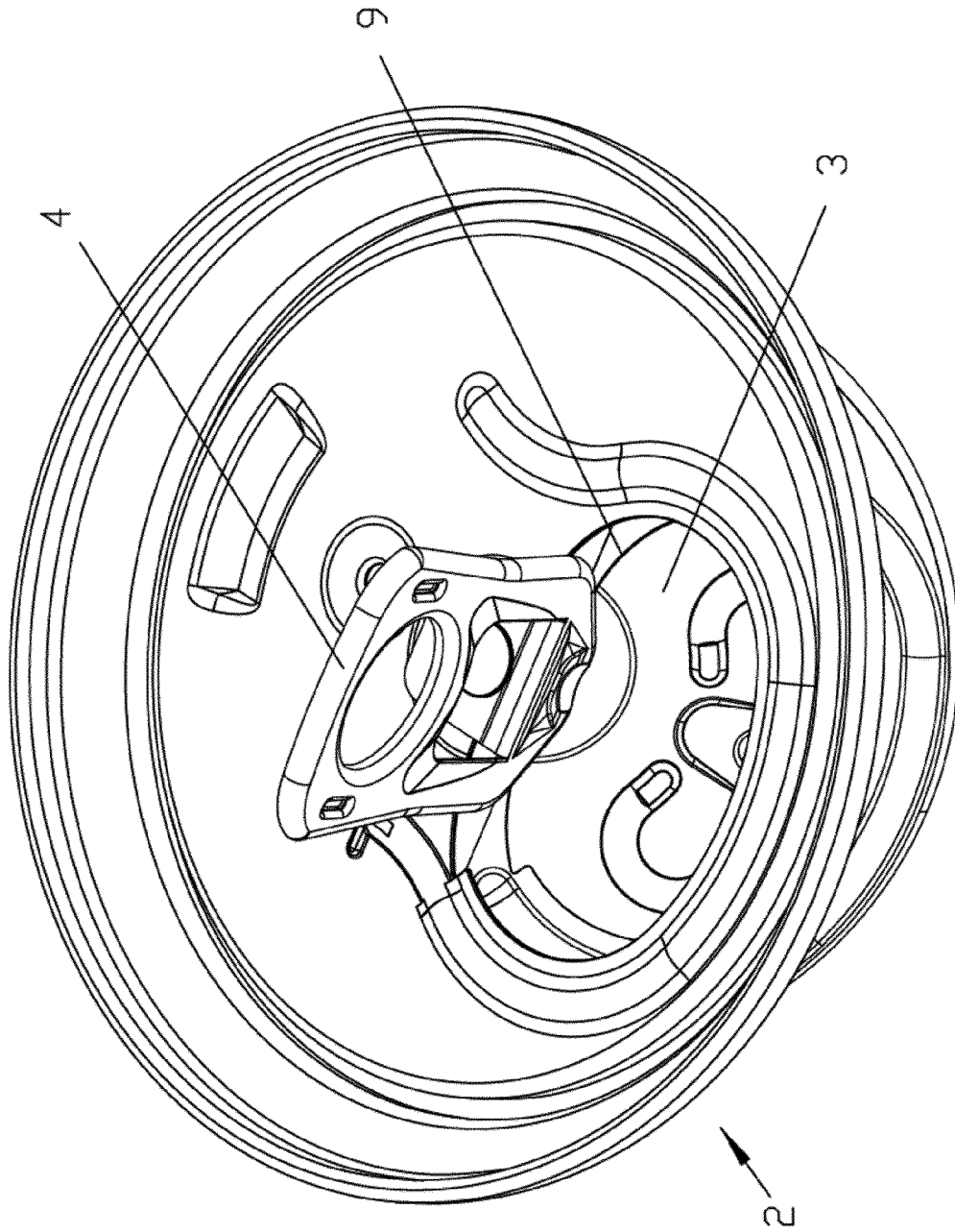


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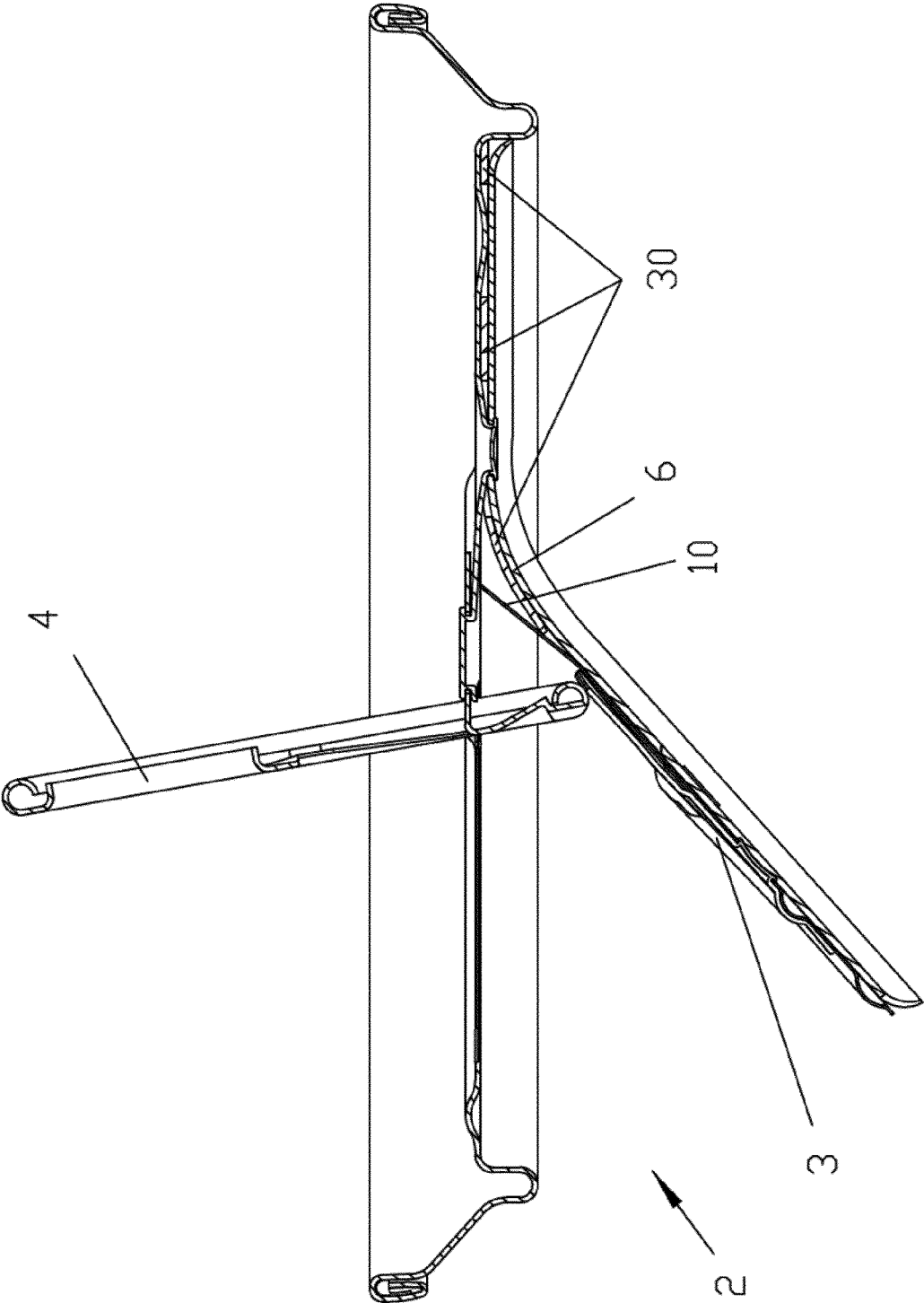


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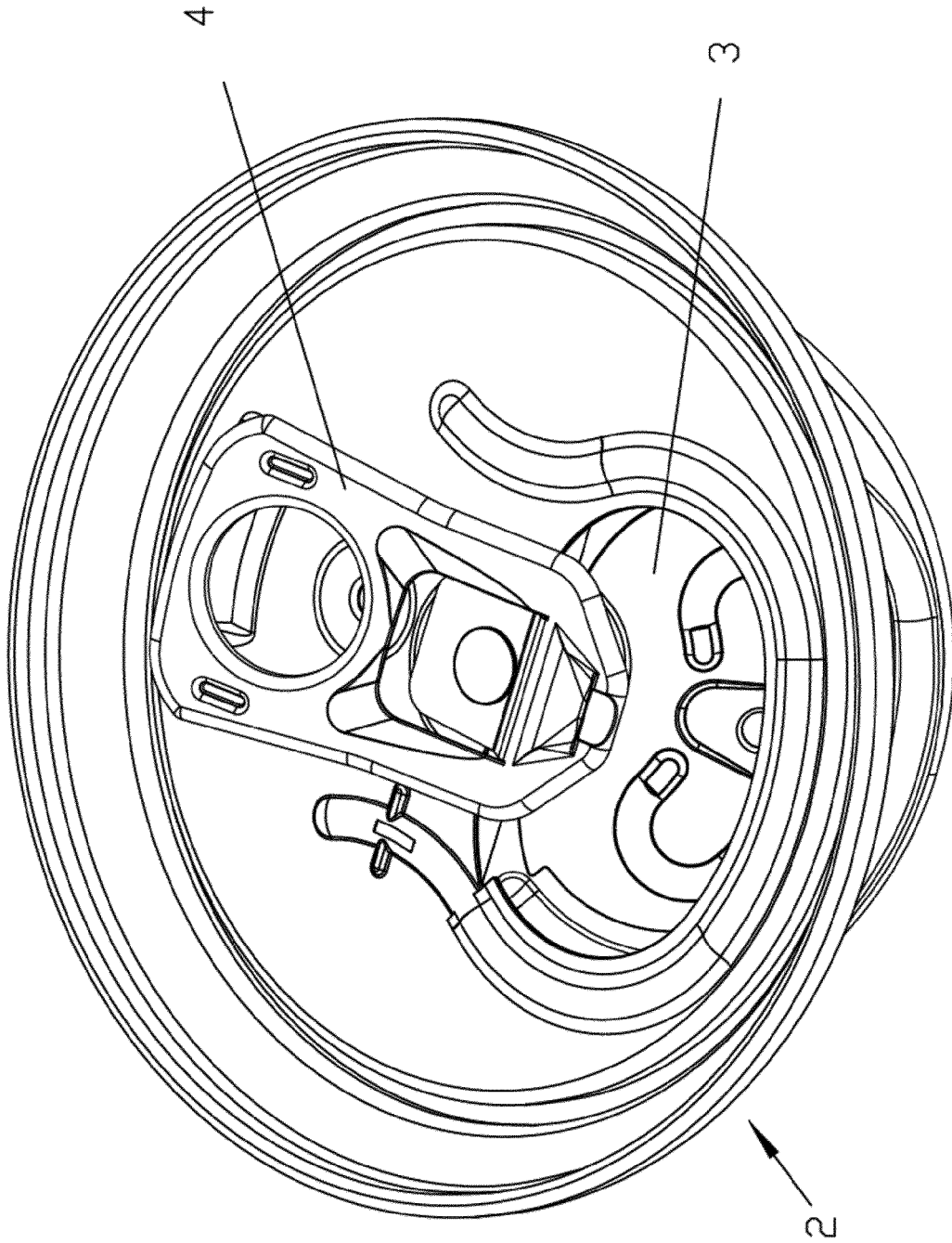


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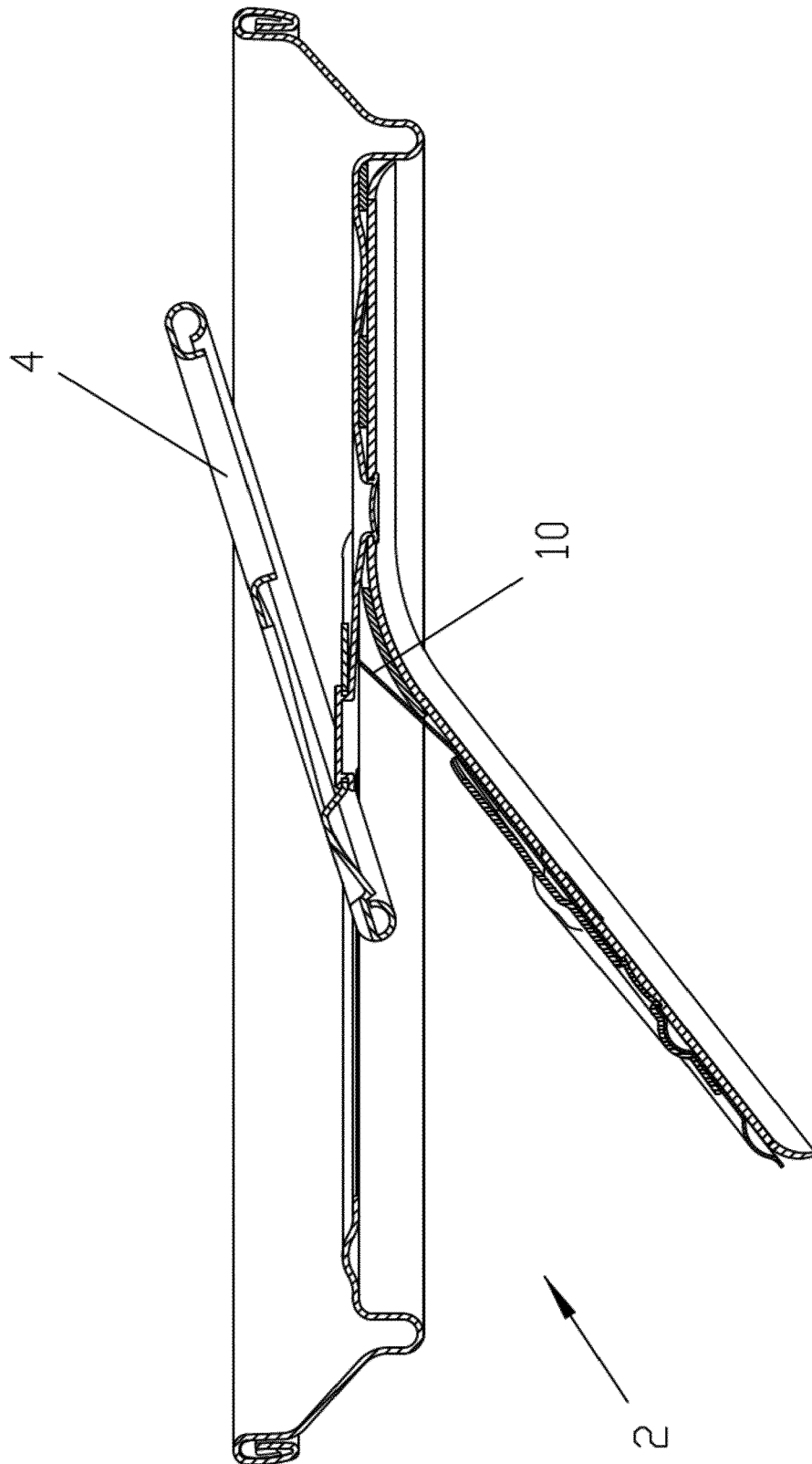
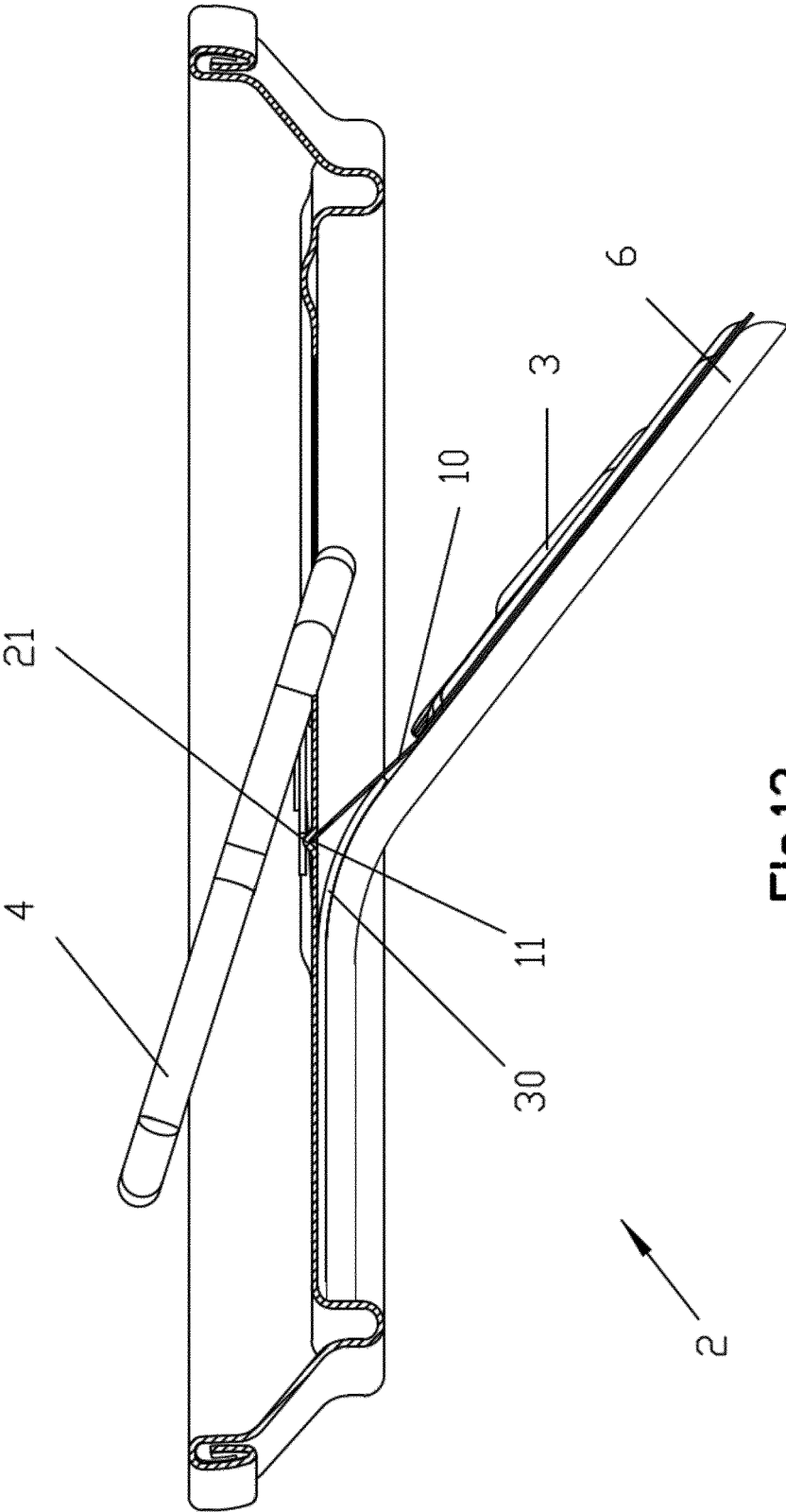


