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(54) Induction-sealable closure for liquid container

(57) A closure (1) for a container carrying a liquid comprises a first body (2) and a second body (3) mounted rotatably onto said first body, and a valve. The valve opens and closes by the action of tabs slidingly rotating over apertures provided in a member arranged transversely in a substantially cylindrical opening.

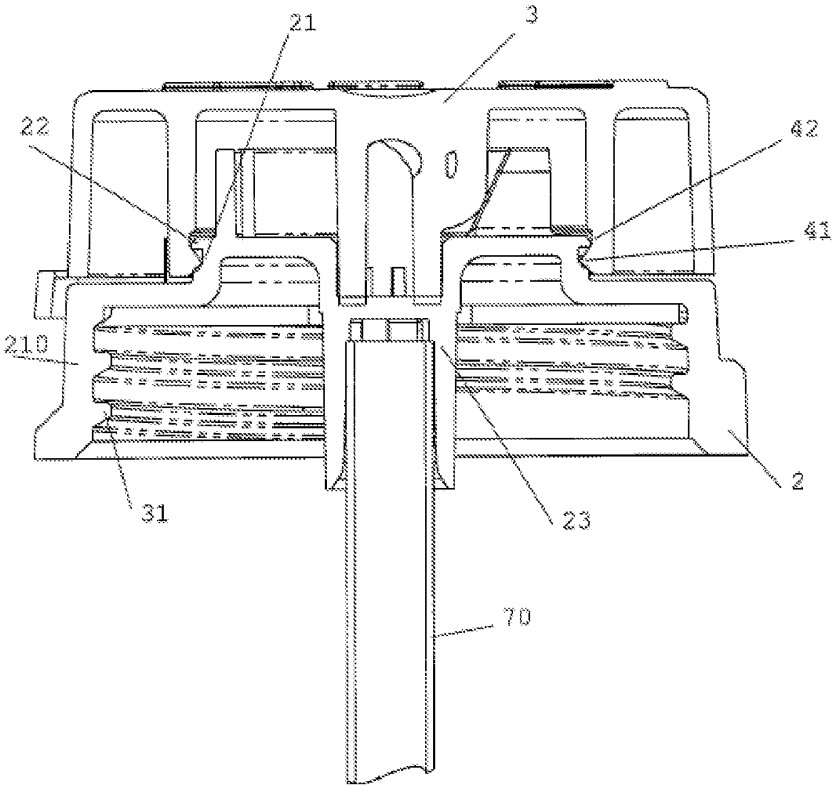

FIG 3

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Description

Field of the Invention

[0001] The present invention is related to closures for liquid containers. Particularly, the present invention is related to child-resistant closures. The present invention is equally related to closures for liquid containers with external trigger and dispensing devices.

State of the Art

[0002] Child-resistant closures are used nowadays for containers carrying lightly inflammable and/or toxic liquids, in order to prevent accidental exposure of a child to the container's content. These liquids, which may contain hazardous agricultural or household chemicals, are dispensed from the container in a number of different ways. In some applications, e.g. for pesticides, it is desirable to apply the liquid solution by spraying in order to achieve a maximal coverage of the surface to be treated. In a spraying device, the fluid is dispensed under pressure through a nozzle. The nozzle may be integrally comprised in the closure, or may be mounted in an outlet hose or extension rod. Pressure is applied by squeezing the container or pressurizing the liquid with the use of a pump.

[0003] Document US 2004/0129728 discloses a child-resistant fluid delivery device comprising a tubular wand with spray nozzle. The wand is assembled onto a liquid container through a child-resistant rotatable connector. This connector is provided with a ratchet mechanism to permit attachment of the connector to the container and thereafter prevent removal of the connector from the container. The spray nozzle is protected by a child-resistant cover of the "squeeze-and-turn"-type. A drawback here is that, in order to be child-resistant, the wand has to remain assembled with the container.

[0004] Patent document US 3874562 discloses a squeeze bottle having a closure with a flip spout. The bottle dispenses liquid in a pump-like fashion. The closure comprises a vent and inlet and outlet check valves, the combination of which constitutes what in effect is a pump. The flip spout can rotate between a closed and open position. The vent is located within the housing that accepts the flip spout when in closed position. The flip spout is provided with a bump, which closes the vent when the spout is closed, thereby avoiding leakage of liquid through the vent. However, if the spout is not fully rotated to the closed position, there is a possibility of leakage through the vent. This closure is not child-resistant.

[0005] In the Patent Abstracts of Japan, 1996, Japanese patent application publication 08 072915 discloses a liquid discharging container comprising a closure comprising a base connected to the container and a cap rotatably coupled to the base for closing and opening a discharge of the container. The axis of rotation of the cap is substantially parallel to the cylindrical axis of the base. The closing valve is formed by a cylindrical projection provided on the first body and a mating cylinder provided on the cap. Both the cylindrical projection and the mating cylinder comprise two grooves arranged at 180 degree angle. The valve is open in a position of the cap where the grooves of the cylindrical projection match the grooves of the cylinder. A drawback of this configuration is that the closing face of the valve is located in between the base and the cap. Hence, when the valve is closed, there may be liquid trapped outside of the container, in between the base and the cap. The trapped liquid may leak when the cap is deformed by an unauthorized person (e.g. a child), causing a possible hazardous situation.

Summary of the Invention

[0006] Therefore, the present invention aims at providing an improved closure for a container. Particularly, it is an aim of the invention to provide a closure which does not present the drawbacks of prior art closures.

[0007] It is a further aim of the invention to provide a closure comprising a valve with improved closing properties. It is still a further aim of the invention to provide a closure comprising a child-resistant closing valve.

[0008] It is a further aim of the invention to provide an improved child-resistant closure.

[0009] It is a further aim of the invention to provide a closure to which a dispensing device can be connected and disconnected.

[0010] It is a further aim of the invention to provide a closure arranged for not being removed from the container and with improved sealing properties compared with prior art closures.

[0011] The invention further aims at providing an improved method of sealing a closure onto a container for carrying liquids.

[0012] Aims of the invention are met by providing a closure, as set out in the appended claims, for a container for carrying a liquid.

[0013] According to a first aspect of the present invention, there is provided a closure comprising a first body, a second body, a valve and an outlet. The first body comprises an upper face, a sidewall and means for mounting onto a discharge opening of the container. The first body also comprises a passageway for the evacuation of liquid out of the container. The valve is arranged for closing said passageway. The second body is (rotatably) mounted onto the first body.

[0014] The closure comprises means for rotating the second body with reference to the first body between a position in which the valve is open and a position in which the valve is closed. Preferably, when the valve is open, the container communicates with the outlet of the closure through said valve. In the closure, for opening and closing the valve, the second body is arranged to rotate around a main axis substantially perpendicular to the upper face of the first body.

[0015] The main axis refers to the axis of rotation of

the second body relative to the first body (and hence relative to the container). According to a preferred embodiment, the main axis is parallel to the symmetry axis of the sidewall of the first body. The main axis is preferably substantially parallel to a longitudinal axis of the container, although other embodiments are possible as well.

[0016] The valve comprises a valve seat and a valve element. The valve seat is arranged for housing the valve element. The first body comprises the valve seat and the second body comprises the valve element. The valve seat and the valve element together constitute the valve.

[0017] According to a preferred embodiment, the valve element and valve seat are arranged so that the passageway through the valve (i.e. at the location of the valve) is substantially parallel to the main axis.

[0018] The combination of valve element and valve seat comprises an extension (or a projection), arranged to liquid-tightly fit inside an opening (or a hollow member) and arranged to rotate with reference to said opening.

