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(54) **Closure device**

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Dispositif de fermeture

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Description

[0001] The invention relates to a closure device for closing a fluid container according to the preamble of claim 1; i.e, comprising: a mount piece for fixing the device to said fluid container; a closure cap fixed to said mount piece along a perimeter of said cap, the closure cap provided with an outflow opening; a stud coupled to said mount piece, corresponding with said outflow opening of said closure cap for closing said outflow opening in a closing position, and said closure cap being movable, under the influence of overpressure in the fluid container, in axial direction of the stud between said closing position and an outflow position freeing the outflow opening with respect to the stud.

[0002] Such a container is known from European patent publication EP700353 and serves to store and use fluids including viscous substances such as soaps and shampoos and the like.

[0003] The known closure cap is made of elastic material and contains a number of concentric folds intended to make the closure cap carry out a better axial movement along the stud. In this manner, the closure is improved and the closure cap can move back and forth like an accordion.

[0004] Although in said publication some venting solutions are presented to refill the container with air to replace the fluid that is flowing out of the outflow opening, these venting solutions are quite complex in construction and require for example a separate valve arrangement mounted oppositely to the closure device.

[0005] Moreover, document JP 09039990 A also discloses a closure device according to the preamble of claim 1.

[0006] Furthermore, from the German Offenlegungsschrift DE10109064 a venting arrangement is proposed. Around an axially movable stop element a concentric enclosure is arranged that houses a valve member that is seated against a wall of said enclosure to form a valve arrangement for return air flow into the container.

[0007] This venting arrangement suffers from various drawbacks and appears to be too large to apply in conjunction with the above identified closure cap arrangement. Another drawback is that a valve member present in the valve arrangement appears to be critically dependent on relative positioning to a seating face for providing a reliable closing. However, such positioning accuracy appears to be difficult to attain. Furthermore, during research, it was found that due to the impact of the contents (usually comprising volatile element which affect the plastics used for these purposes) can alter the dynamic behaviour of the valve, for instance, since it can affect the thickness and flexibility of the valve arrangement. This can result in sticking or leaking of the valve member, which affects the reliability and consumer satisfaction of the product.

[0008] Another drawback of the known closure cap is that the dose rate strongly depends on the type of fluid

enclosed in the container. As a result, with a relatively less viscous fluid, an undesirably large amount of fluid may flow out of the container, and with a relatively more viscous fluid, less fluid, or a considerably higher pressure may be needed to be able to dose the required amount of fluid. It is a further object of the invention to avoid this drawback and to provide a fluid container which is less expensive to manufacture, contains fewer constituent components and offers a very reliable closure, the closure being virtually independent of the type of fluid present in the container or the pressure provided in the container.

[0009] Thus, the invention has as one of its objects to provide a closure device that improves the known closure and venting solutions and which provides a compact venting arrangement which continues to provide reliable closure.

[0010] This object is achieved by a closure device of the above type and further comprising the features of claim 1. Specifically, in a closure device according to the invention, said mount piece comprises an enclosure arranged around said closure cap and housing a valve member that is seated against a wall of said enclosure to form a valve arrangement for return air flow into the container. Further specifically, said enclosure comprises a micro perforation permitting airflow into said container and shielding said valve member from said fluid in said container.

[0011] By such a valve arrangement, the valve member is generally kept dry from the fluid contained in the container, all the more, since the fluid can be vented out of the enclosure during a venting action. In rest, fluid flow into the enclosure is restricted due to the presence of said micro perforation, and a relative mild standing pressure of the fluid column above the enclosure. The enclosure can be designed to allow specific parts in the circumference to comprise venting micro perforations. During pressing, the valve member blocks, so that the air is kept contained in the valve enclosure. During release, the valve member vents, so that air is permitted to flow inside the enclosure, venting the container and pressing liquid out of the enclosure. Thus, the proposed solution keeps the valve member generally dry and in reliable working order.

[0012] For providing a compact and simple construction, preferably, the cap is clamped on an inner wall of said enclosure and said valve member is monolithically formed with said cap. Further, preferably, for reducing interference of the closable cap portion and the valve member, said valve member is decoupled from said movable portion of said cap by a weakening.

[0013] According to another aspect of the invention, in a further preferential embodiment said valve member is conically extending outward to be seated against an outer cylindrical wall of said enclosure. Further, preferably, said enclosure shaped in U form in cross sectional view. In such an embodiment, the opposing walls are monolithically formed from a mold, which optimizes manufacturing

accuracy of the valve member respective to a seating wall of the enclosure. With respect to a "U" form the skilled person will understand that this form encompasses any configuration with two opposing walls coupled by a connecting wall, not necessarily symmetric with respect to a central axis.