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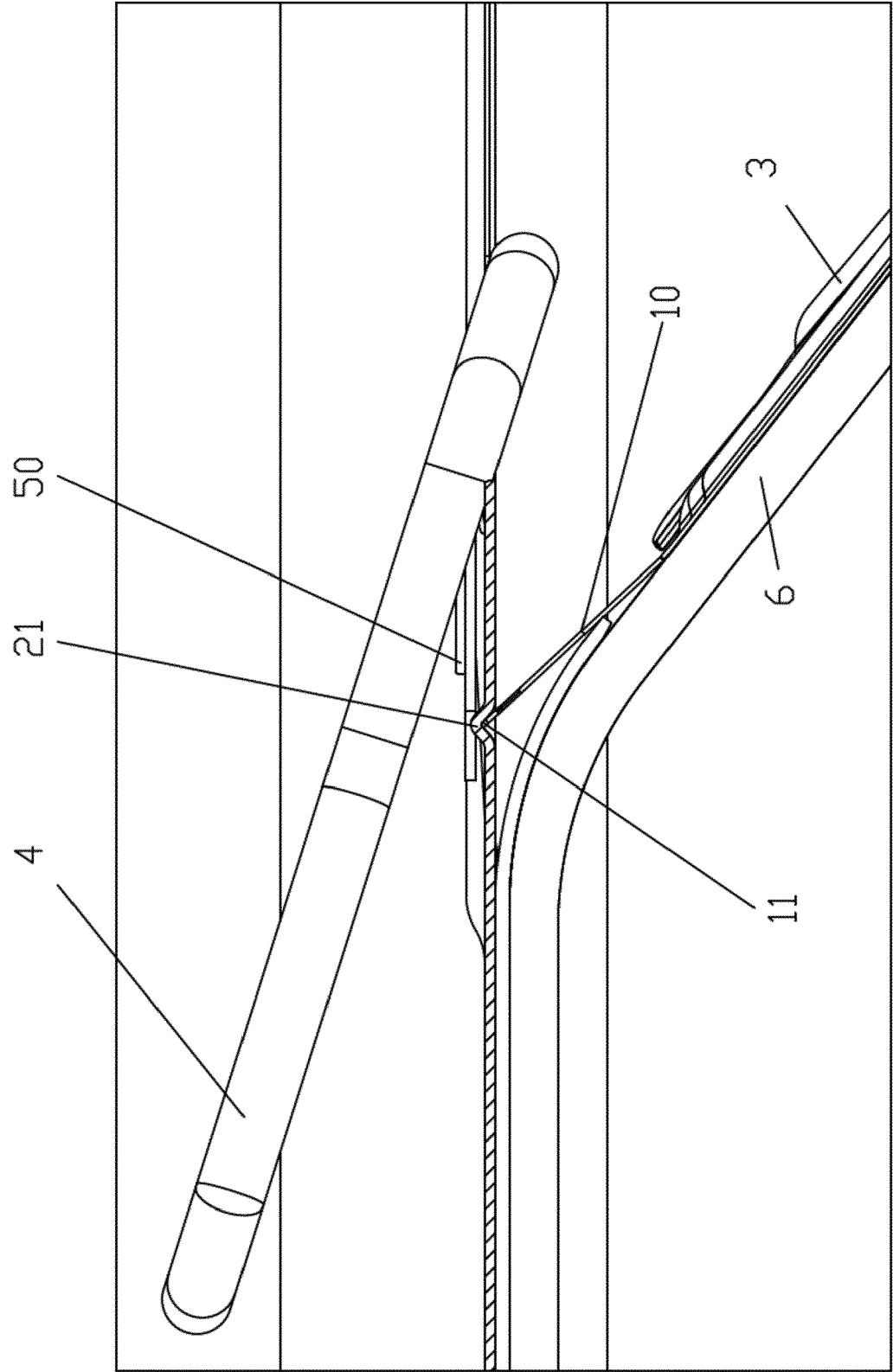


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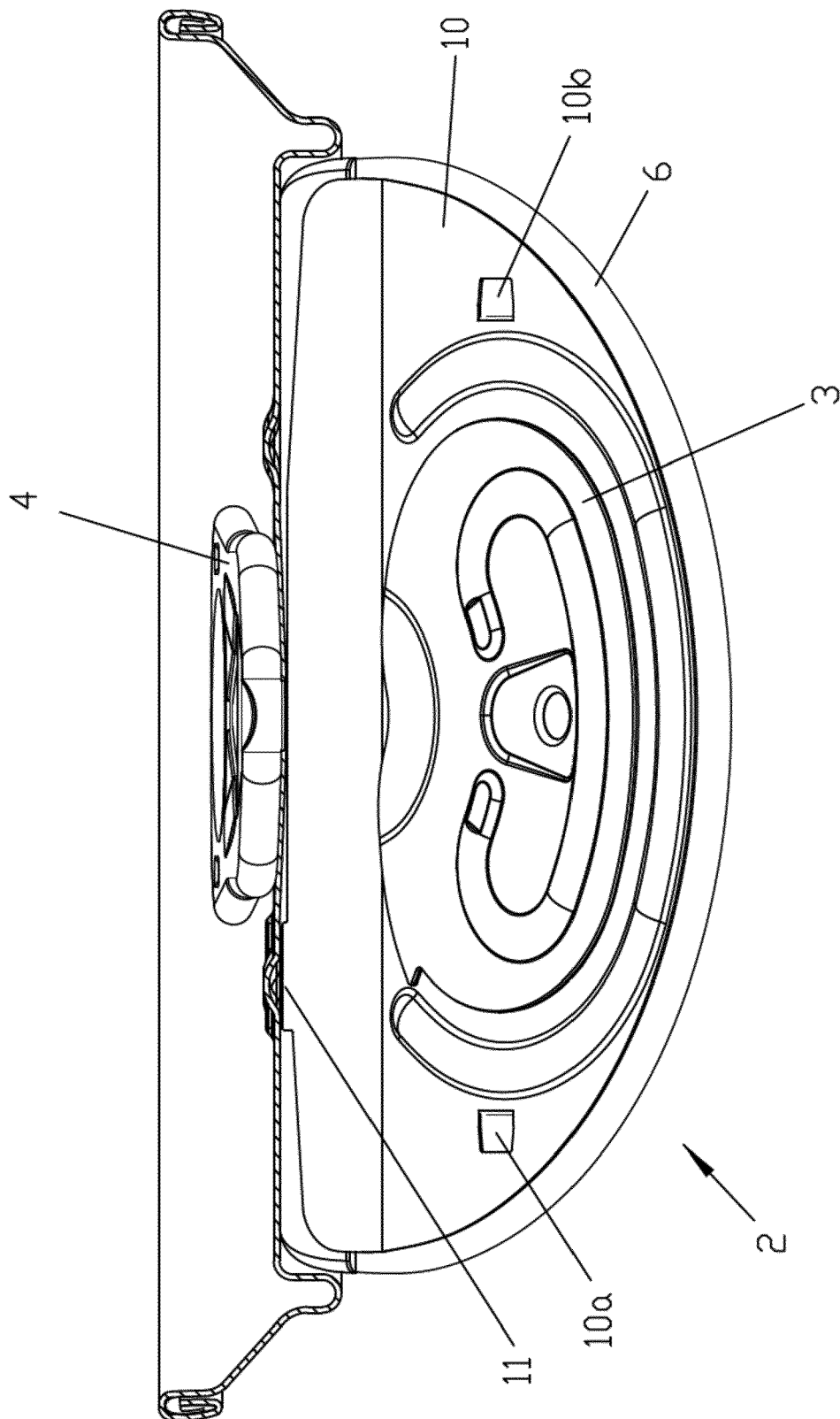


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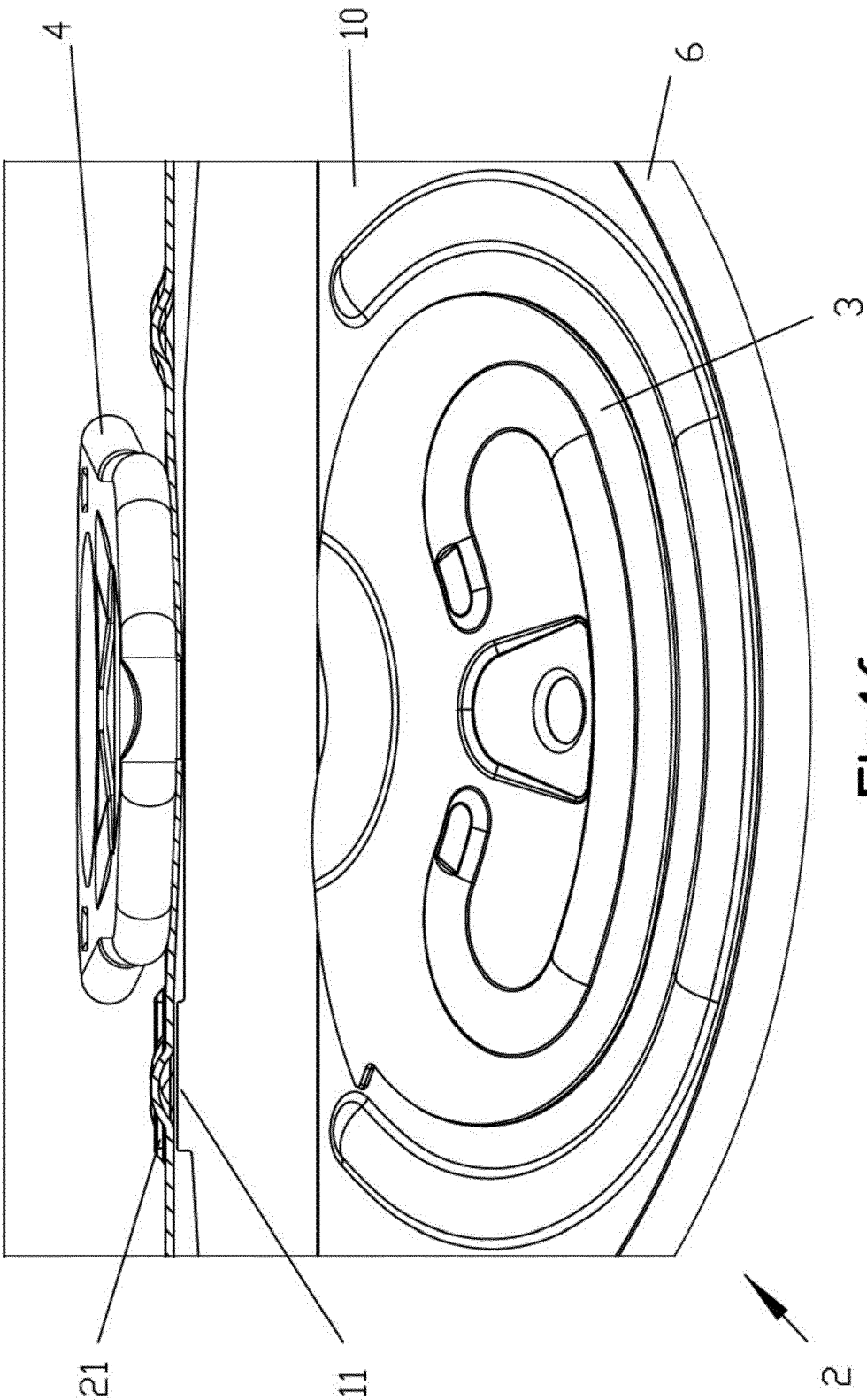


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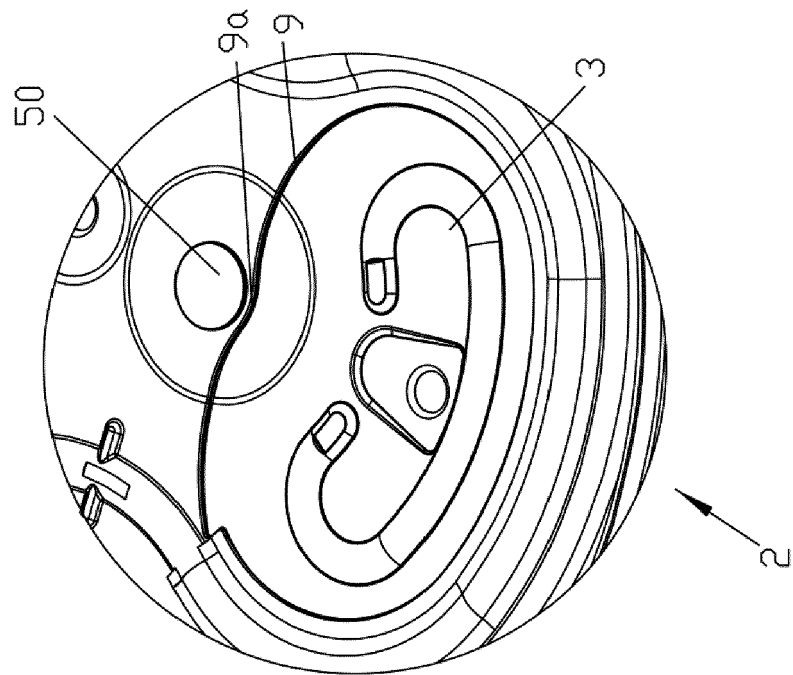


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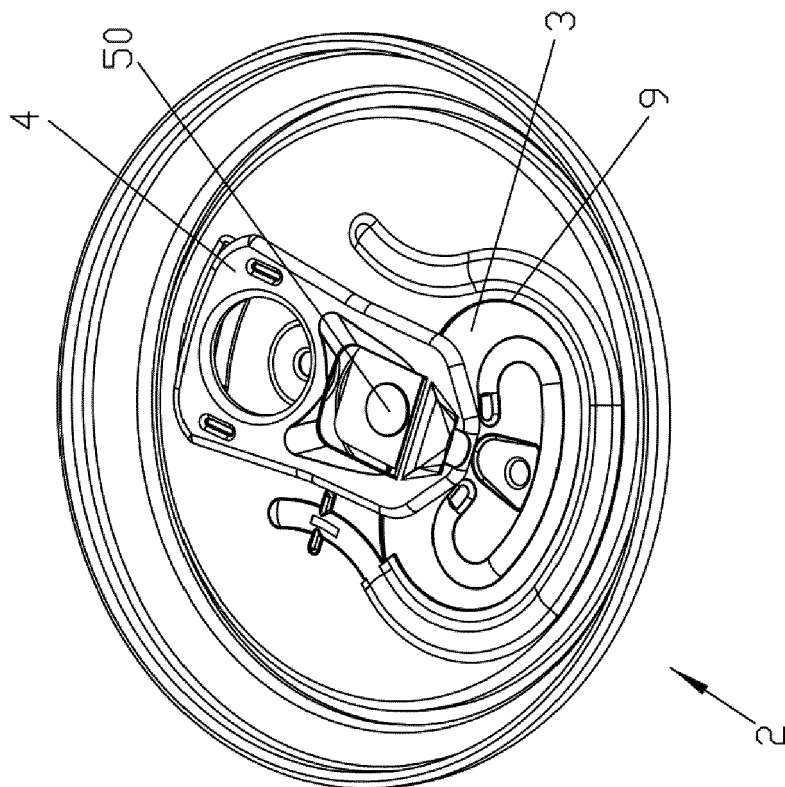