[0019] The opening and the extension are concentric. Preferably, the extension is hollow. The axis of rotation of the extension relative to the opening is coincident with the main axis.

[0020] Preferably, the liquid passageway through the valve is essentially concentric with the main axis.

[0021] The extension and the opening are advantageously of substantially cylindrical shape. The extension and the opening can have the shape of conical segments. The extension and the opening can have the shape of cylinders.

[0022] Preferably, the opening and the extension provide a liquid passageway which is substantially parallel to the main axis.

[0023] Either the opening or the extension comprises a transverse member which narrows the liquid passageway and the other of the opening and the extension comprises at least one tab. The transverse member and the at least one tab are arranged for sliding over each other, whereby the at least one tab opens or closes the valve. The sliding is performed by said rotation of the second body.

[0024] Preferably, the transverse member is substantially perpendicular to the main axis. Either of the opening or the extension that comprises the transverse member preferably comprises a fitting for frictionally holding a dip tube.

[0025] The narrowing of the liquid passageway is achieved by the transverse member comprising one or more apertures. The tabs are arranged for opening or closing said one or more apertures.

[0026] Even more preferably, the first body comprises a vent and the second body comprises a second valve arranged for closing the vent. The vent is closed when the closure is in a closed position. According to a preferred embodiment, the vent is comprised in the upper face of the first body. According to an equally preferred embodiment, the vent comprises an L-shaped channel, the channel abutting in the upper face of the first body. The vent passes in both cases through the upper face of the first body.

[0027] Preferably, in the closure of the invention, said means for rotating the second body with reference to the first body comprise a circular rib provided on either the first body or the second body and a circular groove provided on the other of the first body and second body, the groove accepting said rib and the groove and rib guiding the rotation of the second body.

[0028] Preferably, either the first body or the second body further comprises an arc-shaped skirt and the other of the first body and the second body further comprises a bar arranged for engaging with the lateral ends of said skirt. Even more preferably, said bar extends between the valve (i.e. the opening or the extension) and the outlet of the closure and comprises a passageway for the evacuation of liquid from the valve to the outlet of the closure.

[0029] Preferably, the first body of the closure comprises a projection and the second body comprises a lip. The projection is arranged for engaging with the lip when the second body is in the closed position thereby preventing rotation of the second body towards the open position. The lip is more preferably arranged for being disengaged from the projection by application of a squeezing force on the second body at a substantially right angle with reference to the location of said projection and lip.

[0030] Preferably, the first body of the closure comprises a (second) tab and the second body comprises a flap, arranged for engaging with the (second) tab at a position in which the valve is open. The action of said engaging produces a click-sound.

[0031] The closure according to the invention preferably comprises a double-sided induction seal comprising an electrically conductive core layer coated at both sides with plastic. The double-sided induction seal is preferably located at a distance from the upper face of the first body. The double-sided induction seal can contact the sidewall of the first body, at an end remote of the upper face.

[0032] Preferably, the outlet of the closure comprises a socket arranged for accepting a connector plug.

[0033] The present invention equally provides a method of sealing a closure non-removably onto a container, the method comprising the steps of: providing a closure and providing a seal between the closure and the container, wherein the seal is a double sided induction seal comprising an electrically conductive core layer coated at both sides with plastic. The method further comprises the step of induction-heating the seal.

Brief Description of the Drawings

[0034] Figure 1 represents the closure according to the invention.

[0035] Figure 2a represents the closure base that is mounted onto a container. Figure 2b represents a top view of the closure base.

[0036] Figure 3 represents a cross section of the clo-

sure and the dip tube.

[0037] Figure 4 represents a bottom view of the closure cap that is mounted on top of the base.

[0038] Figure 5 represents a cross-sectional view of the closure.

[0039] Figure 6 represents a bottom view of the closure base comprising an induction seal.

[0040] Figures 7a and 7b represent respectively a cross sectional and upper view of the closure base.

[0041] Figures 8a, 8b and 8c represent respectively a bottom view, a cross sectional view of the cap and a cross sectional view of the vent valve.

Detailed description of the Invention

[0042] The closure according to the invention, for a container carrying liquids, can be provided with a spout for discharging the container's content, or with a spray nozzle. Preferably, the closure is provided with a socket at its outlet. The socket accepts a connector plug of an extension hose. At the distal end of the extension hose a spray gun is preferably provided. Liquid may be withdrawn from the container by the sucking action of the spray gun creating a vacuum at the outlet of the extension hose. The liquid in the container may be brought under pressure. The closure can be arranged for attaching a dip tube to it for withdrawing liquid from the bottom of the container.

[0043] The closure comprises two main bodies: a first body or closure base, comprising means for mounting onto the discharge opening of the container, and a second body or cap that is secured onto the base and is allowed to rotate thereby opening or closing a liquid passageway from the container to the outlet of the closure.

[0044] The closure comprises a valve for closing the liquid passageway. The valve comprises a valve element arranged for fitting into a valve seat.

[0045] According to the invention, the valve comprises a first member (or opening) of rotation symmetrical shape, arranged for accepting a second member (or extension) of rotation symmetrical shape. The first member and the second member are preferably of substantially cylindrical shape (they are referred to as respectively the first cylinder and the second cylinder). The second member can rotate relative to the first member.

[0046] The second cylinder can be a substantially cylindrical extension which is arranged to liquid tightly fit inside the first cylinder, which can be a substantially cylindrical opening. The first and the second cylinders provide a liquid passageway which is substantially parallel to the axis of rotation of the cap and which can be closed by rotation of the cap (the second body) with reference to the base (the first body).

[0047] The first cylinder forms part of either the valve seat or the valve element. The second cylinder forms part of the other of the valve seat and the valve element.

[0048] Either the first or the second cylinder comprises a member, arranged transversely in the cylinder which comprises the member. The other of the first and the second cylinder comprises sliding means arranged to slidingly rotate over the transverse member. By slidingly rotating, the sliding means open or close one or more apertures provided in the transverse member, thereby opening or closing the valve. Advantageously, said means can be one or more tabs.

[0049] Hence, when the cap is rotated, the one or more tabs rotate relative to the transverse member. The rotation of the cap (the second body) relative to the base (the first body) causes the second cylinder (cylindrical extension) and the first cylinder (cylindrical opening) to rotate relative to one another and the one or more tabs to rotate relative to and slide over the transverse member.

[0050] The transverse member can be a plate provided at the inside of the first or the second cylinder. One or more apertures are provided in the plate.

[0051] The one or more tabs refer to one or more flaps or tags, projecting from the inside wall of the first or the second cylinder. The tabs' face sliding over the transverse member advantageously ensures liquid-tight sealing of the apertures.

[0052] The first and second cylinders (members) can be conical segments instead of cylinders.

[0053] The axis (of symmetry) of the first and second cylinders substantially coincides with the axis of rotation of the cap relative to the closure base (i.e. the main axis). Hence, the first and second cylinders (the opening and extension) are preferably concentric. The transverse member is preferably arranged perpendicular to the axis (of symmetry) of the first and the second cylinders.

[0054] The closure of the invention allows to close a container liquid tightly. When the valve is in a closed position, the liquid of the container can not go beyond the closure base. As a result of the valve assembly, no liquid can get entrapped between the closure base and the cap. As the liquid passageway of the valve and the closing elements (i.e. the transverse member, the one or more tabs and the first and second cylinder) can be arranged in close proximity of the axis of rotation of the cap, a liquid tight closure is ensured even in case of inappropriate use of the closure, such as during actions of deforming the cap in order to open or to damage it. Hence, an improved child-resistant closure results.