[0014] In another preferential embodiment, said enclosure extends below said cap and said valve member is extending curvedly inward to be seated against an seat provided below said cap by said enclosure. This embodiment has as an advantage that during production, the valve member is shielded by the outer circumference and mounting parts of the closure cap, which improves the manufacturing reliability. Furthermore, during assembly, the (preferably monolithically formed) closure cap and valve member can axially be pressed into the mount piece until the valve member is positioned against the circular seat.

[0015] Further, preferably, the closure device is shaped to form a stand for said fluid container. Here preferably, the enclosure is vented via an air feed that is distanced from a base plane of said stand. Such a setup prevents that the closure device, on a wet floor, accidentally sucks water instead of air into the valve arrangement.

[0016] In another aspect of the invention, the closure cap comprises a snap zone in order to undergo a relatively sudden deformation and move to the outflow position under the influence of a relatively high first overpressure, and to be maintained in the outflow position under the influence of a relatively low second overpressure.

[0017] The invention will now be elucidated with reference to the drawing, in which:

Figure 1 shows a schematic side view of a preferred embodiment of the invention;

Figure 2 shows schematic perspective view of a cross cut closure cap displayed in Figure 1;

Figure 3 shows schematic perspective view of a cross cut closure device comprising the closure cap of Figure 2;

Figure 4 shows a schematic side view of another embodiment of the invention;

Figure 5 shows a production configuration of a flexibly coupled stud arrangement;

Figure 6 shows a working configuration of the arrangement of Figure 5;

Figure 7 shows a perspective cross cut view of another flexibly coupled stud arrangement;

Figure 8 shows yet another perspective cross cut view of a flexibly coupled stud arrangement;

Figure 9 shows a schematic side view of a mounting configuration for mounting the closure cap to a mount piece;

Figure 10 shows a detailed view of another mounting configuration for mounting the closure cap to a mount piece;

Figure 11 diagrammatically shows, in side elevation-

al view, the fluid container showing aspects of the invention;

Figure 12 diagrammatically shows, in side elevational view, the fluid container showing aspects of the invention, with the closure cap in closing position;

Figure 13 diagrammatically shows, in side elevational view, a fluid container, with the closure cap in outflow position;

Figure 14 diagrammatically shows, in side elevational view, a fluid container, with air being sucked in via the outflow position;

Figure 15 diagrammatically shows, in side elevational view, a fluid container, with air being sucked in via a return valve;

Figure 16 diagrammatically shows an alternative embodiment of the fluid container;

Figure 17 diagrammatically shows, in side elevational view, the fluid container according to Fig. 6;

Figure 18 shows, in cross section, a closure cap according to the preferred embodiment;

Figure 19a diagrammatically shows the snapping behavior of the closure cap of Figure 18;

Figure 19b is a force-distance diagram which shows the snapping behavior at a position A-A in Figure 19a

[0018] In the Figures, the same or similar parts are designated by the same reference numerals.

[0019] Turning to Figure 1, there is disclosed a schematic side view of a closure device 1 of the invention. The closure device 1 shows a mount piece 2 for fixing the device to a fluid container 3 (for reasons of clarity, a contour of the container 3 is only schematically illustrated, see also container 39 in Figure 12). In the position illustrated in Figure 1, the closure cap 4 is oriented downwards. The closure cap 4 is fixed to said mount piece 2 along a perimeter and comprises an outflow opening 5 (see the dotted opened configuration of the cap 4) that is closed by a stud 6 coupled to mount piece 2. The stud 6, in a closing position of the cap 4, corresponds with the outflow opening 5 of the closure cap 4 so to close the outflow opening 5.

[0020] As will be further explained with reference to Figure 10 and further, said closure cap 4 is movable, under the influence of overpressure in the fluid container. Mount piece 2 comprises an enclosure 7 arranged around said closure cap 4. The enclosure is shaped according to concentric cylindrical walls 8, 9 distanced by a U-profile 10. The enclosure houses a valve member 11 that is seated against a wall 9 of said enclosure to form a valve arrangement for return air flow 12 into the container. To restrict the flow of fluid into the enclosure, preferably, the enclosure comprises only a tiny micro perforation 13 permitting airflow 12 into said container and shielding said valve member 11 from said fluid in said container. Since only one perforation 13 is present air trapped in the enclosure 7 can only escape via the one micro perforation under the exchange of fluid. Since the flow impedance of the micro perforation for fluid flow is

high, this process only takes place slowly and every time the enclosure 7 is vented, air flow 12 is pushed through the enclosure 7 thereby freeing the enclosure from fluid. In this way, the valve action is considerably enhanced since the valve member is free to move and will not suffer from remaining fluid preventing free movement. Furthermore, the valve member 11 is kept dry and will suffer less from the impact of volatile elements of the fluid affecting the dynamic behaviour thereof. Furthermore, the valve member 11, will not stick due to drying of fluid that enters the enclosure 7. Figure 1 further shows the cap 4 clamped on an inner wall 8 of said enclosure 7 and said valve member 11 is monolithically formed concentric with said cap 4.