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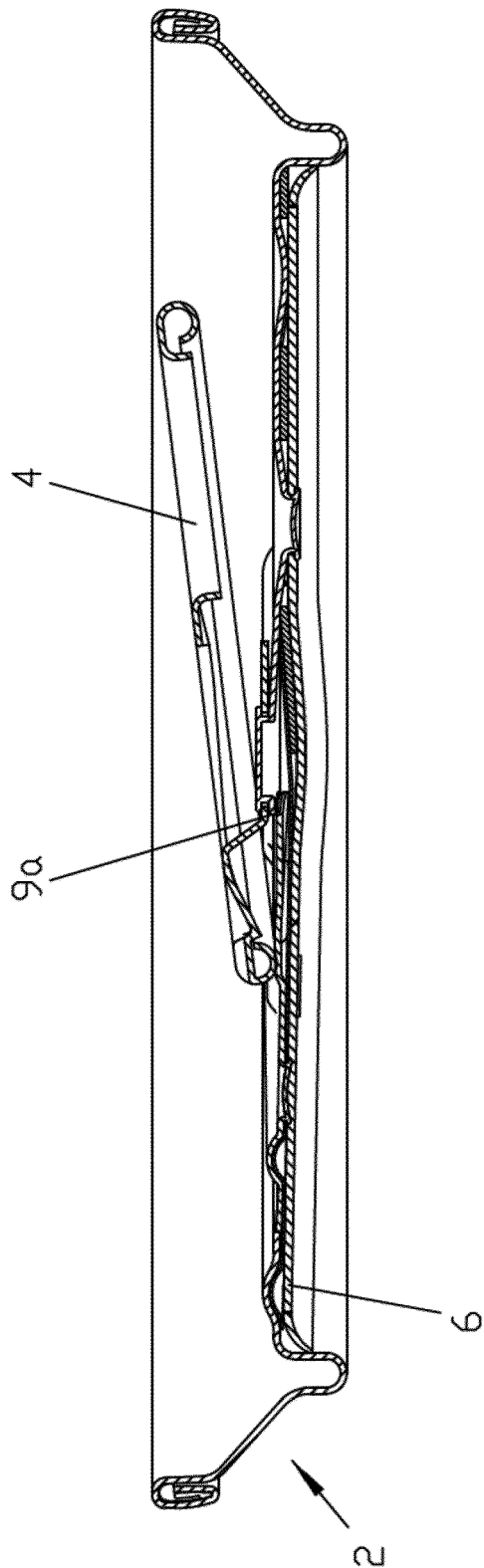


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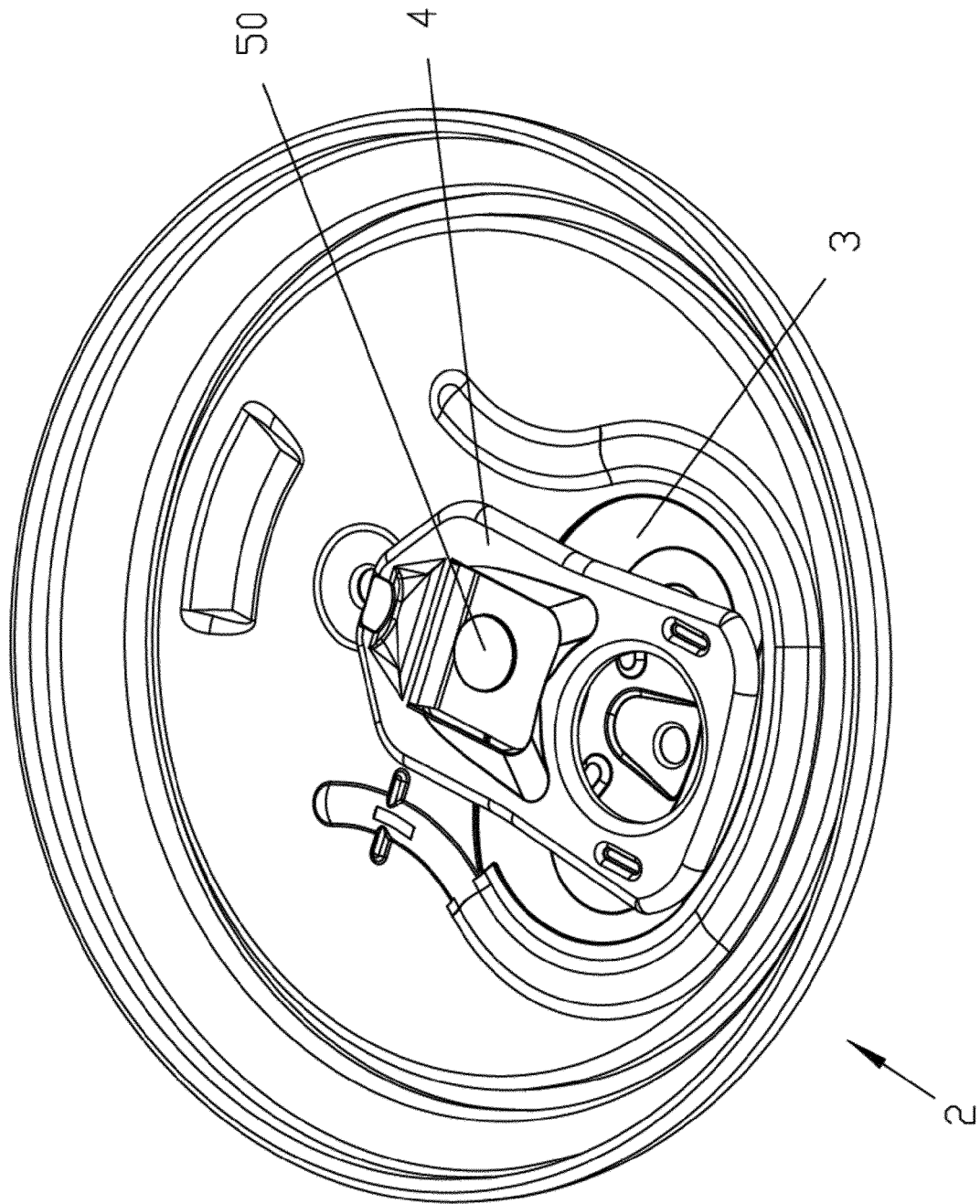


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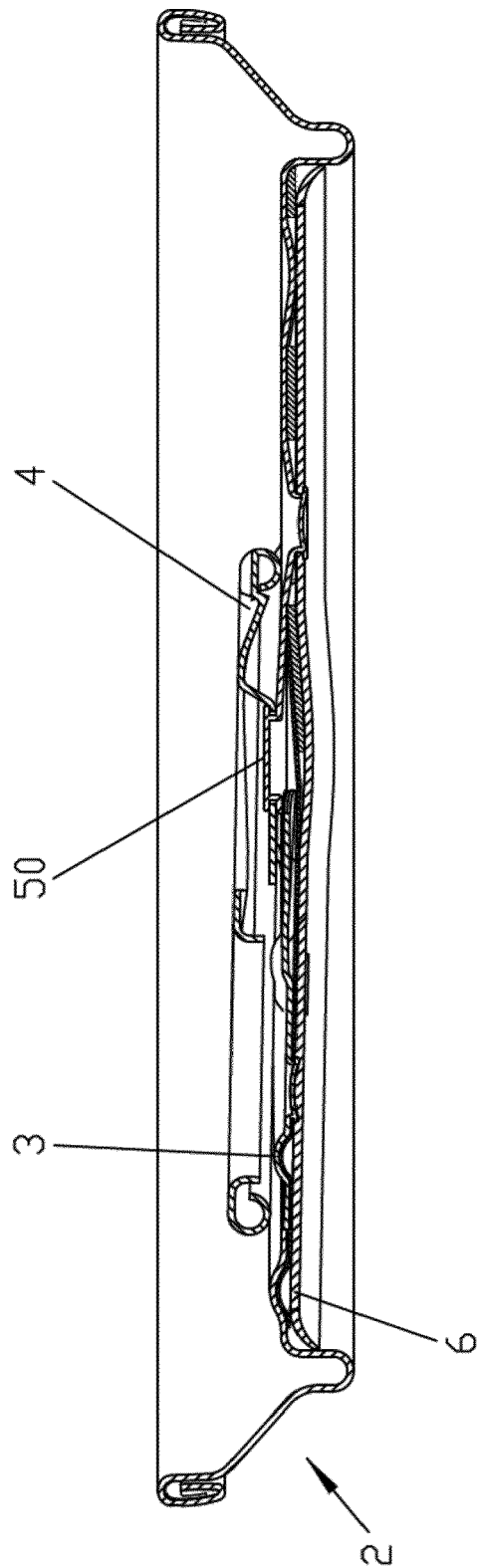


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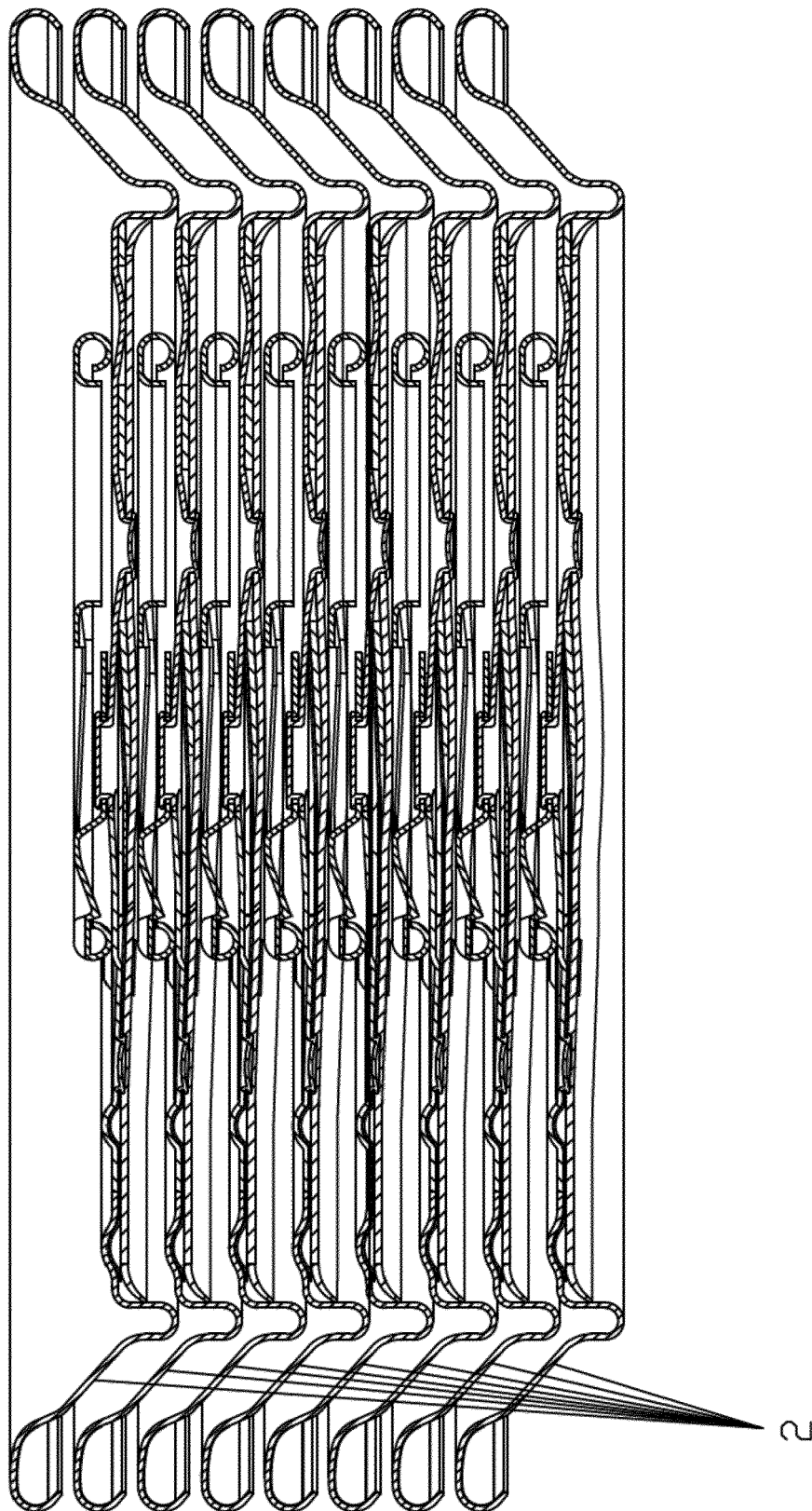


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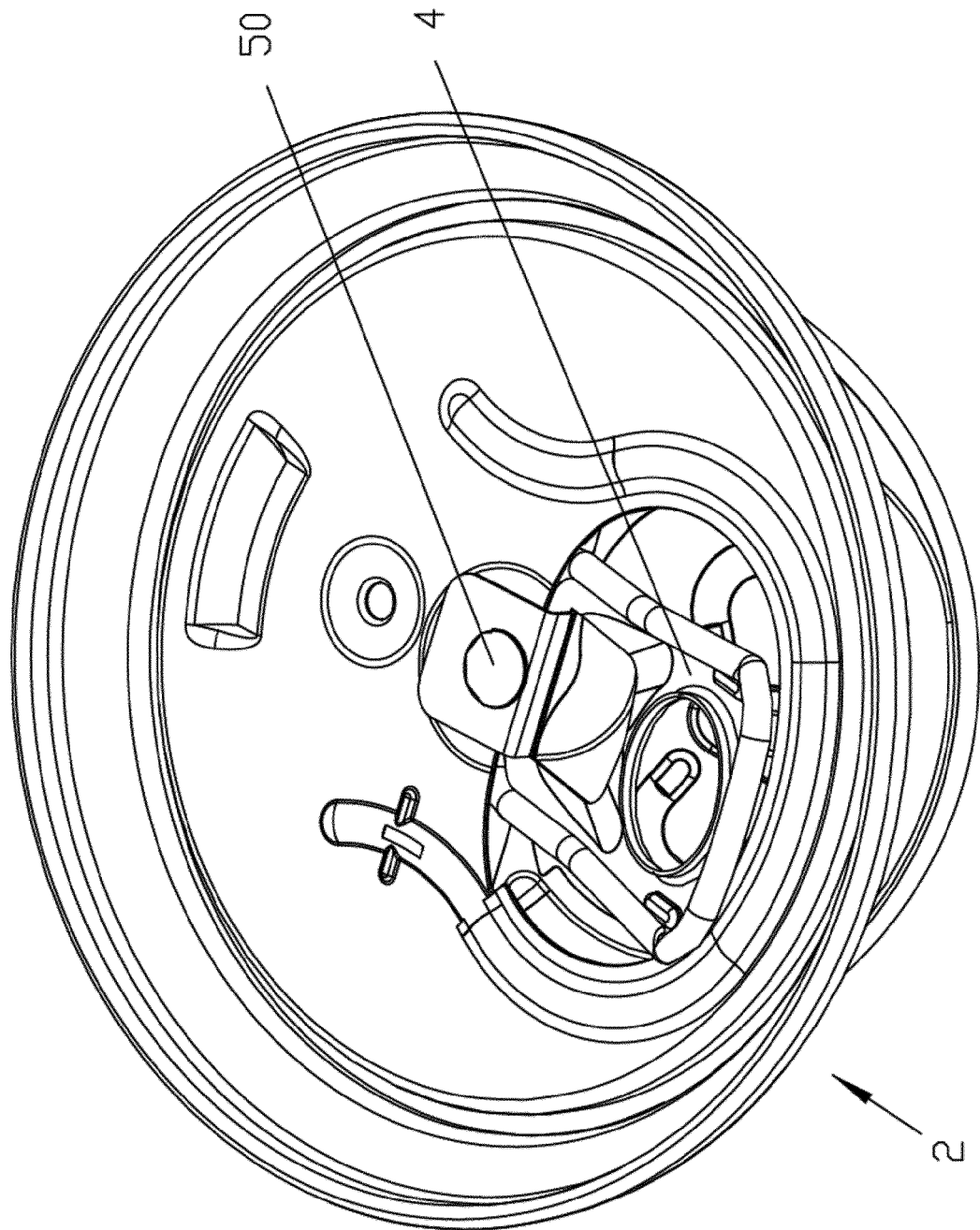