[0055] According to a preferred embodiment, the closure comprises a vent. The vent is closed off when the closure is in its closed position. The vent is preferably also closed when the cap is positioned in between the open and closed positions.

[0056] The closure is preferably attached in such a way to the container that it can not be removed from the container without damaging both the container and the closure. Securing the closure on the container is preferably achieved by use of a double-sided induction seal. The induction seal is interposed between the container's discharge opening and the closure base. Induction-heating the seal bonds the closure to the container.

[0057] The closure according to the invention is pref-

erably child-resistant. Preferably, the cap's rotation from the closed to the open position is child-resistant. The liquid passageway in the closure can only be opened after application of a squeezing force onto the cap. The squeezing force releases a lip that otherwise is stuck behind a projection.

[0058] The valve in the closure that closes off the liquid passageway is designed so as not or almost not to deform during the squeezing action. This ensures a liquid-tight closure and prevents accidental discharge of liquid. These properties are best achieved when the valve is located in the vicinity of, and preferably concentrically around the cap's axis of rotation and the valve opening is as small as possible.

[0059] An additional advantageous child-resistant feature of the cap is the tight mounting of the cap onto the closure base. A circular groove and rib, present both on the cap and on the base, engage in each other and ensure that the cap is not easily torn off the base.

Description of a Preferred Embodiment of the Invention

[0060] 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. 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, A and B are relevant components of the device.

[0061] A preferred embodiment of the closure according to the present invention is depicted in figure 1.

Figure 1 presents a closure 1 for a liquid container, said closure comprising a base part 2 and a cap 3 on top of base 2. Cap 3 can rotate with reference to base 2 around axis 4 between an open and closed position. Referring to figure 3, base 2 is screwed onto a container with aid of internal thread 31. The thread 31 is provided at the inner side of the sidewall 210 of base 2. It is therefore necessary for this embodiment that the discharge opening of the container accepting closure 1 is provided with an external thread of the same size. Figures 2a and 2b present the base 2 with cap 3 removed. On top of sidewall 210, the base is provided with an upper face 200. Face 200 is related to the axis of rotation 4, in that axis 4 is essentially perpendicular to face 200.

[0062] Figure 4 presents cap 3 turned upside down. Cap 3 is assembled onto base 2 by pressing circular rib 41 and groove 42 into circular groove 21 and rib 22 respectively. The cap comprises a hollow cylindrical extension 43 which fits liquid-tightly into a cylindrical opening 23 arranged in the base. The cylindrical opening 23 defines a passageway for the fluid out of the container. The engagement of rib 41 into groove 21 and of rib 22 into groove 42 enable a tight fit of cap 3 onto base 2 and make it difficult for e.g. a child to accidentally remove the cap from the base.

[0063] The cylinders 43 and 23 constitute a combination of a valve element and valve seat respectively, arranged concentrically with the main axis 4 around which the cap can rotate. Referring to figure 2b, into cylindrical opening 23 a transverse member 24 is provided, with a number of apertures 25. The transverse member 24 narrows the liquid passageway of cylinder 23 to only the apertures 25. In the present embodiment, the transverse member has four apertures. Cylinder 23 abuts in face 200 and extends at both sides of the transverse member 24 as shown in figure 3, thus defining the liquid passageway out of the container. The lower end of the cylinder 23, proximal to the container, is meant to frictionally hold a dip tube 70 (see figure 3) which leads to the bottom of the container from where liquid is taken. Referring to figure 4, the cylindrical extension 43 abuts in tabs 44 around aperture 45.

[0064] When assembled, tabs 44 slide over transverse member 24. In a closed position, tabs 44 close all apertures 25. No liquid can escape from the container. By rotating cap 3 towards the open position, tabs 44 will free the apertures 25, thereby providing a passage for the liquid out of the container. The apertures 25 should be large enough in size and/or sufficient in number so as to avoid an excessive pressure loss when the liquid flows through apertures 25.

[0065] The reverse arrangement of cylinders 23 and 43 is equally possible. In that case, the base 2 comprises a cylindrical extension with tabs 44 at its end aperture, and the cap 3 comprises a cylindrical opening with a transverse member comprising apertures 25. In the same way as described above, the extension fits in the opening in a liquid-tight way. In this reverse embodiment, the cylindrical opening plays the part of the valve element (i.e. the movable part), which rotates around the cylindrical extension, the latter playing the part of the valve seat (i.e. the non-movable part). In both the embodiment shown in the drawings, and the reverse embodiment described above, the tabs 44 and transverse member 24 with apertures 25 may be interchanged, i.e. tabs 44 may be provided in the cylindrical opening, while the transverse member 24 with apertures 25 is provided at the end of the cylindrical extension.

[0066] The walls of cylinders 23 and 43 constitute a liquid-tight seal so as to avoid liquid leakage. A small internal diameter of cylinder 23 reduces possible deformations and eases the closing off of the liquid passageway. The flow path of the liquid is best seen on figure 5, which depicts a cross-sectional view of closure 1. Cylinder 43 is in fluid communication with passage 51 which provides a lateral discharge aperture 52 for the liquid. Discharge aperture 52 may be shaped in a determined way for accepting a connector plug of an extension hose to which a spray gun is connected at a distal end. It may alternatively be provided with a spray nozzle.

[0067] Cylinders 43 and 23, together with tabs 44 and the intermediate member 24 constitute a valve that opens or closes the liquid passage out of the container. The

cylinders 43 and 23 are concentric with the axis of rotation 4 of cap 3. The liquid passageway through the valve is located in a close vicinity around the axis of rotation 4. Therefore, closure of the valve is ensured even when an unauthorized user, such as e.g. a child tries to deform cap 3 by squeezing it or by trying to tear cap 3 off from base 2.

[0068] Referring to figures 2a and 4, the rotation of cap 3 with reference to base 2 is guided by groove 21, rib 22 and cylinder 23. The cap's angle of rotation is limited by skirt 28 to the arc in between closed position 5 and open position 6 (see fig. 1). This skirt 28 is provided onto face 200. The lateral ends of skirt 28 constitute end travels for the rotation of the body 48 of fluid passage 51.

[0069] In a preferred embodiment, the closure is equipped with a vent 26 (see figure 2b) providing a fluid communication between the internal volume of the container and the ambient air. Vent 26 is provided on face 200. In order to prevent the vent from spilling liquid when the closure is in a closed position, cap 3 is provided with a projection 46 having a bump 47. The projection 46 acts as a valve. Vent 26 accepts bump 47 when cap 3 is rotated in the closed position, thereby sealing the vent. When cap 3 is rotated to the open position, projection 46 travels to depression 27 in face 200 providing a seat for bump 47, thereby leaving vent 26 open. The projection 46 has the shape of an arc. Bump 47 is located substantially in the centre of the arc. Even if cap 3 is not fully rotated to the closed position 5, projection 46 will be on top of vent 26. Hence, vent 26 is closed liquid-tightly by bump 47 in the closed position. In between the closed and open position, the closing of vent 26 by projection 46 is generally not liquid-tight (i.e. sealing liquids such as water or comparable to water). However, accidental spill of liquid through the vent when e.g. the container is turned over is considerably reduced in the latter case.

[0070] Figures 7 and 8 represent an alternative embodiment for the vent 26 and the skirt 28. In this embodiment, vent 261 is provided in the skirt 28. As can be seen in figure 7a, the vent 261 is an L-shaped tube between face 200 and the outer wall of skirt 28. At the outer wall of skirt 28, vent 261 is closed off by a projection 81 provided in cylinder 80. This cylinder also comprises rib 41 and groove 42. Projection 81 ensures closure of the vent 261 when the closure is in the closed position.

[0071] Referring to figure 7b, skirt 28 abuts in tags 71 and 72 at both ends of the arc. The tags 71 and 72 constitute the end travels for the rotation of the body 48 of fluid passage 51.

[0072] Cap 3 of closure 1 is provided with a child-resistant turning mechanism. Opening of the closure - i.e. turning cap 3 from the closed position to the open position - is made impossible for persons not having enough force or not knowing how to perform the non-obvious combination of actions, which are based on the "squeeze and turn" principle. In the closed position 5, the cap 3 is locked because lip 49 on cap 3 (fig. 4) engages with projection 29 of base 2 (fig. 2b). Hence, the cap can not be rotated in a direction towards the open position 6. In the closed position of cap 3, a rotation lock in the other direction is provided by skirt 28 as explained previously. The child-resistant locking mechanism resembles that of a ratchet mechanism. In order to rotate cap 3 from the closed position 5 to the open position 6, a pressure has to be applied onto cap 3 at the positions indicated by numeral 7 in figure 1. This pressure has to be directed towards the cap centre, such as tending to squeeze the cap in a direction indicated by arrows 8. The squeezing action causes the outer skirt 9 of the cap (see fig. 4) to move outwards in a perpendicular direction with reference to the squeezing direction 8. Lip 49 is located along this direction, at a 90 degree angle from where the squeezing force should be applied. Hence, the squeezing causes lip 49 to move outwards, which releases lip 49 from projection 29. Cap 3 is now enabled to rotate towards position 6. When cap 3 is rotated back from position 6 towards position 5, the lip 49 engages with projection 29 at side 291, which guides lip 49 radially outwards, thereby deforming cap 3 a little. Once lip 49 passes side 292, cap 3 reassumes its undeformed state and the engagement of lip 49 with projection 29 at side 292 ensures a rotation lock in the direction of opening the cap.

[0073] Referring to figures 2b and 4, base 2 may be provided with tabs 203 at the open position and optionally also at the closed position and cap 3 may be provided with flap 401. When turning cap 3, flap 401 engages with tabs 203 so as to produce a click-sound each time the cap has been turned in the open or closed position. Hence, the click-sound draws the user's attention to the fact that the closure has reached either the open or the closed position. Referring to figure 7b, tab 203 is provided only at the open position. In the closed position, the engagement of lip 49 with projection 29 already serves as an acknowledgement of reaching the closed position of the cap 3.

[0074] At the open position, the engagement of flap 401 with tab 203 has the additional advantage of constituting a certain resistance against an accidental, unwanted rotation of cap 3. For example, supposing that a hose with spray gun is attached to the cap, and the user is in the action of spraying the container's contents (e.g. insecticide, herbicide, etc.), the engagement of flap 401 with tab 203 reduces the risk that the cap is accidentally rotated a little towards the closed position thereby closing the valve element 44 a little, which would reduce pressure and cause a less optimal flow of liquid out of the container (and in this particular case a less optimal spraying).

[0075] The closure may additionally be equipped with a tamper evidence. In such case, cap 3 is provided with a tag 402, as depicted in figure 4. Tag 402 is connected to cap 3 at both lateral ends 403 and 404 with tooth-shaped links. The tag is removed from cap 3 at first use of closure 1 by tabs 201 and 202 provided on base 2 (see figure 2a). Tabs 201 and 202 engage with the tooth-shaped links 403 and 404 respectively when cap 3 is turned from the closed position 5 towards the open po-

sition 6, thereby destroying each link between tag 402 and cap 3. Hence, tag 402 need not be removed manually prior to first usage of the closure 1. Furthermore, the present configuration ensures that tag 402 will be completely removed from the closure at first usage of the closure (i.e. first turning from the closed to the open position).

[0076] Closure 1 is preferably mounted onto the discharge opening of a container in a sealed and non-removable way. This can be performed in a number of ways. According to a first embodiment, the base 2 is provided with internal thread, arranged for being screwed onto the discharge opening of a container, which is provided with external thread of the identical size. Liquid-tight sealing of the base onto the container can be achieved by state-of-the-art methods, such as providing a circular, tapered seal in the base that engages with the discharge opening of the container, such as is usual for sealing bottles with screw caps. In that case, removal of the base may be prevented by a ratchet mechanism such as the one described in document US 2004/0129728.

[0077] The present invention additionally proposes an alternative embodiment of the closure and a method of sealing a closure, as e.g. the closure 1 onto a container. The embodiment provides a closure for a container for carrying a liquid which comprises a double-sided induction seal. Referring to figure 5, a double-sided induction seal 53 is provided at the bottom of base 2, above the thread 31. This induction seal 53 comprises a metal, electrically conductive (e.g. aluminium) core layer, coated at both sides with a plastic foil (e.g. a PE-foil).

[0078] In the method of sealing, the double-sided induction seal also prevents removal of the closure from the container. When base 2 is screwed onto the container, the seal 53 is pressed between base 2 and the discharge opening of the container. Thereafter, an inductive heating of seal 53 is performed, through which the plastic foils at both sides of the seal 53 melt thereby sealing at the lower face the seal 53 to the container and at the upper face the seal 53 to the base 2. Solidification of the plastic foils ensures a high-resistant fixation of closure base and container, making removal of the closure base from the container impossible. A large contact area between seal and base and between seal and container increases the sealing force.

[0079] Figure 6 depicts the closure base 2 viewed upside down with the induction seal 53 mounted in it. As is clear from figures 5 and 6, a clearance is provided between induction seal 53 and cylinder 23. The clearance ensures a fluid (air) passage between the container's internal volume and vent 26 or vent 261. Furthermore, in order to prevent that vent 26 or vent 261 is closed off by the double-sided induction seal when it is heated, face 200 is provided at a distance from the double-sided induction seal 53.

[0080] An advantage of the closure according to the present invention is that it is leakage-free even when unauthorised persons try to deform the cap. As the valve element 44 of the valve for closing the liquid passageway is located near the axis of rotation of the cap, the valve will not deform when the cap 3 is accidentally squeezed. Therefore, the valve remains liquid-tightly closed when in closed position.

[0081] Leakage through vent 26 or 261 is also unlikely to occur. The valve 46 for vent 26 closes the vent unless the closure is in an open position.

[0082] Alternative embodiments than the ones disclosed above are possible. Particularly, the thread 31 for screwing the base 2 onto a container may be substituted with a skirt comprising one ore more grooves and/or ribs. These grooves and/or ribs are intended to mate with ribs and/or grooves provided on the neck of the container. Such a configuration is analogous to the rib/groove combination 21/22-41/42 for snapping the cap 3 onto the closure base 2. Alternatively it may be of the kind as described in patent document US 3874562.

Claims

1. A closure (1) for a container for carrying a liquid, said closure comprising a first body (2), a second body (3) mounted onto said first body, a valve comprising a valve seat (23,24) and a valve element (43,44), and an outlet (52), wherein:

   - the first body comprises an upper face (200), a sidewall (210) and means (31) for mounting the first body onto a discharge opening of the container;
   - the closure comprises means (21,41) for rotating the second body with reference to the first body around a main axis (4) substantially perpendicular to said upper face (200) and between a position (6) in which the valve is open and a position (7) in which the valve is closed;
   - the first body comprises the valve seat and the second body comprises the valve element, wherein:
   - the combination of said valve element and valve seat comprises an extension (43) arranged to liquid-tightly fit inside an opening (23) and to rotate with reference to said opening, wherein:
   - the extension and the opening provide a liquid passageway (90) through the valve,
   - either the extension or the opening comprises a transverse member (24) for narrowing said liquid passageway, the transverse member comprising one or more apertures (25) and
   - the other of extension and opening comprises at least one tab (44), said at least one tab and said transverse member arranged for sliding over each other, thereby closing or opening the valve.