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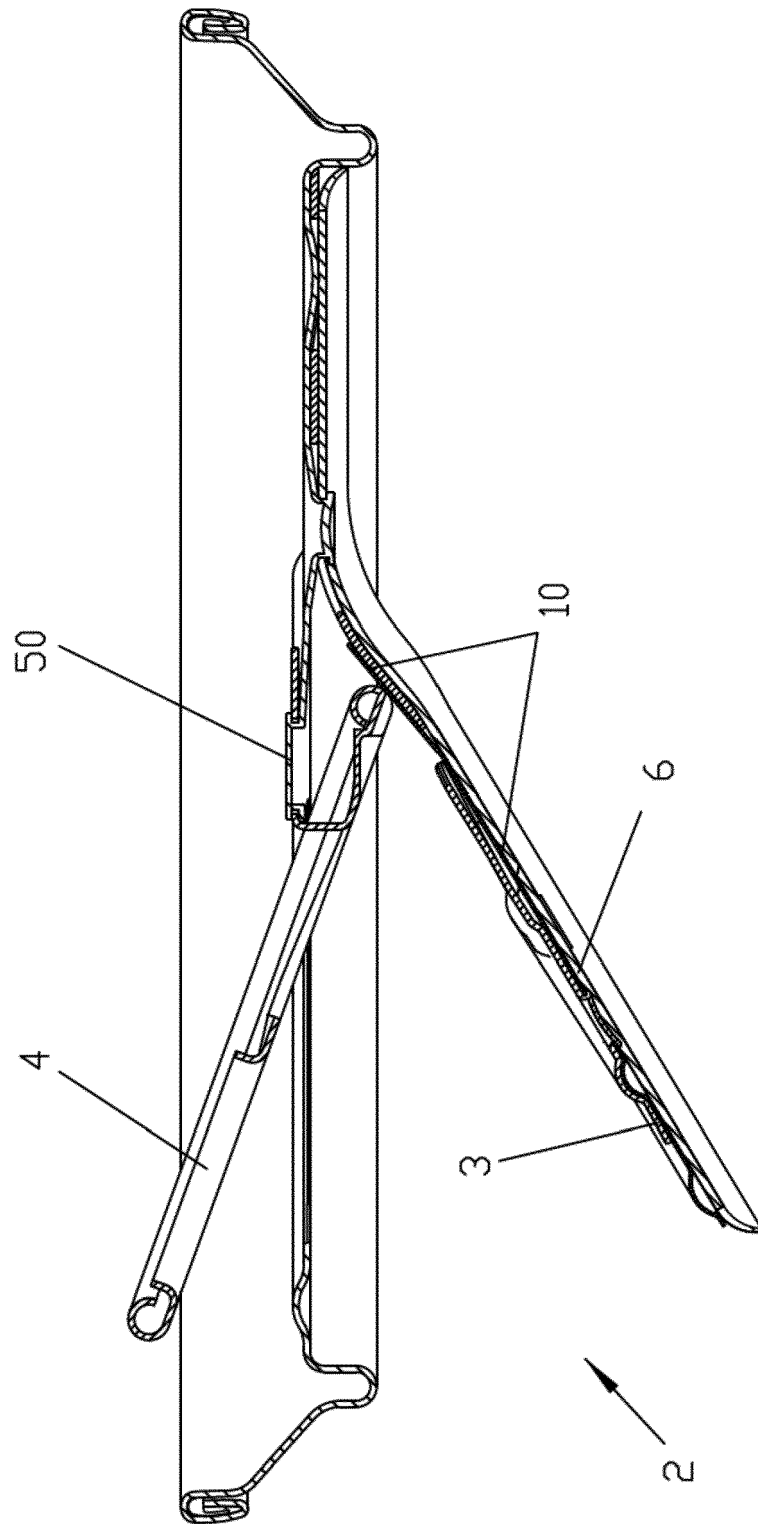


Fig. 24

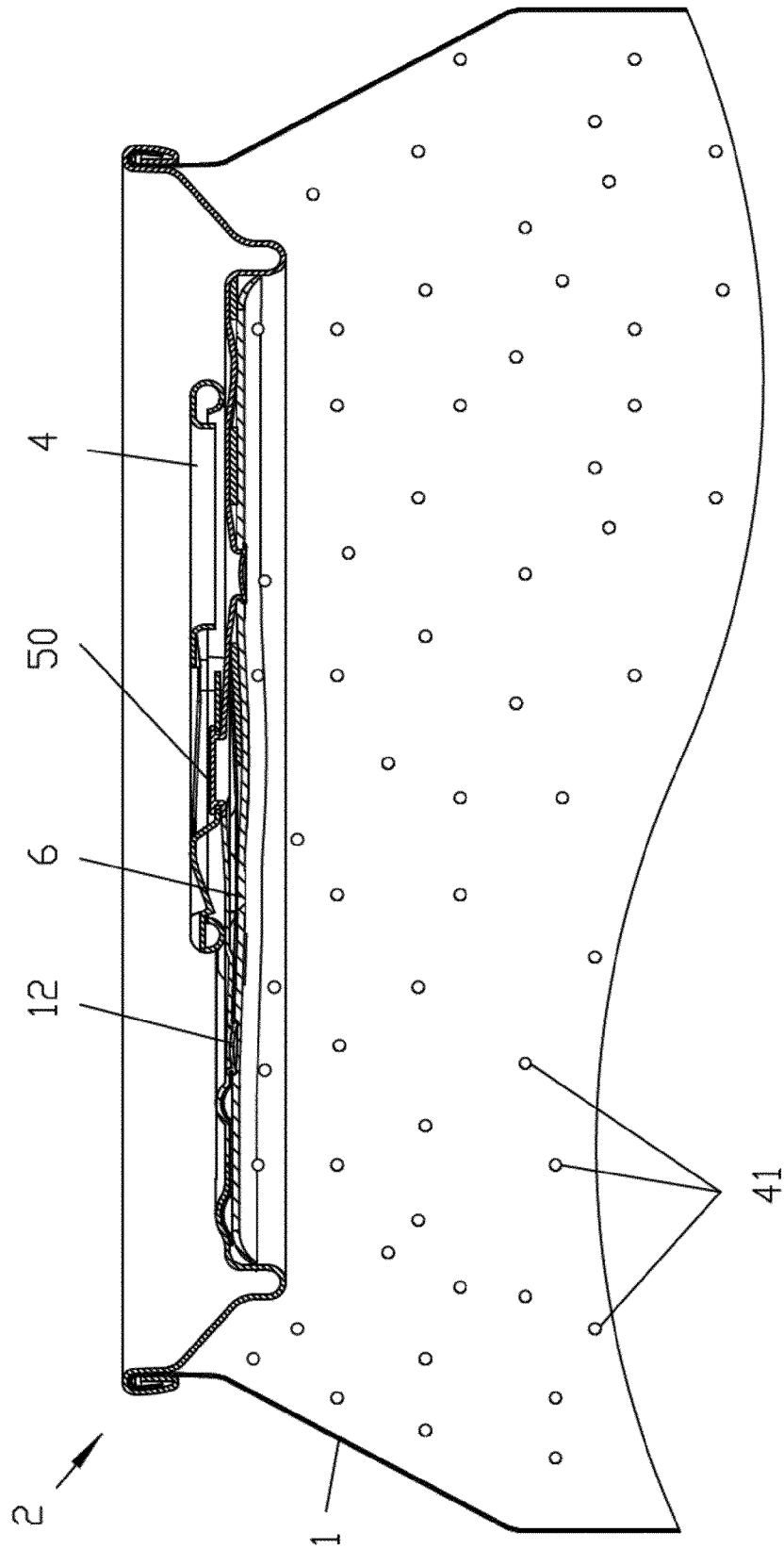


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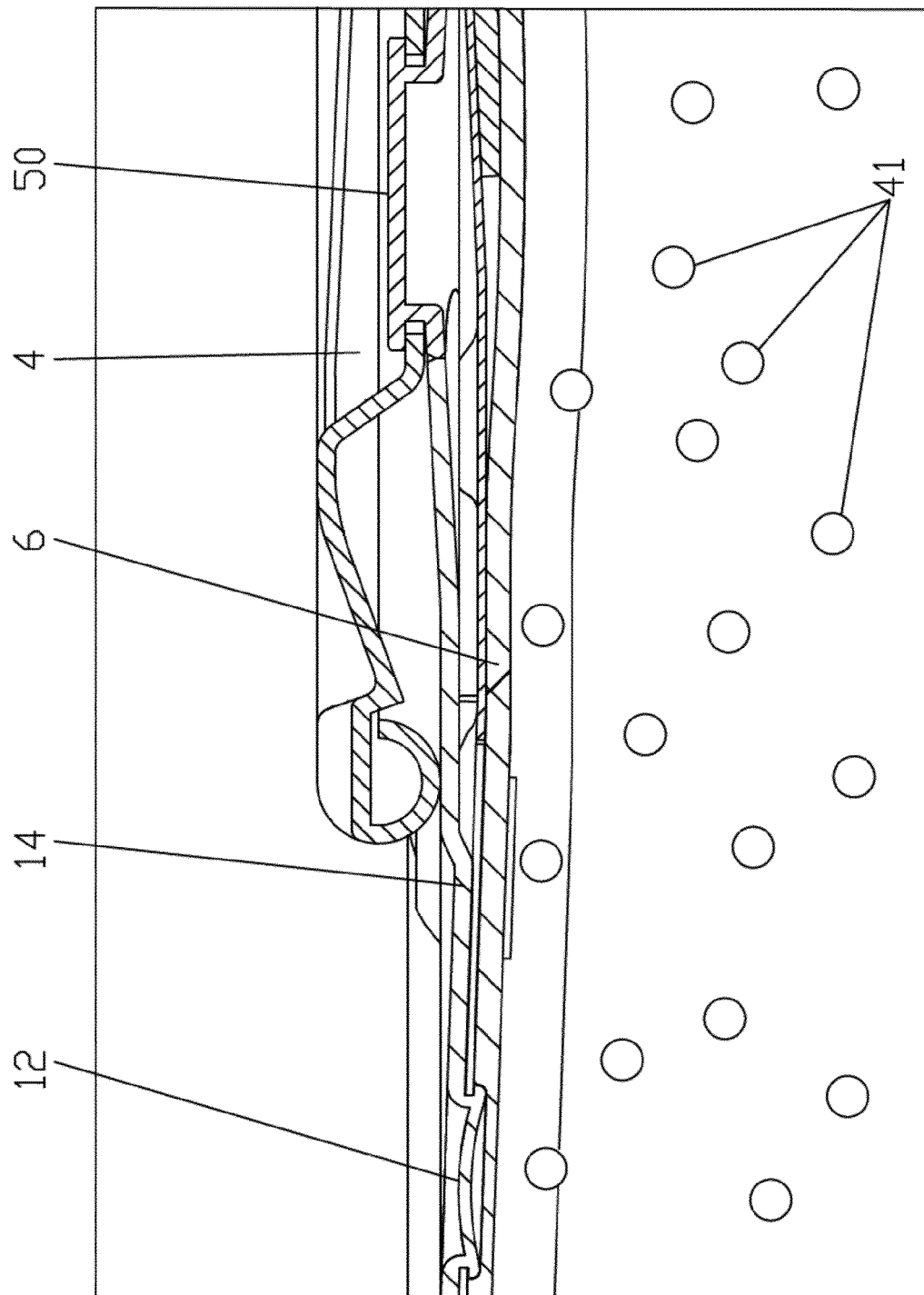