2. The closure according to claim 1, wherein said valve element and valve seat are arranged so that the passageway (90) through said valve is substantially parallel to said main axis.

3. The closure according to any one of the preceding claims, wherein the axis of rotation of the extension relative to the opening is coincident with said main axis.

4. The closure according to any one of the preceding claims, wherein the extension (43) and the opening (23) are of substantially cylindrical shape.

5. The closure according to any one of the preceding claims, wherein the extension (43) and the opening (23) are conical segments.

6. The closure according to any one of the preceding claims, wherein the first body comprises a vent (26) and the second body comprises a second valve (47) arranged for closing said vent, the vent being closed when the closure is in a closed position and said vent being open when the closure is in an open position.

7. The closure according to any one of the preceding claims, wherein said means (21,22,41,42) for rotating the second body with reference to the first body comprise a circular rib (22,41) provided on either the first body or the second body and a circular groove (21,42) provided on the other of the first body and the second body, the groove accepting said rib and the groove and rib guiding the rotation of the second body.

8. The closure according to any one of the preceding claims, wherein either the first body or the second body further comprises an arc-shaped skirt (28) and the other of the first body and the second body further comprises a bar (48) arranged for engaging with the lateral ends (71,72) of said skirt.

9. The closure according to claim 8, wherein said bar (48) extends between the opening or the extension and the outlet (52) and comprises a passageway for the evacuation of liquid from the valve (44) to the outlet of the closure.

10. The closure according to any one of the preceding claims, wherein the first body further comprises a projection (29) and the second body comprises a lip (49), whereby the projection is arranged for engaging with the lip when the second body is in the closed position thereby preventing rotation of the second body towards the open position.

11. The closure according to claim 10, wherein the lip is arranged for being disengaged from the projection by application of a squeezing force on the second body at a substantially right angle with reference to the location of said projection and lip.

12. The closure according to any one of the preceding claims, wherein the first body comprises a tab (203) and the second body comprises a flap (401), the flap arranged for engaging with the tab at a position in which the valve is open, the action of said engaging producing a click-sound.

13. The closure according to any one of the preceding claims further comprising a double sided induction seal (53) which comprises an electrically conductive core layer, coated at both sides with plastic.

14. The closure according to any one of the preceding claims, wherein the outlet comprises a socket for accepting a connector plug.

15. A container for carrying a liquid comprising the closure according to any one of the preceding claims.

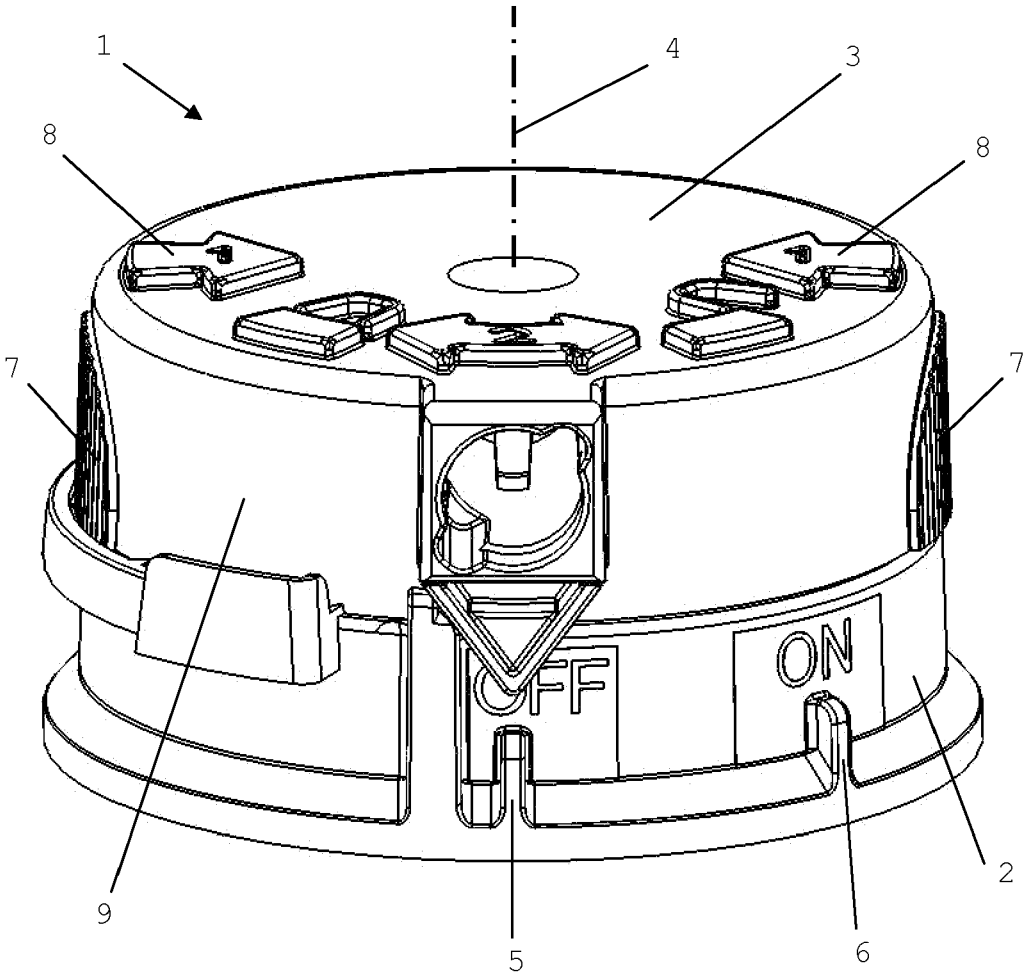
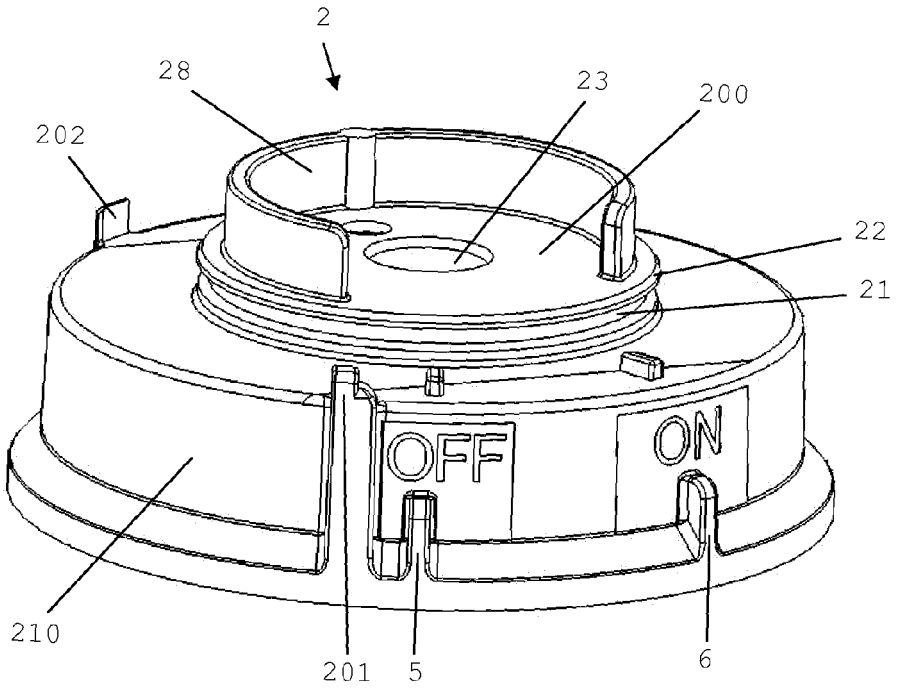


FIG 1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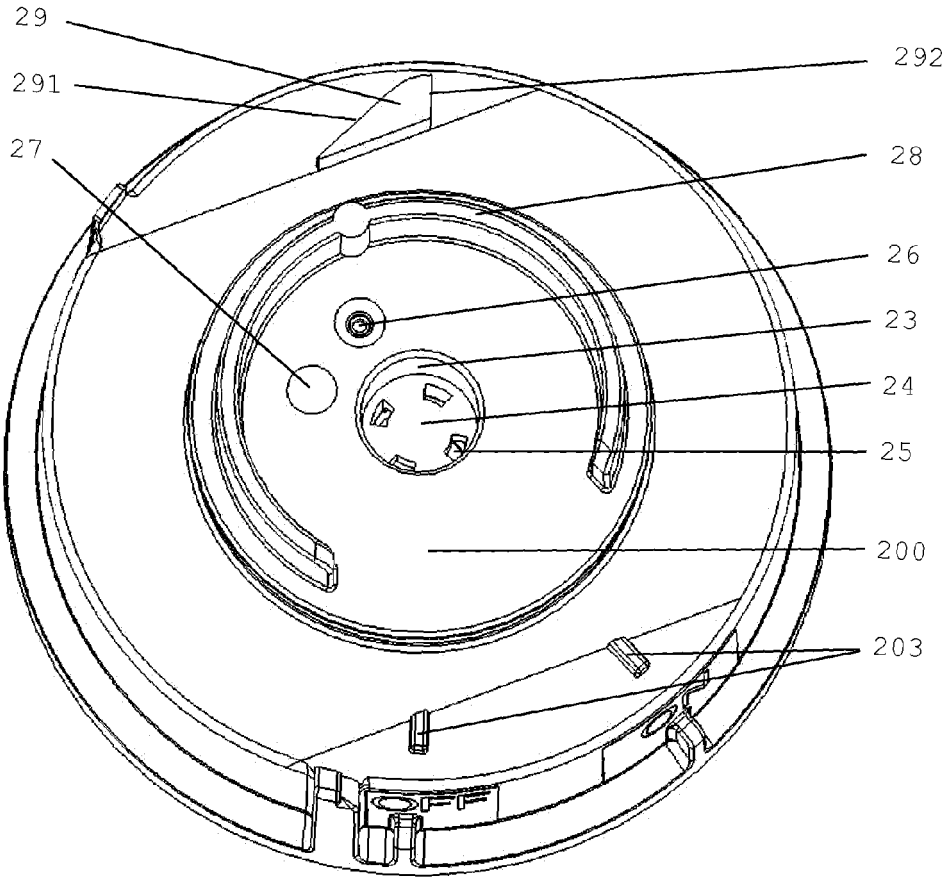
210
201
5
6