Fig.26

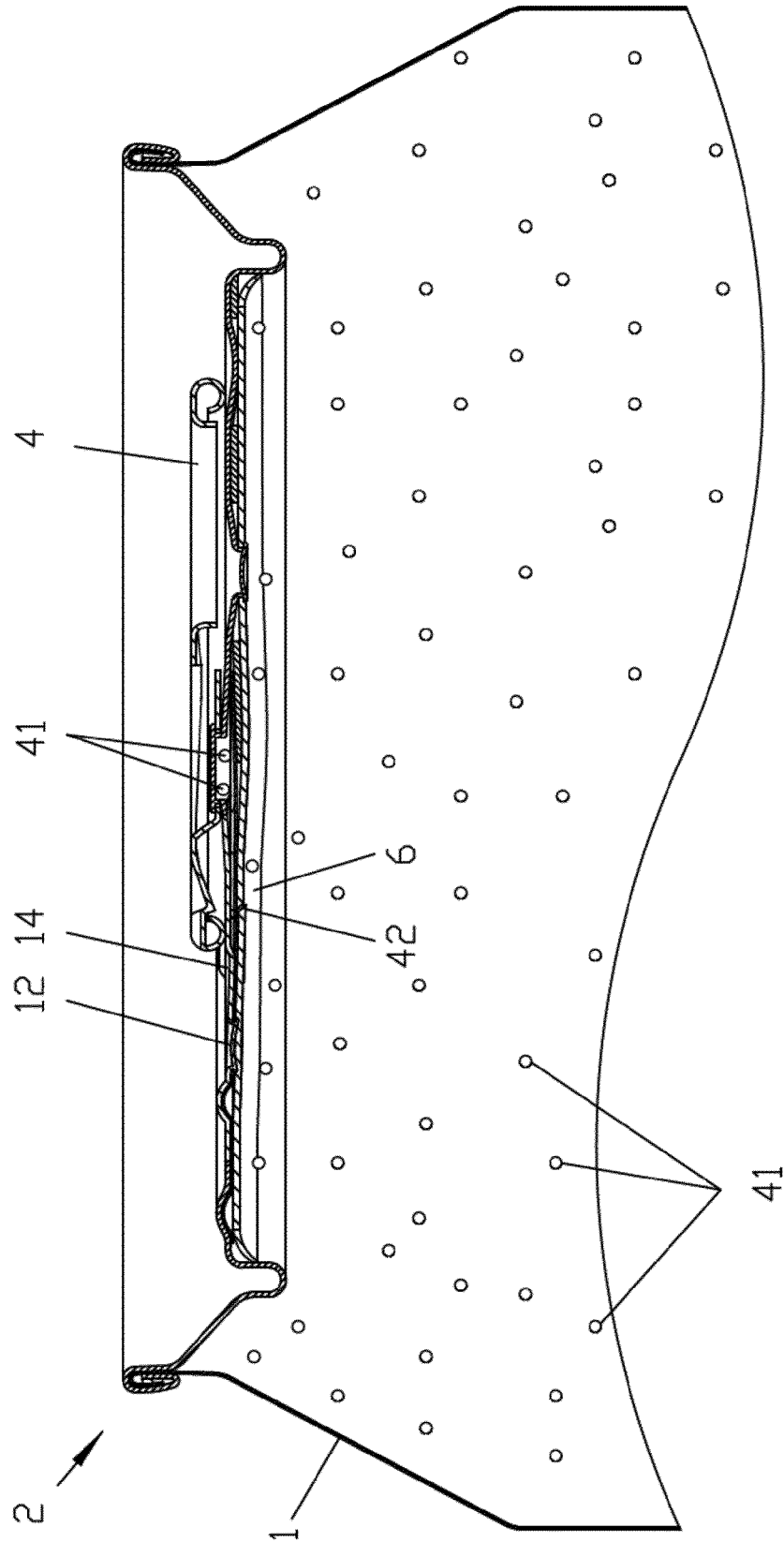


Fig. 27

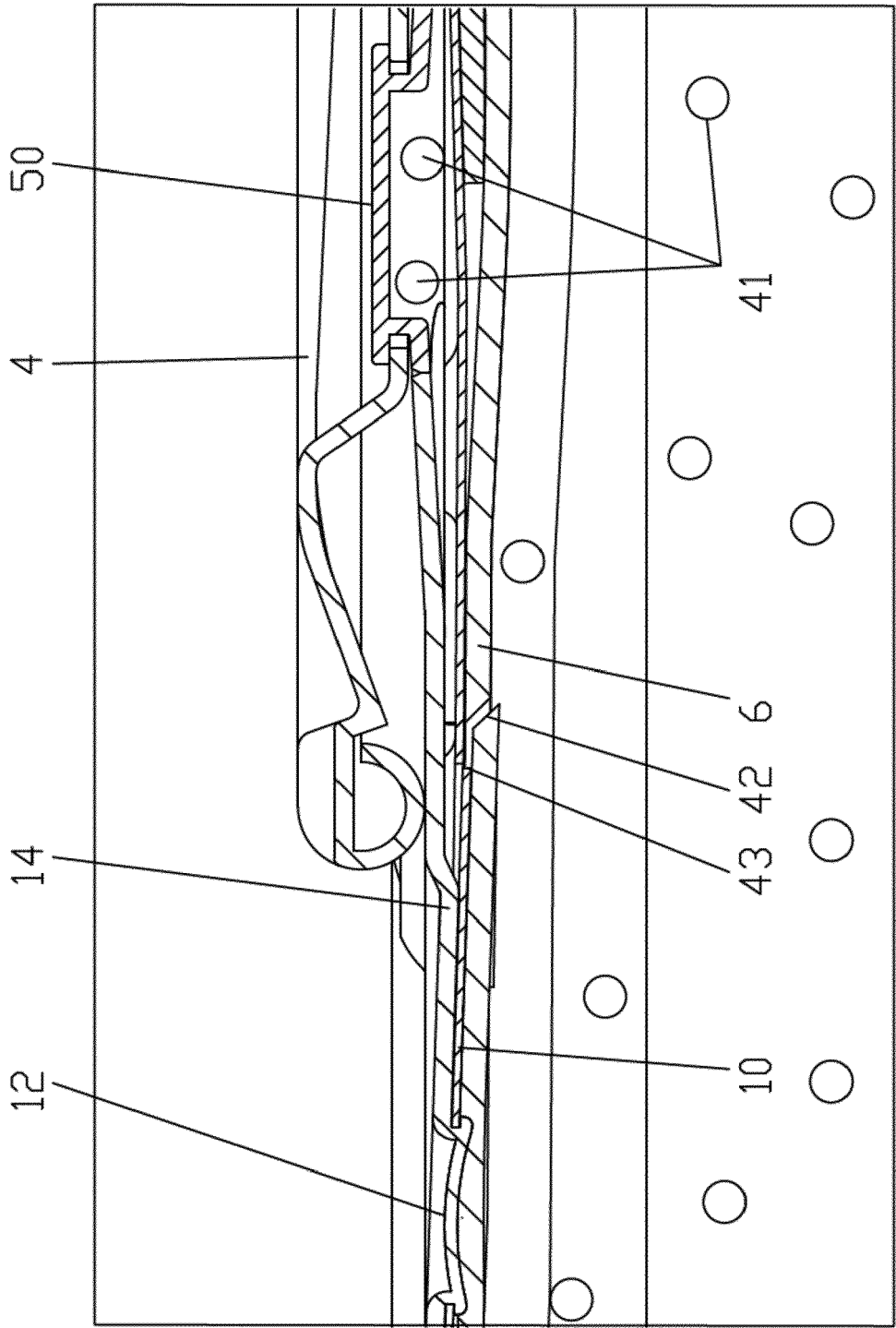


Fig.28

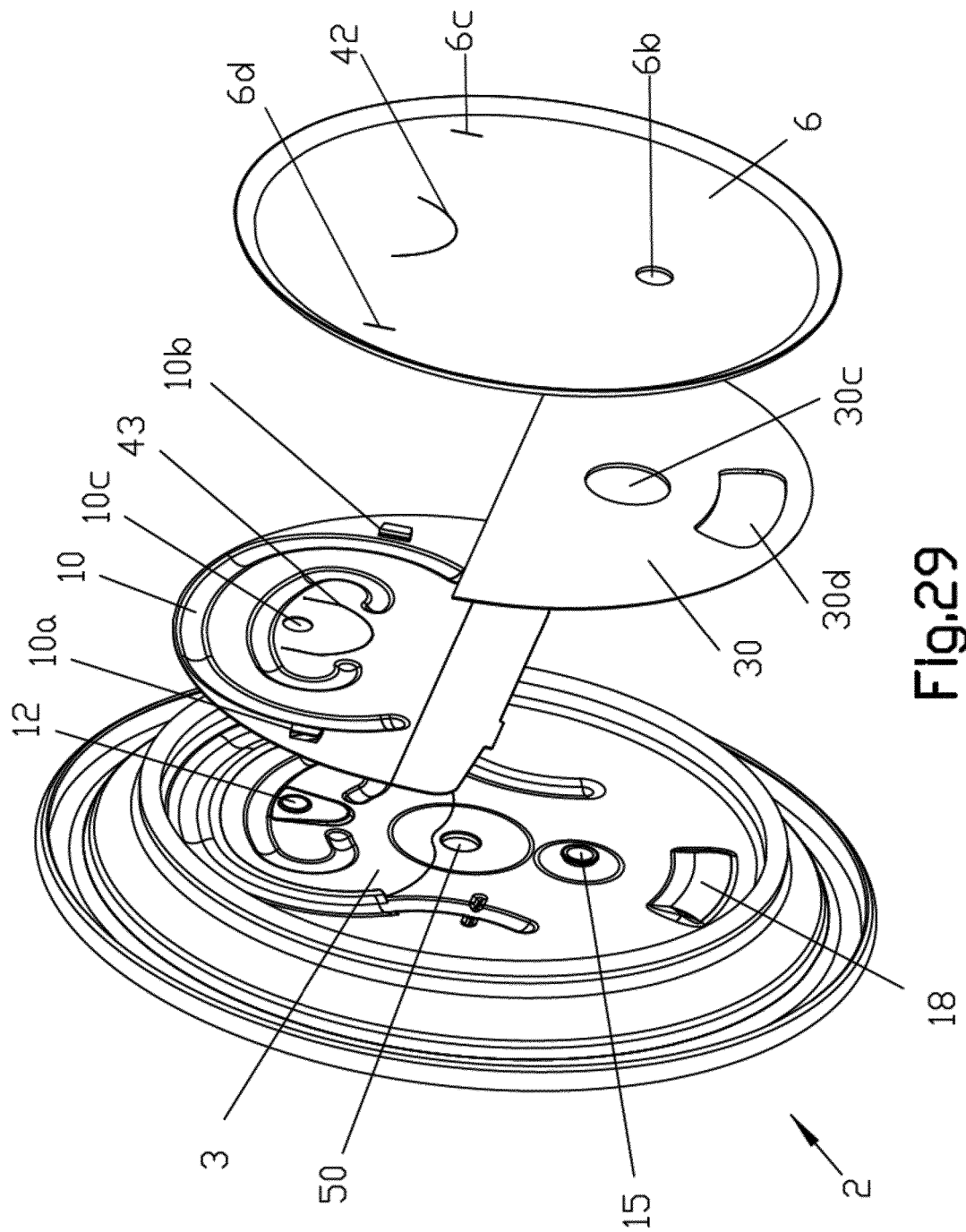


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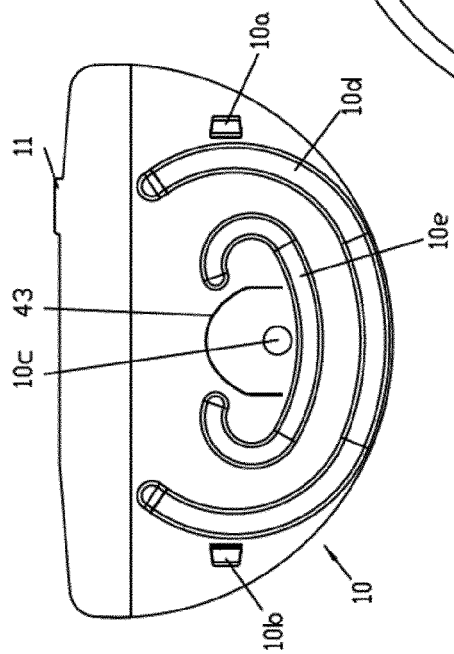


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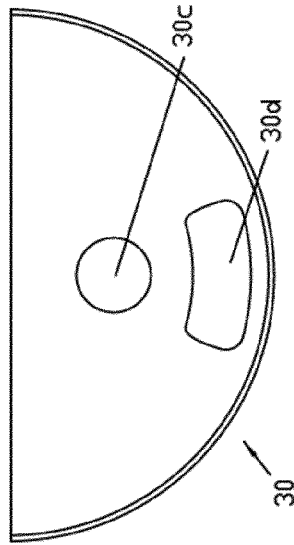


Fig. 32

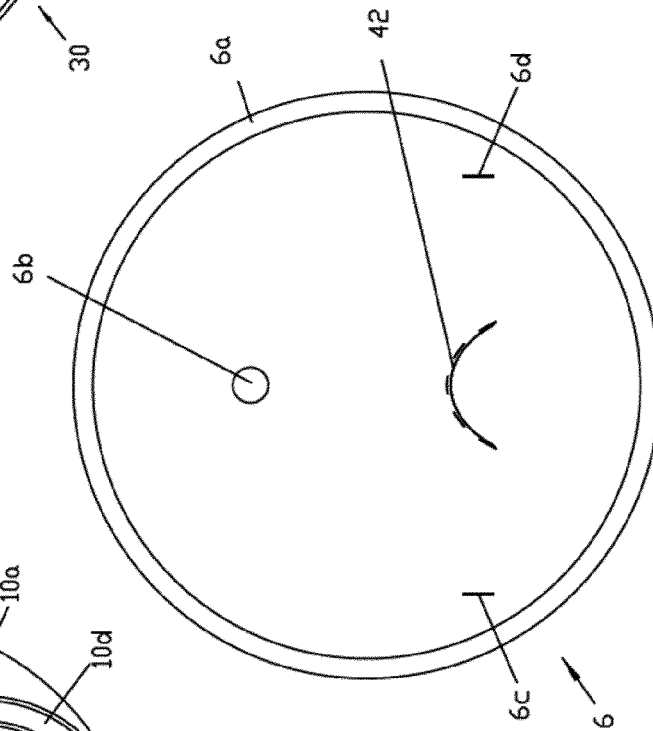


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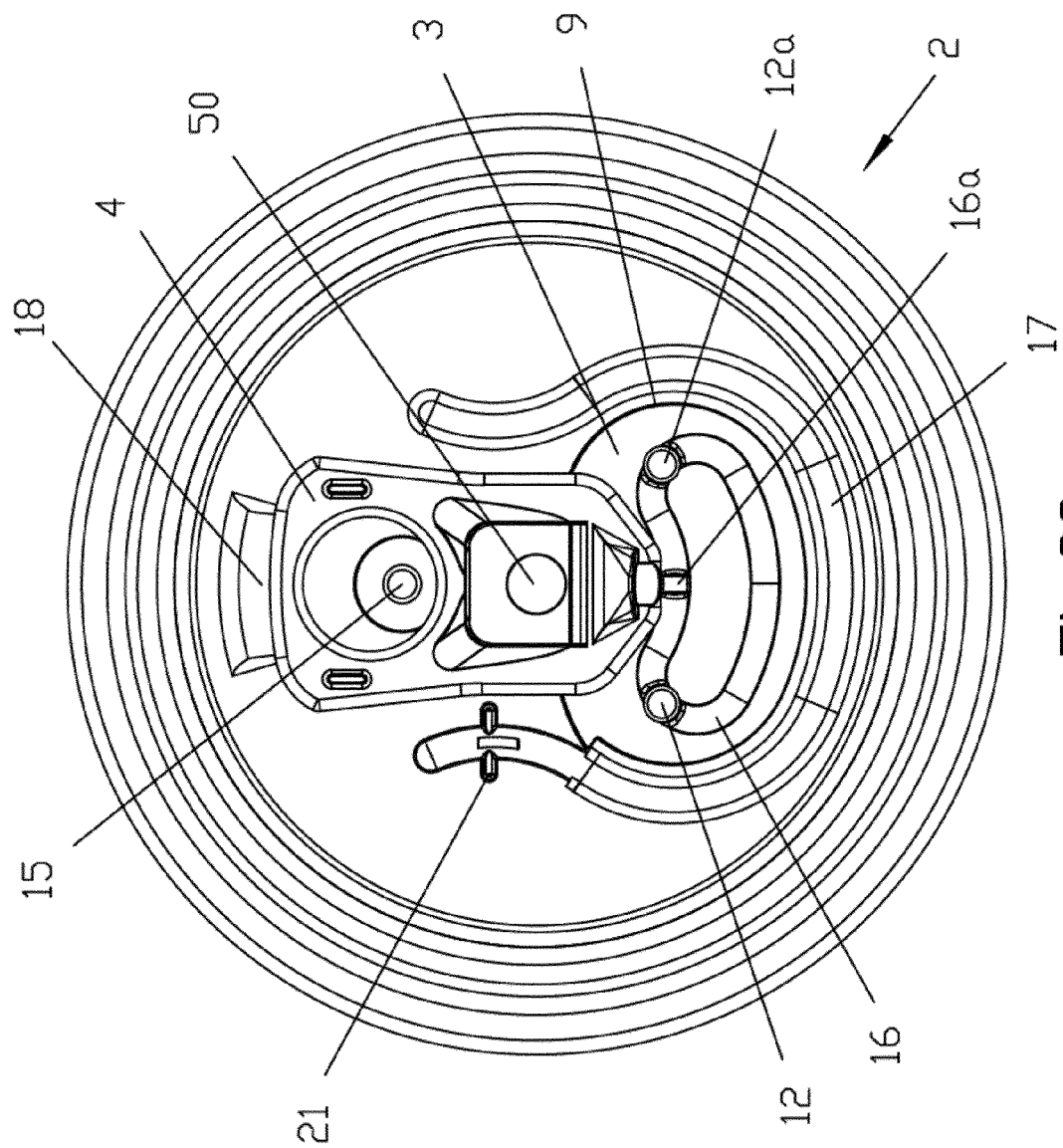


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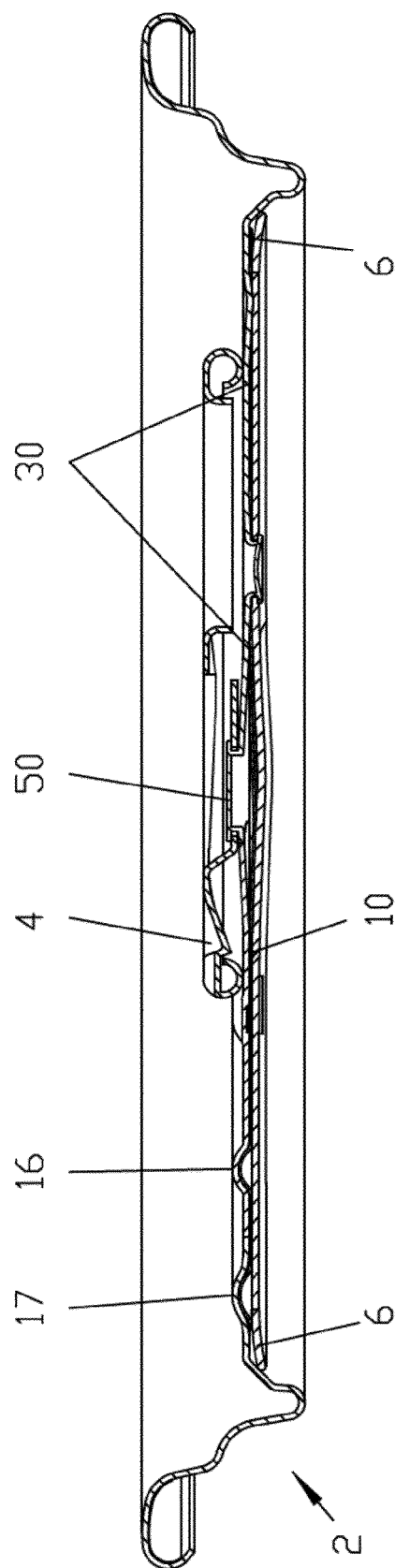


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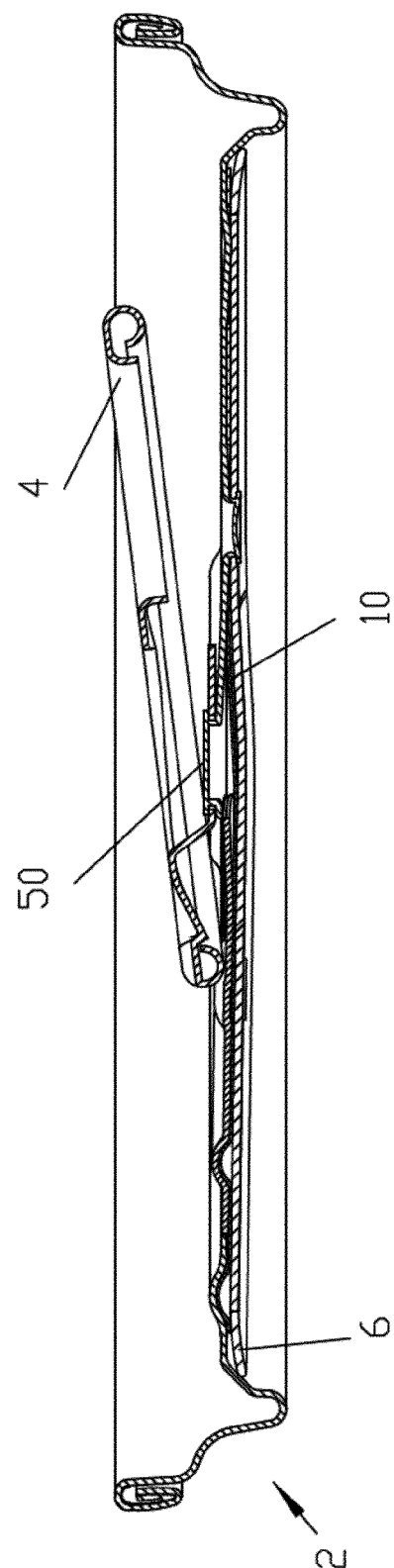