FIG 2a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OFF

FIG 2b

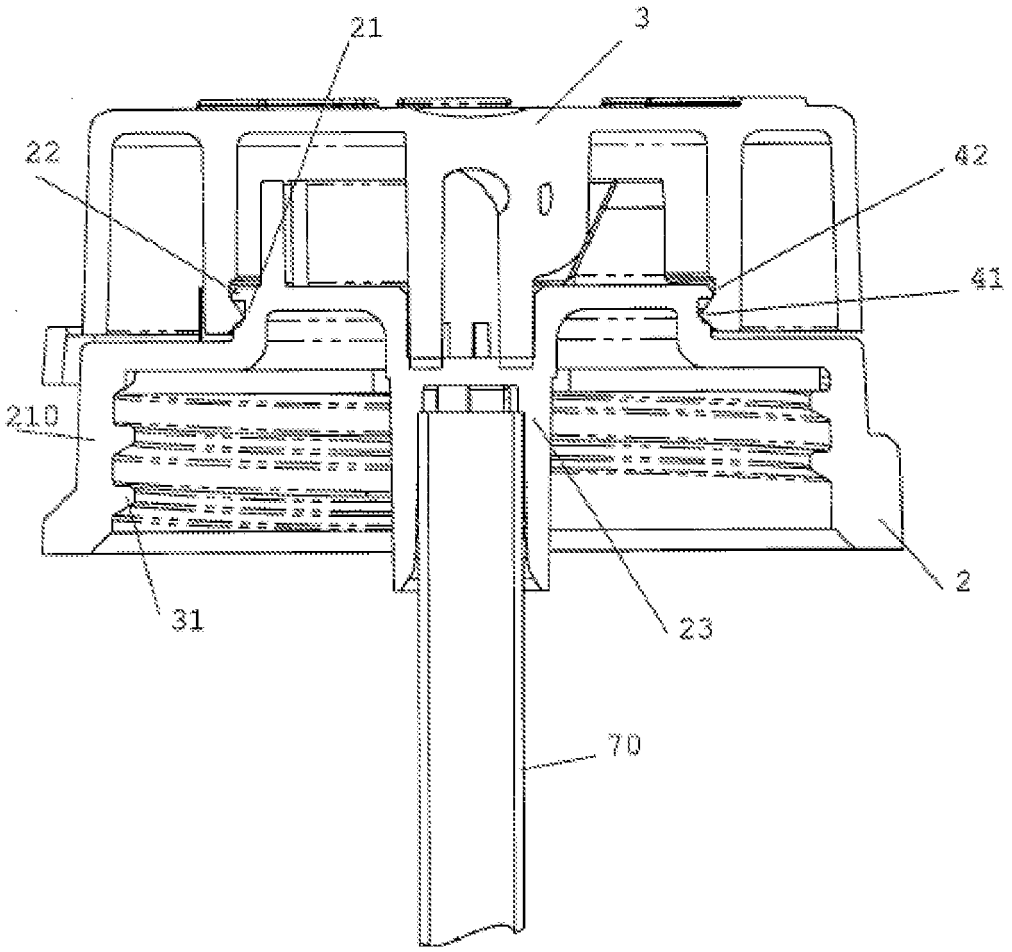

FIG 3

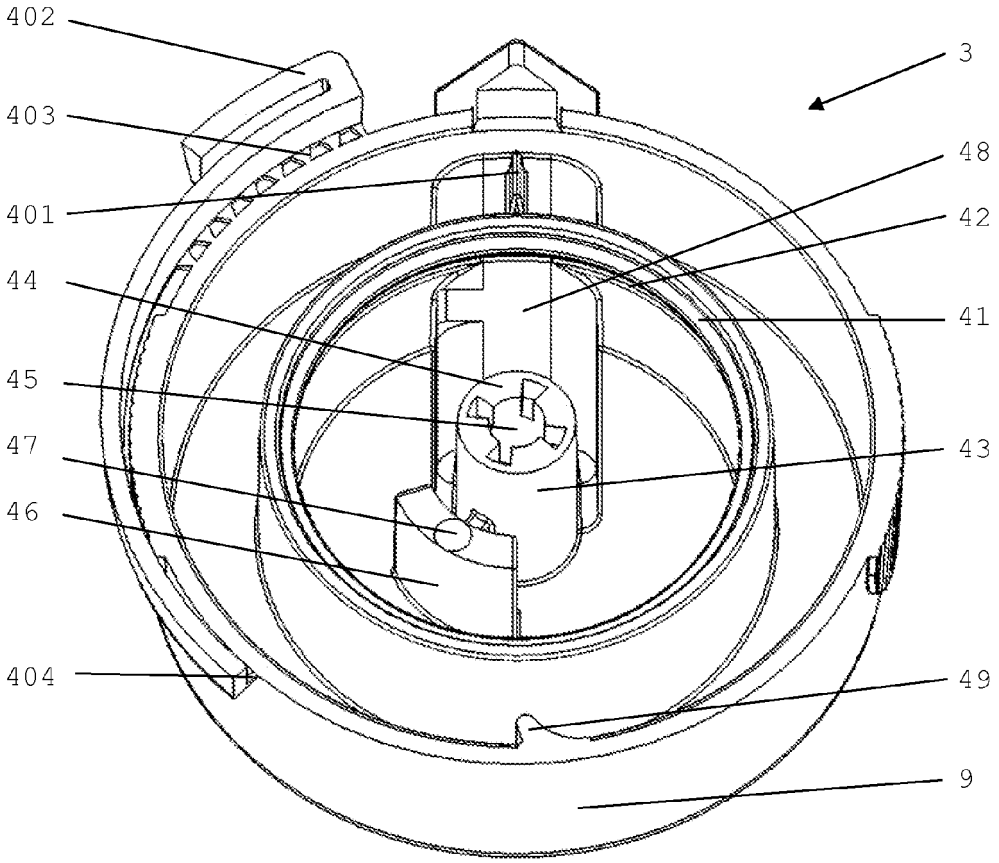
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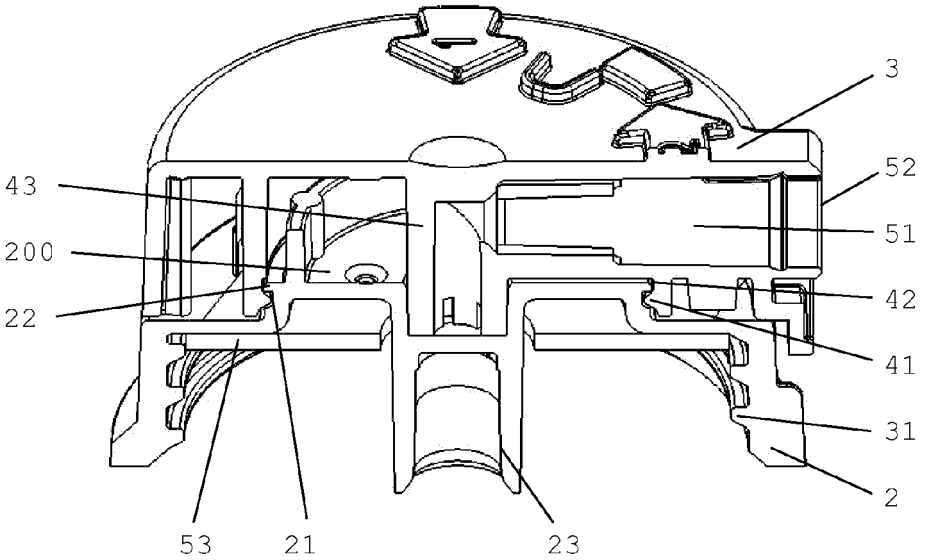
FIG 4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42
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FIG 5