Fig. 35

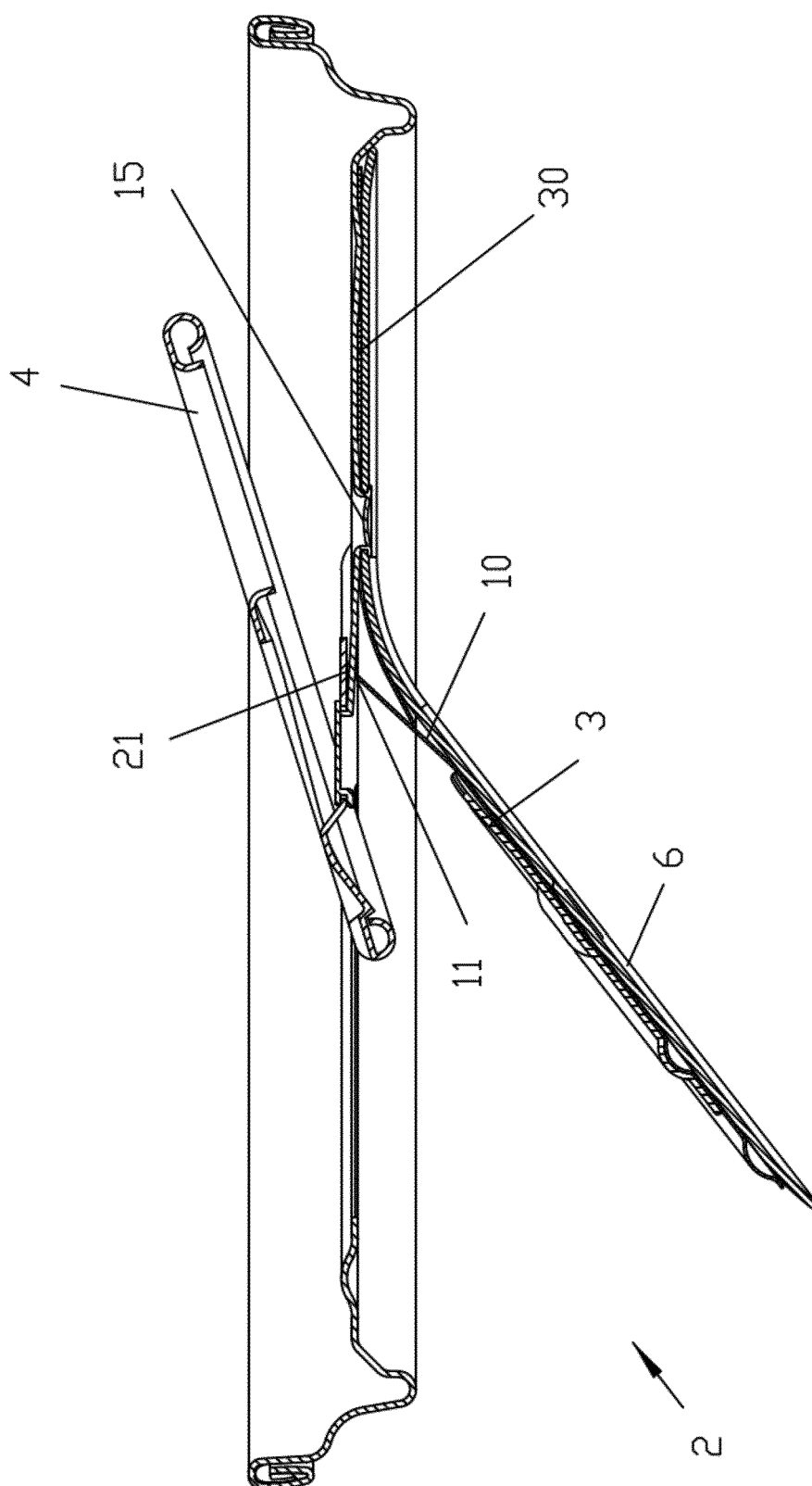


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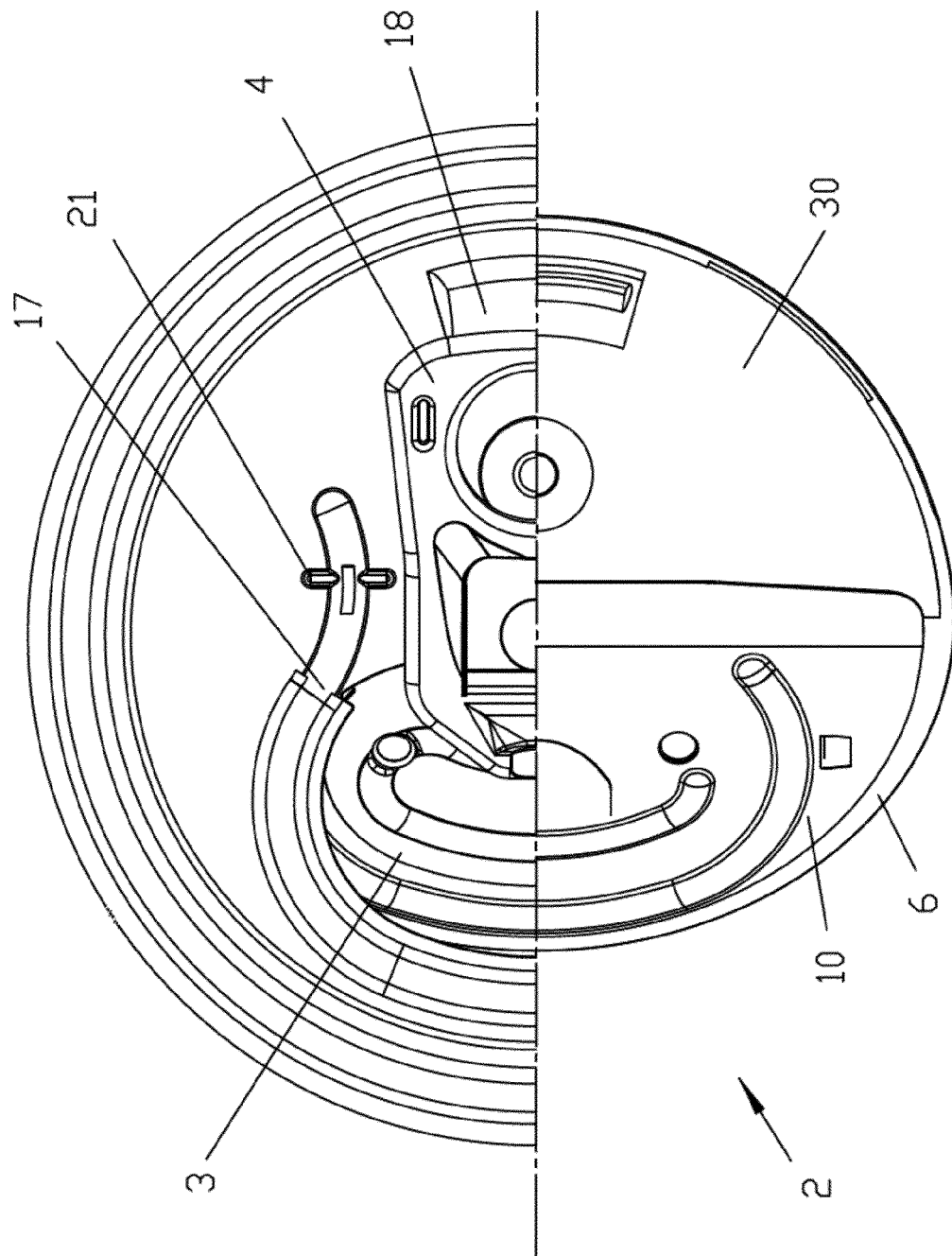


Fig. 37

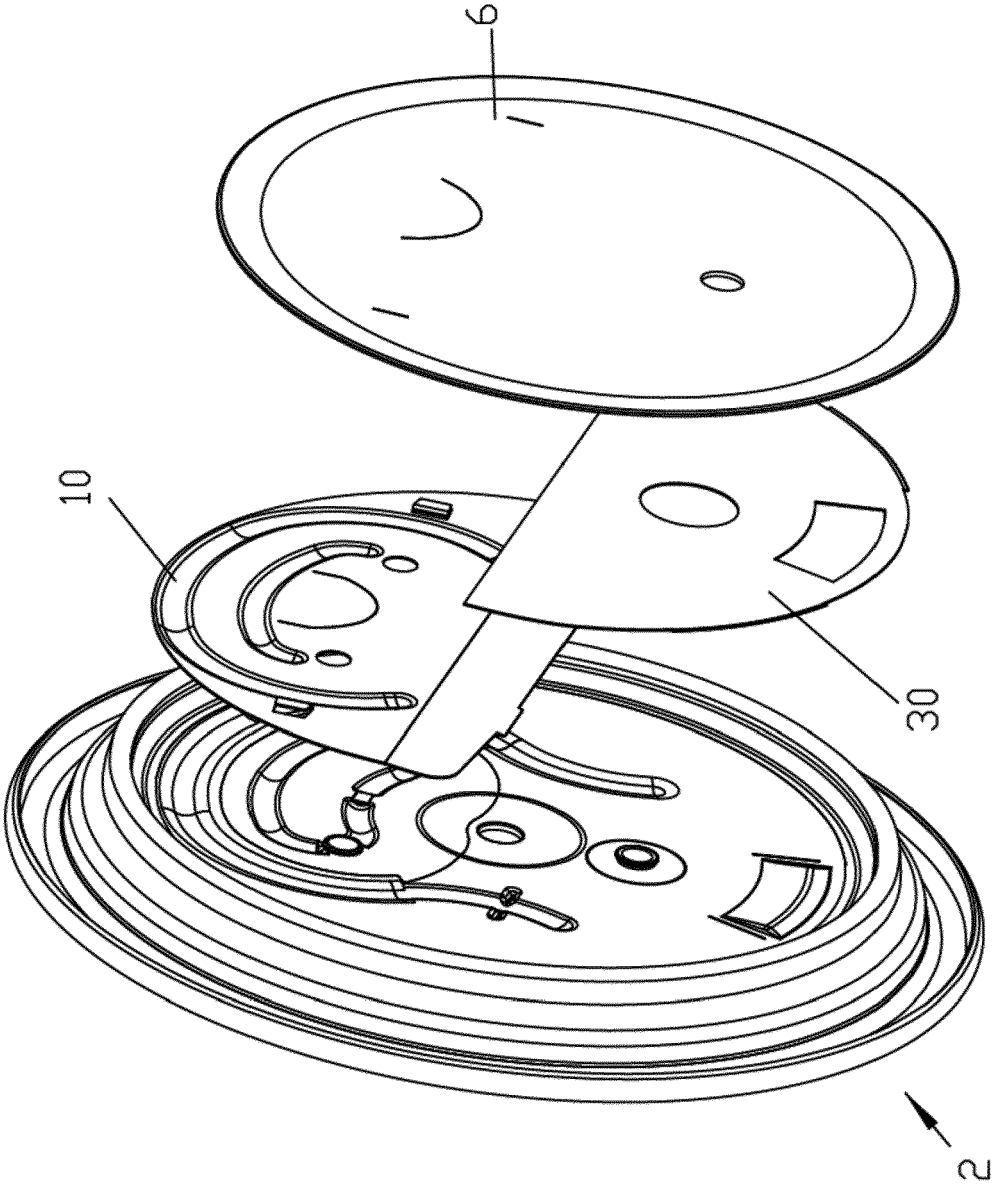


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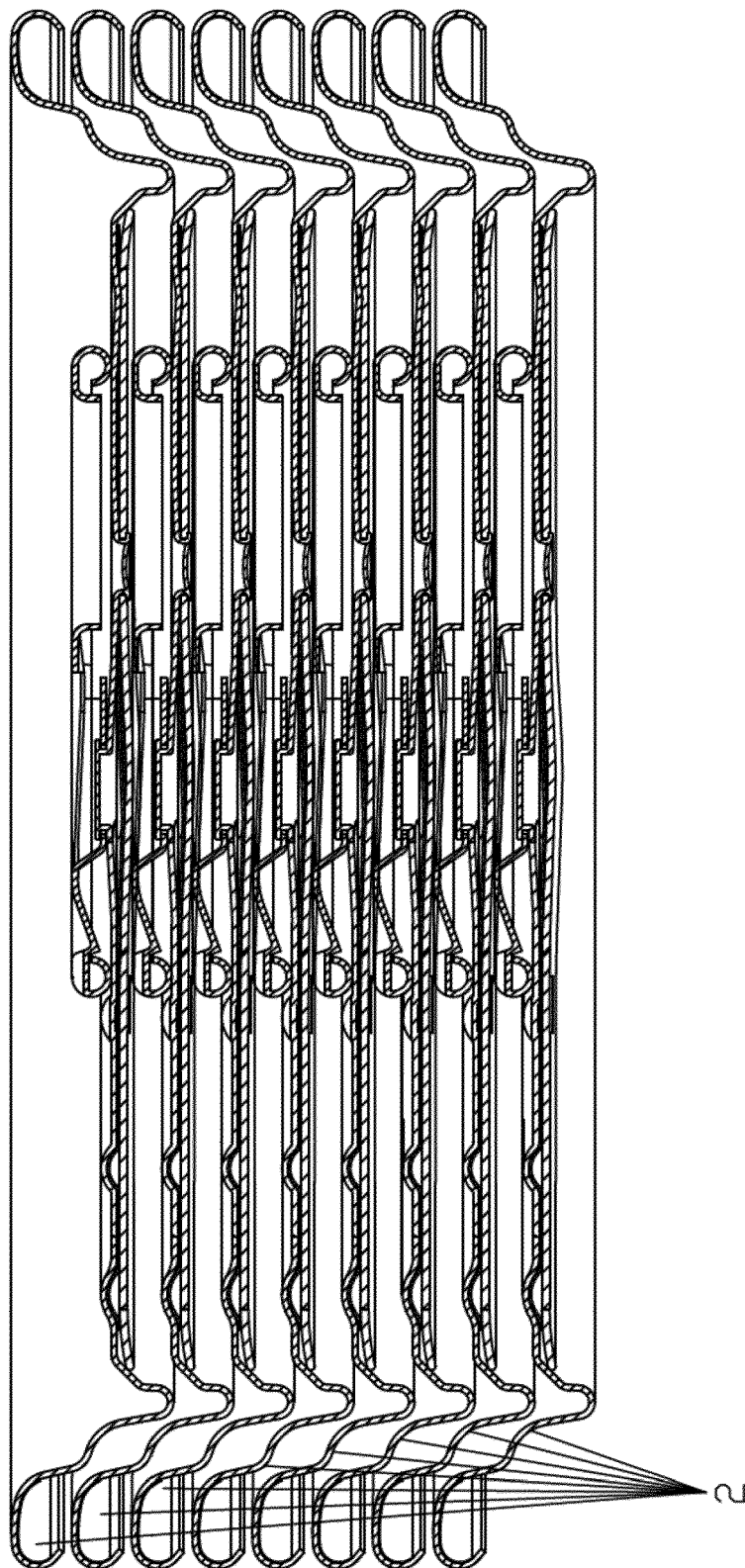