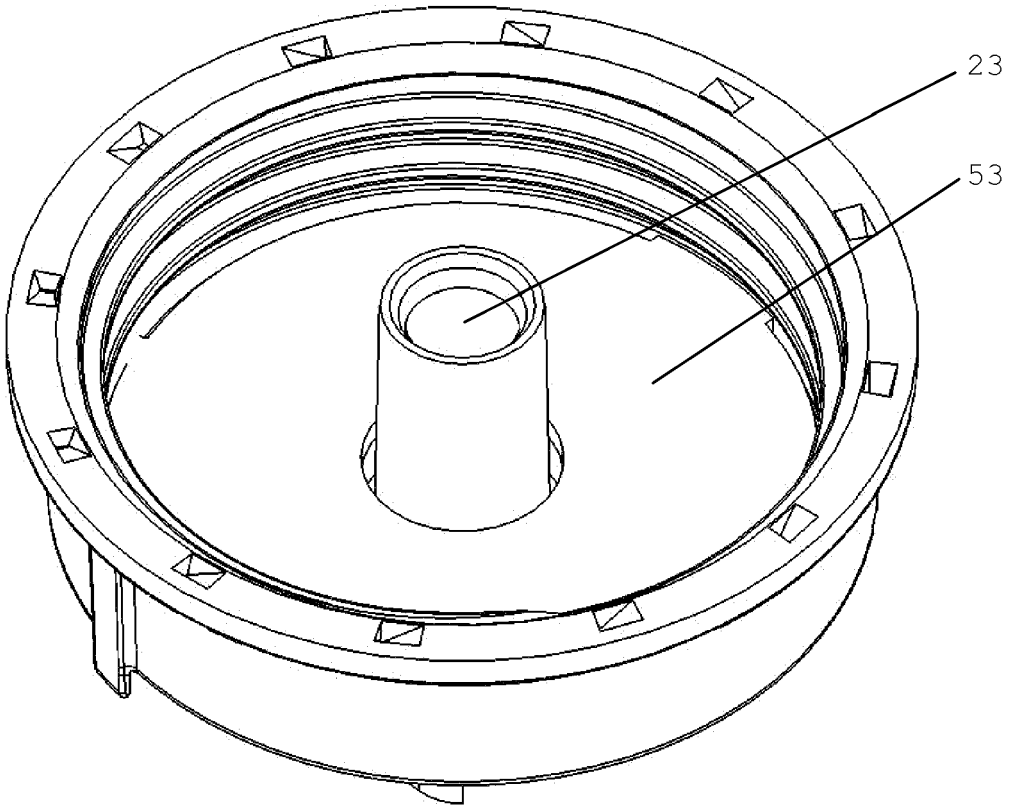

FIG 6

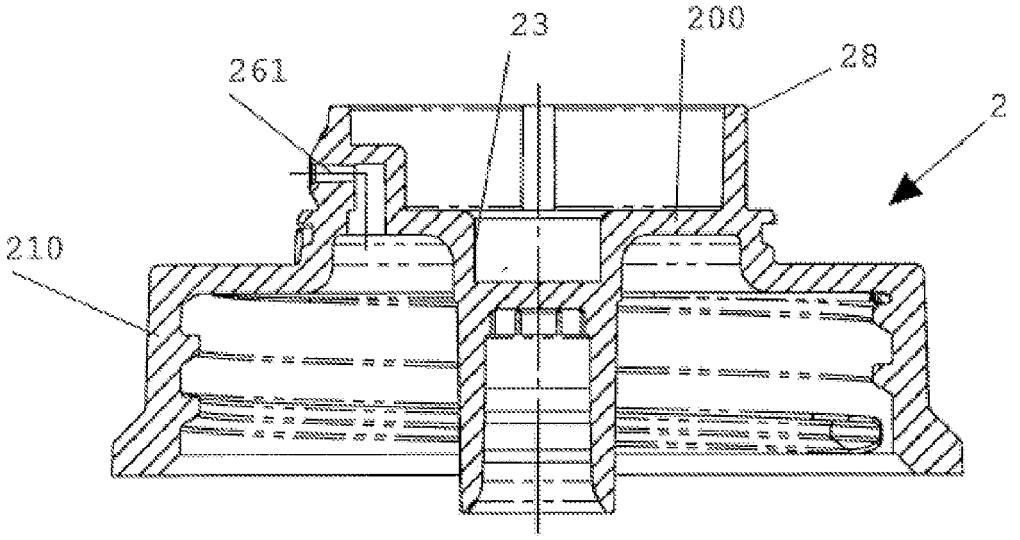

FIG 7a

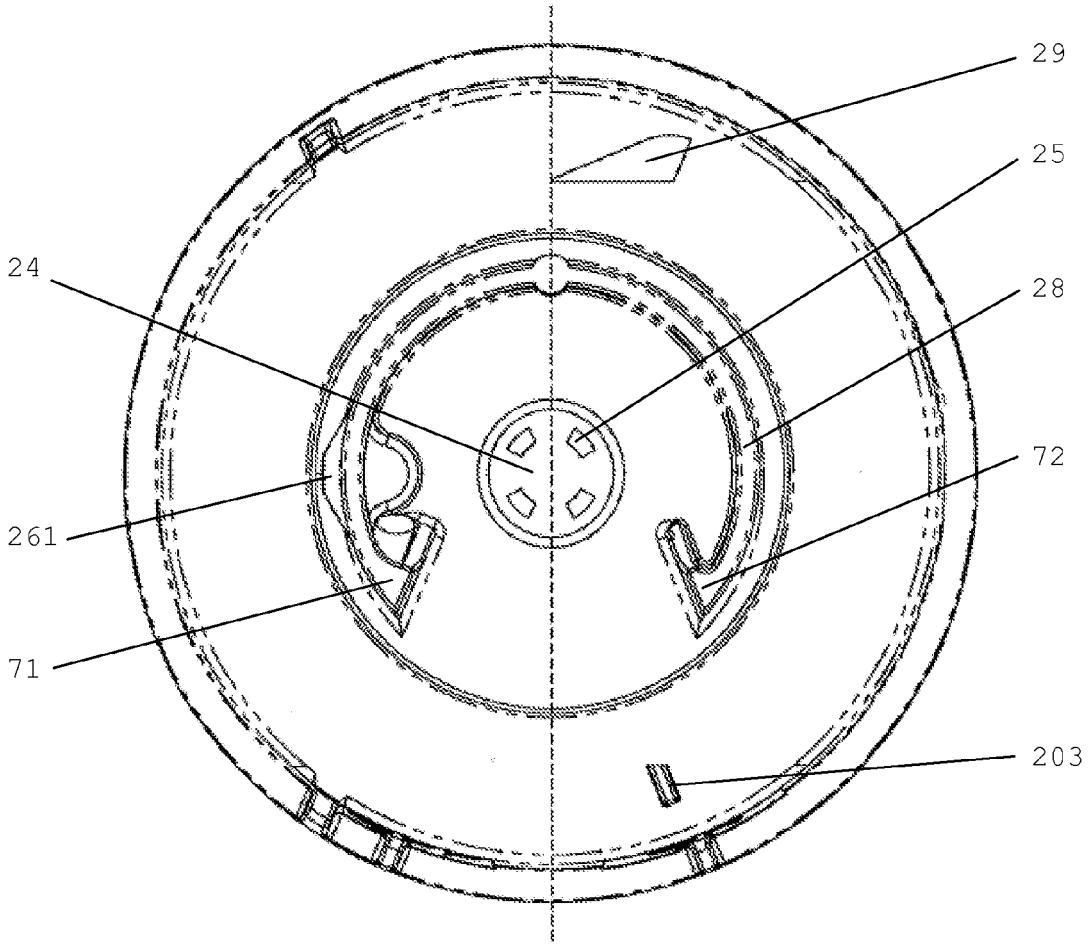

FIG 7b

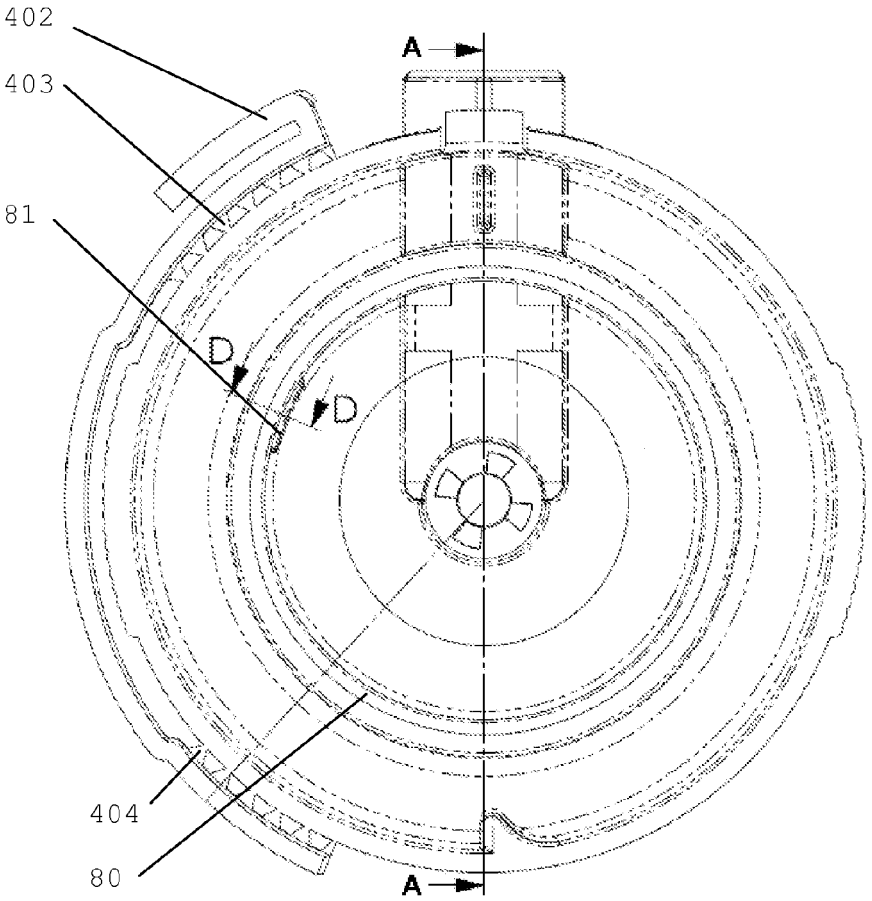

FIG 8a

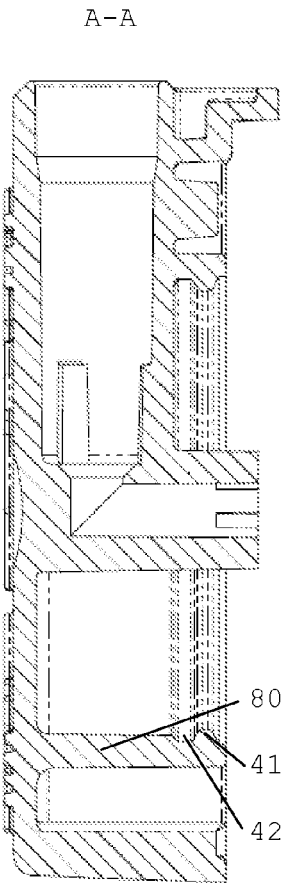

FIG 8b

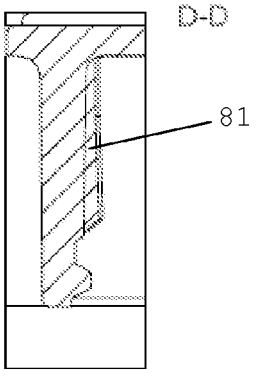

FIG 8c

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 12 1453

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 February 2008	Appelt, Lothar

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