Fig.39

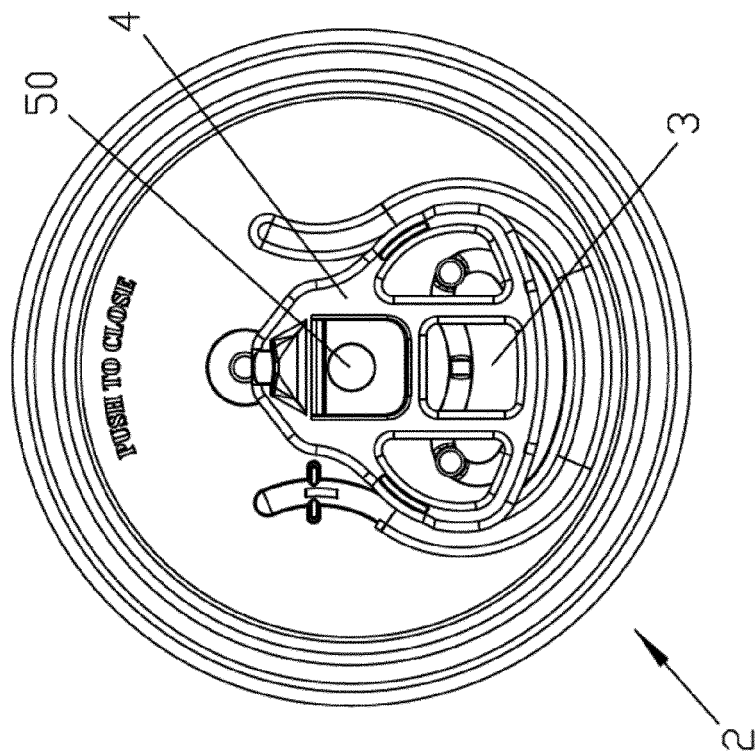


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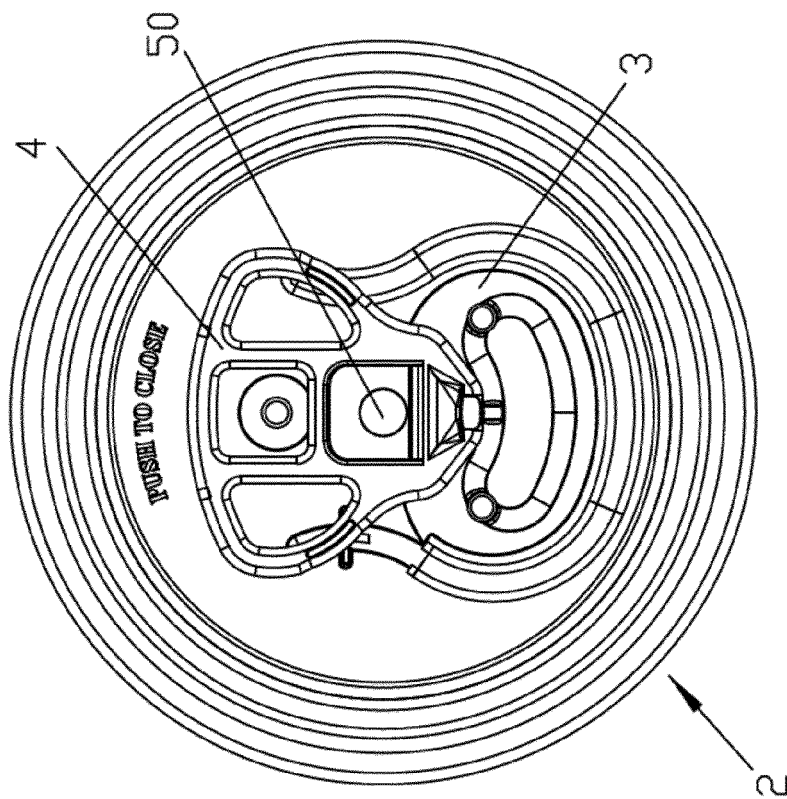
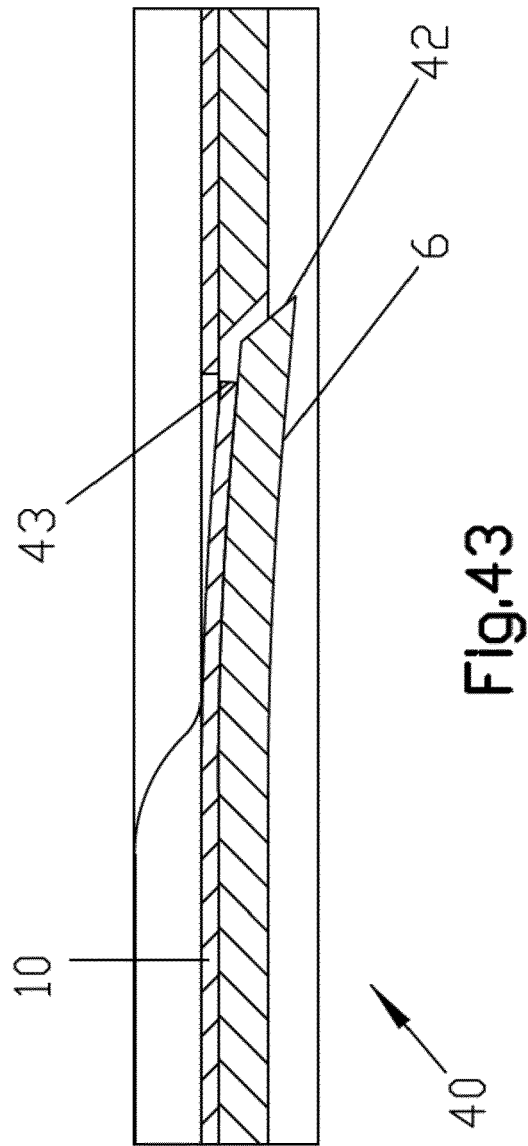
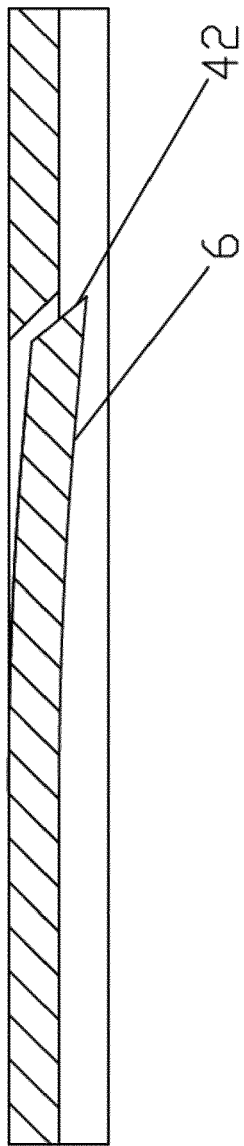


Fig. 40



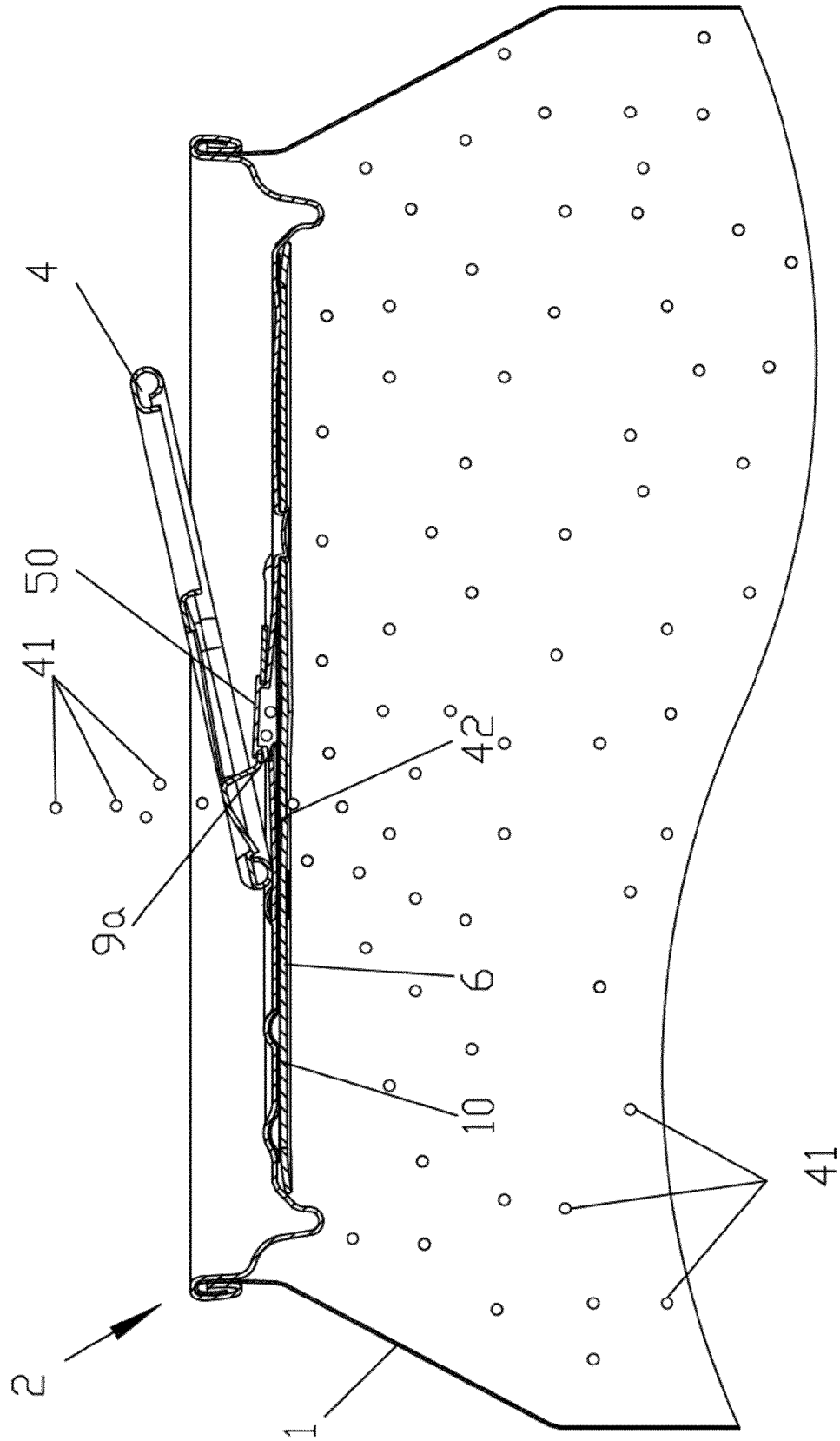


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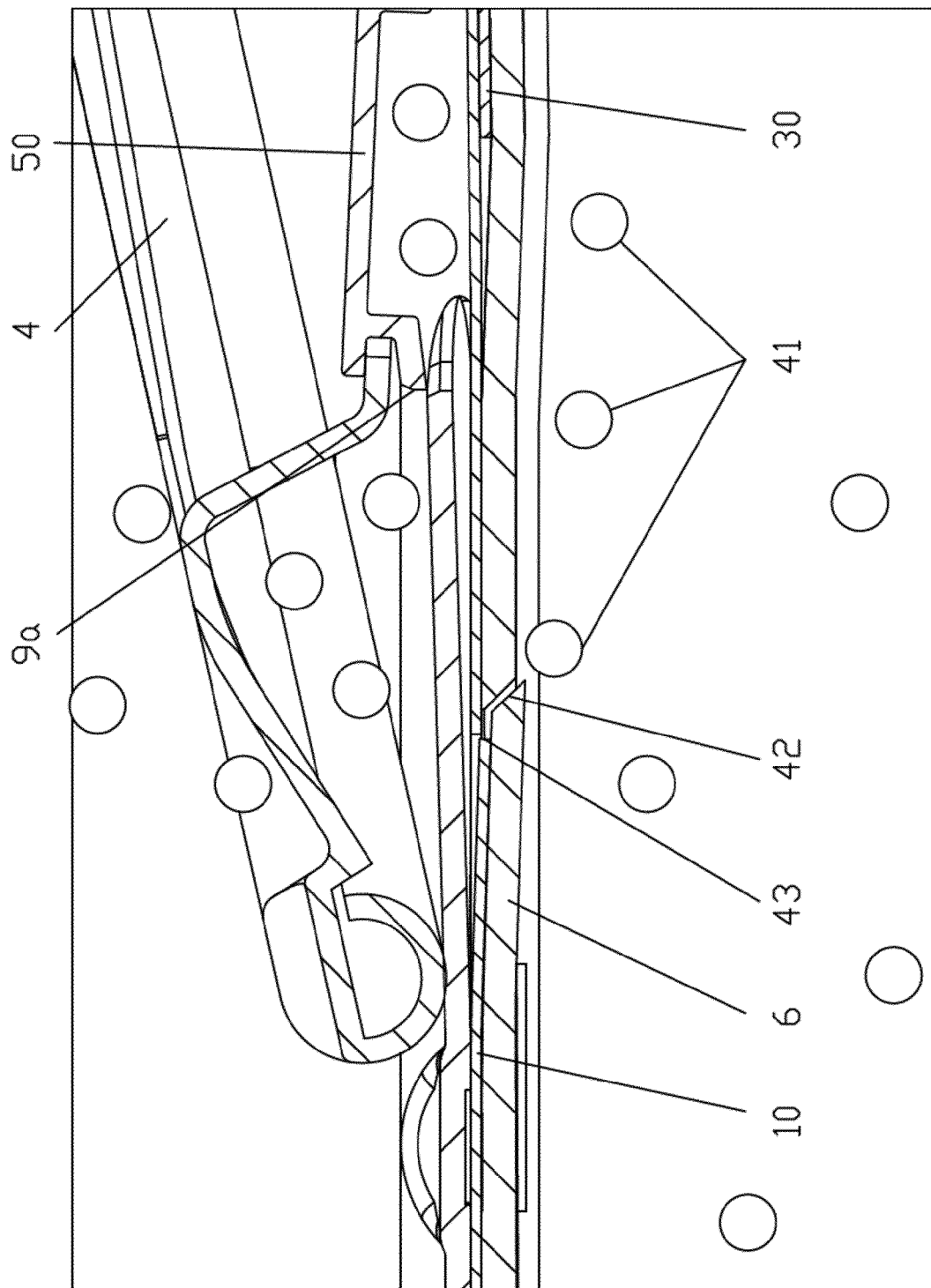


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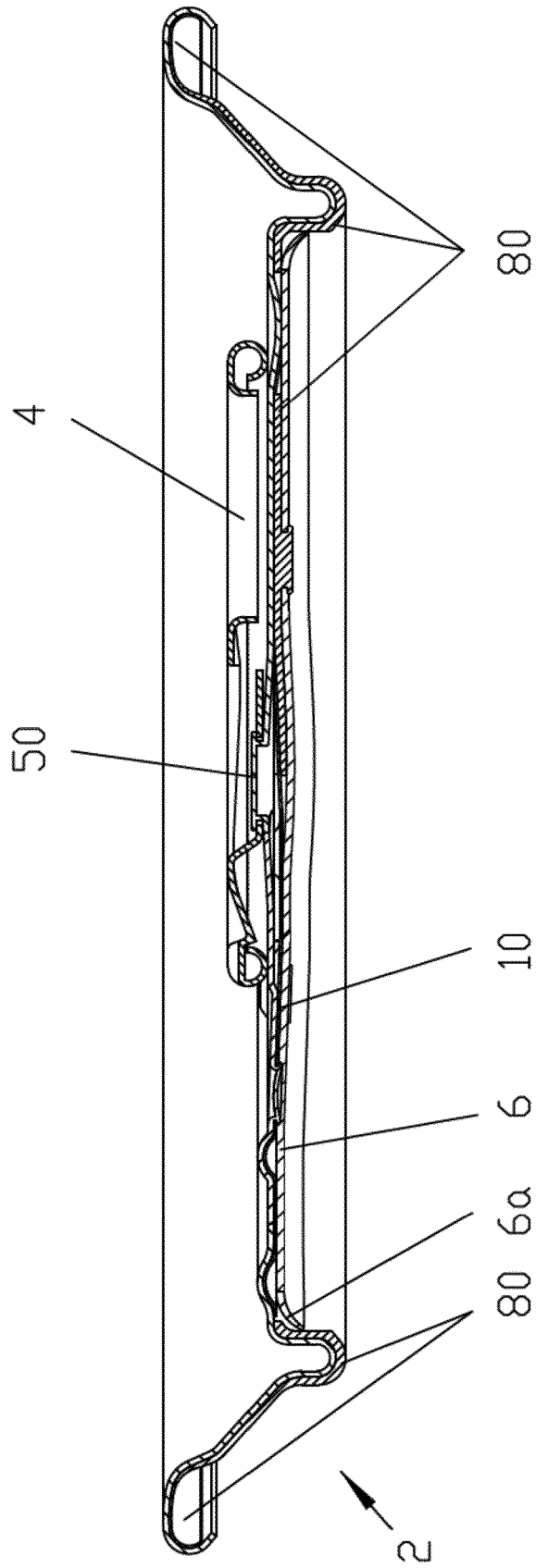


Fig.46

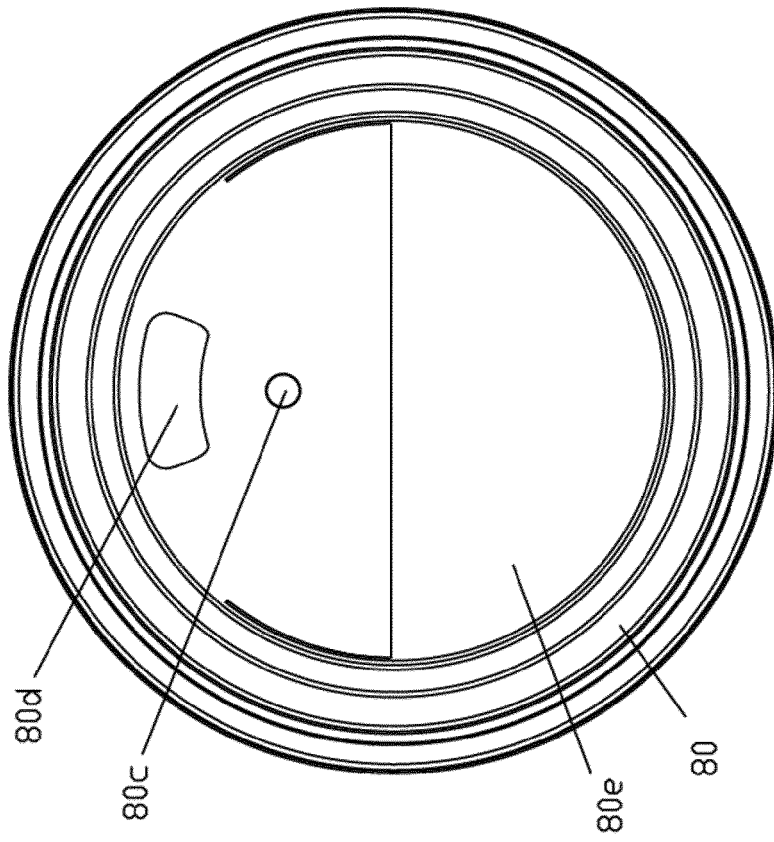


Fig. 47

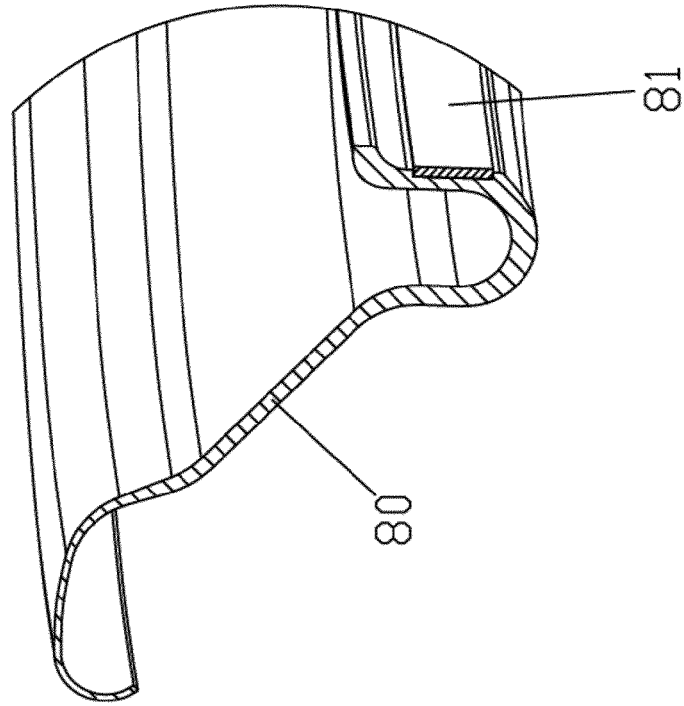
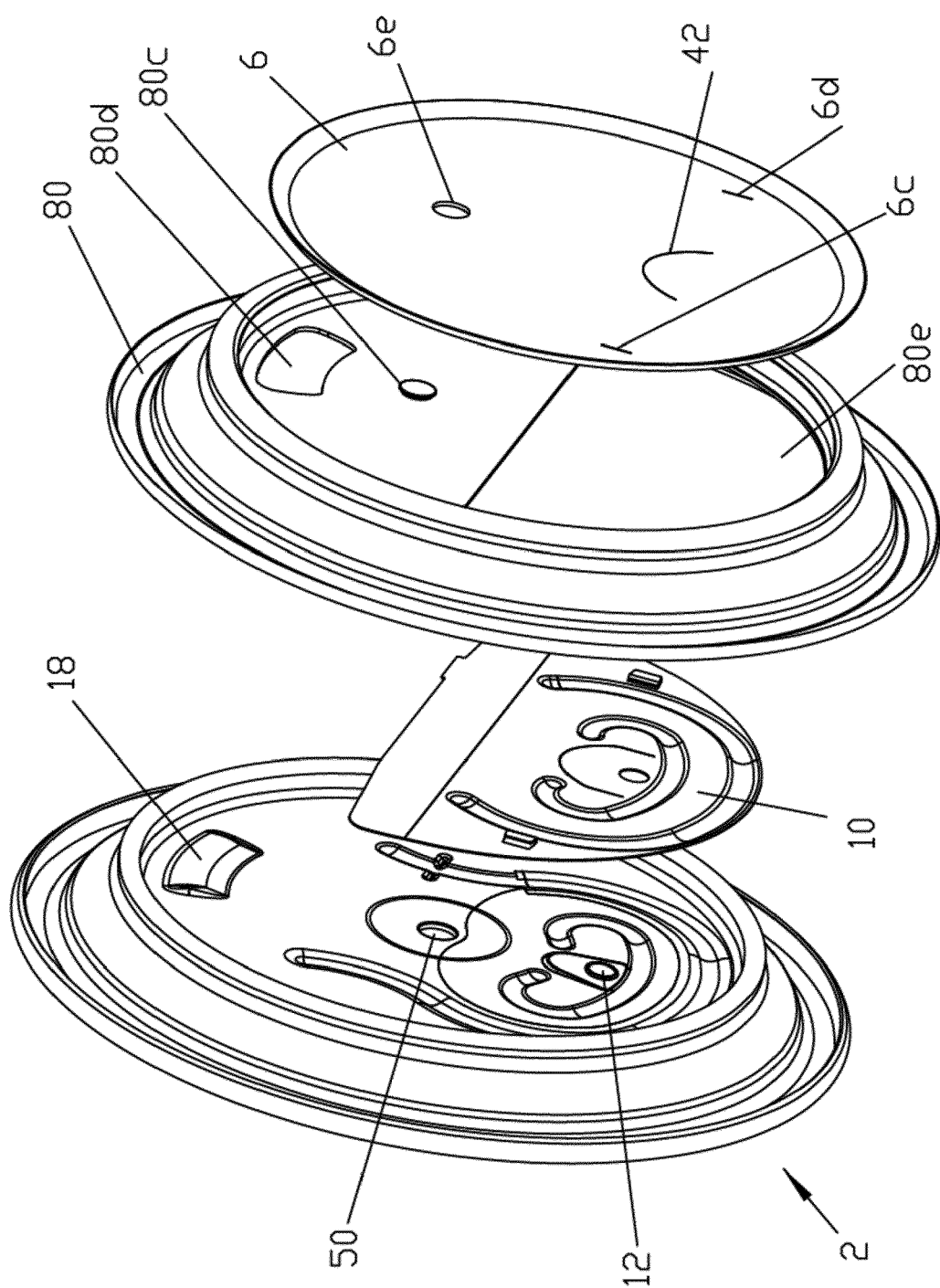


Fig. 48



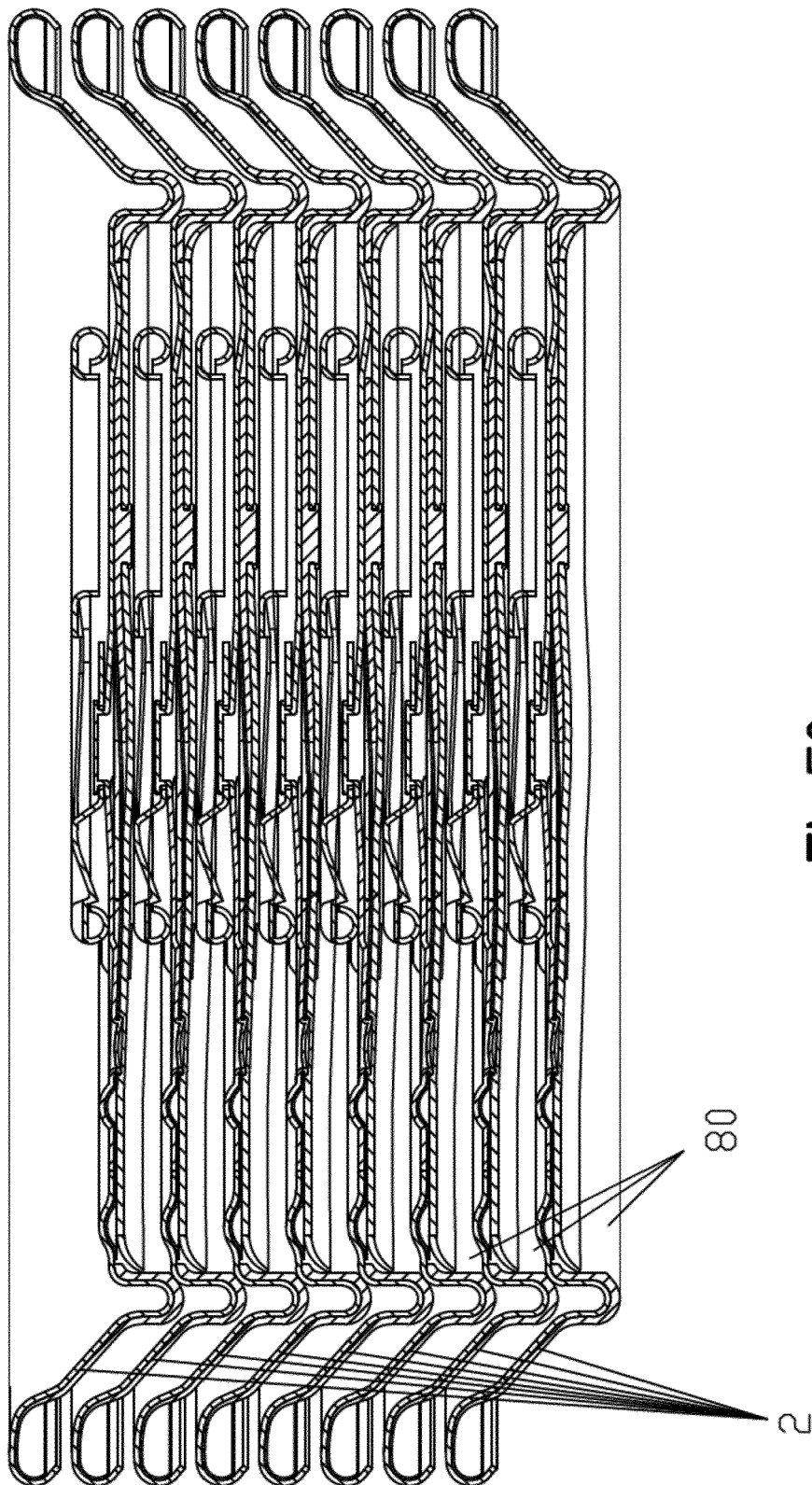
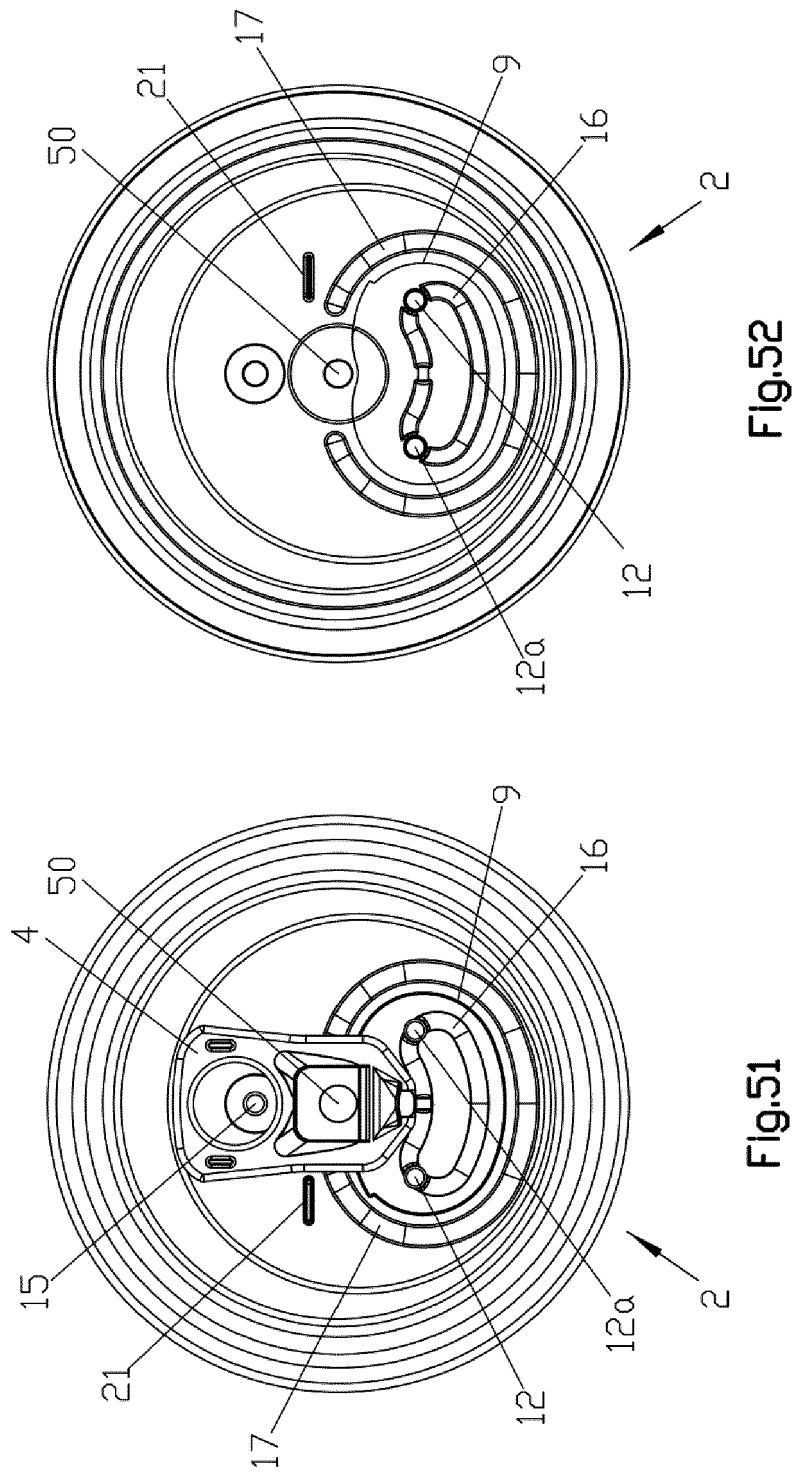


Fig.50



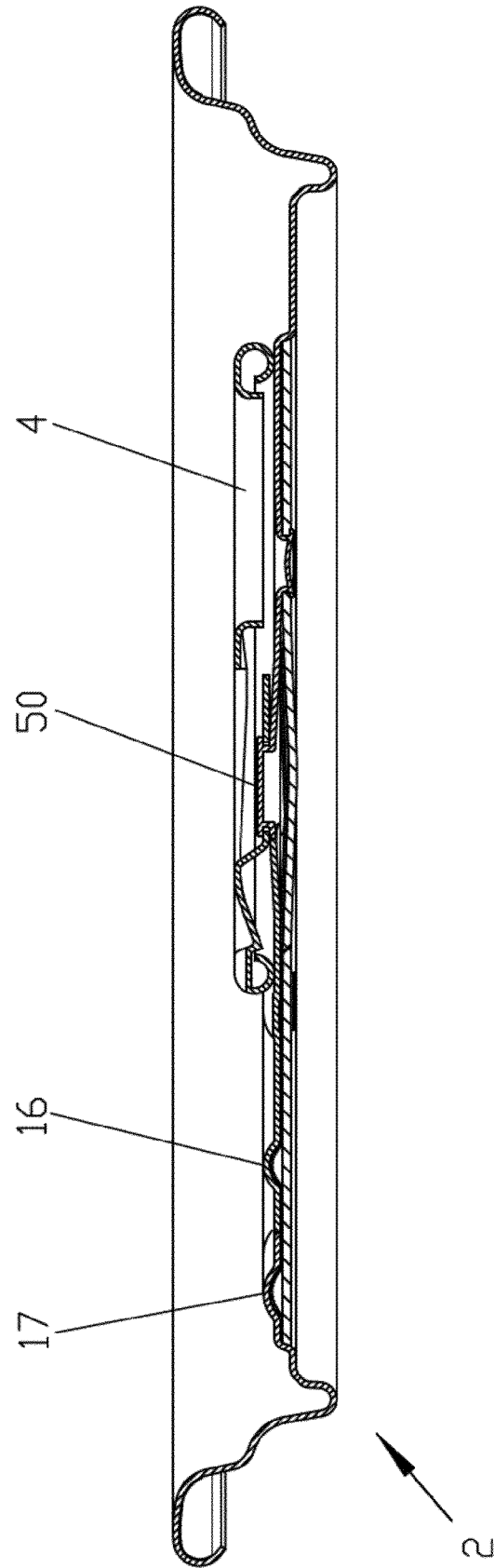


Fig.53



EUROPEAN SEARCH REPORT

 Application Number
 EP 15 18 2075

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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,D	WO 2014/124992 A1 (E V D S BVBA [BE]) 21 August 2014 (2014-08-21)	1,5-8, 11-14	INV. B65D17/00
Y	* abstract; figures 1a,1b,6,7a,7b,10-13 *	2,9,10, 15	
A	* page 14, line 27 - page 15, line 13 *	3,4	
Y,D	WO 2012/028694 A1 (E V D S BVBA [BE]; VANDERSTRAETEN ERWIN [BE]) 8 March 2012 (2012-03-08) * abstract; figures * * page 14, lines 1-11 * * page 15, line 18 - page 17, line 28 * * page 11, lines 1-6 * * page 12, lines 1-11 *	2,9,10, 15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 September 2015	Examiner Serrano Galarraga, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

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