[0021] Specifically referring to Figure 2, the cap 4 is shown in a perspective cross cut view. In this context, the "cap" refers to a monolithic assembly comprising three zones. First, a conically outward extending valve member 11 to be seated against an outer cylindrical wall 9 of said enclosure 7. Second: relatively rigid and thick annular mounting part 14 to be clamped around an inner wall of the enclosure 7. To enhance the clamping and prevent fluid to be pressed outwardly between the wall 8 and the mounting part 14, conjugate ribs 15 are formed on the mounting part and wall 8. Thirdly, the cap 4 comprises the true closure cap portion, in the form of a diaphragm 16, an advantageous snapping embodiment thereof being specifically elaborated in the sections referencing Figure 11 and further. Figure 2 shows the valve member 11, of a thickness decreasing towards the perimeter, and mechanically decoupled from the mounting part 14 and diaphragm 16 by a weakening 17. The valve member 11 is dimensioned to abut in a line contact against the outer wall 8, thus forming an optimal closure when the container is pressed; and receding from the wall 8 when air is sucked into the container.

[0022] Figure 3 shows schematic perspective view of a cross cut closure device comprising the closure cap 4 of Figure 2. For better understanding, lines 18 have been drawn to schematically illustrate the boundary between the container, thus separating the interior 19 of the container from an ambient area 20 from where ambient air 12 can be drawn (see also Figure 1). The flat base plane 21 of the closure device 1 permits inverted standing of the container (that is, with the outflow opening downwards). However, on wet floors or wet environments a risk of water intake via the valve inlet 22 may exist. Thus, the enclosure 7 is vented via an air feed 23 that is distanced from the base plane 21.

[0023] Figure 4 shows a schematic side view of another embodiment of the invention, wherein an enclosure 7 is formed extending below (in the drawing: above) said cap 4 and said valve member 11 is extending curvedly inward to be seated against an circular seat 24 provided below said cap 4 in said enclosure 7. This variant offers a reliable closing contact when pressed by the fluid in the container, and easily vents the air into the container when an underpressure is applied, even in an enclosure

where no shielding from the fluid is provided. Furthermore, this embodiment is easily assembled and has large design tolerance by simple axial push of the cap 4 (including valve member 11) downwards while seating the valve member against the seat 24. Furthermore, the vulnerable thin parts of the valve member 11 are shielded by the mounting part 14 during production, thus minimizing production losses.

[0024] Figure 5 and Figure 6 show a production configuration 25A and a working configuration 25B respectively of a flexibly coupled stud arrangement 25. The flexible suspension of stud 6 offers a benefit in that it provides shock resistance to impact (sudden short movements) of the container. To minimize the chance on undesired outflow of fluid from the outflow opening in case of shock, the stud 6 initially couples with the movement of the mount piece 2 and cap 4 (not illustrated) when accelerated, thus keeping the cap closed. This shock resistance is further explained with reference to Figure 16. The embodiment illustrated in Figure 6 is highly reliable in functioning and due to the tangential leaf spring members 26 is optimally flexible. The spring members 26 are mounted between axial rigid members 27 of the stud 6 and an inner wall 8 of mount piece 2. Thus, the rigid members 27 define axial movement of the stud 6 in said mount piece 2. The production configuration is designed so that it can be cleared from a mold. In this production configuration, the leaf spring members 26 define a conical form in axial direction along the stud. The inner wall 8 of said mount piece 2 comprises stop members 28 for enclosing said rigid members 27 in limited axial movement. This limitation can be designed so that normal impact is resisted but the stud 6 fixed enough for providing easy separation from the cap in normal use.

[0025] In Figure 6 the leaf spring members 26 are brought in an inverse conical form compared to the production configuration. In doing so, the rigid members 27 are rotated relative to the stop members 28. The inverse rotation direction is illustrated in Figure 6 by arrow P. Thus, by rotating the rigid members 27, these are "caught" by the stop members 28 into a working configuration.

[0026] Figure 7 shows a perspective cross cut view of another closure device 29, wherein a coupling between a mount piece 2 and a stud 6 is provided by a star shaped plurality of radial leaf spring members 30 coupling said stud to said mount piece, here the radial spring members are formed from rigid parts 31 connected via fold hinges 32. One the spring members 30 hammer like stop elements 33 are arranged for abutting against the inner wall 8 of the mount piece 2. Figure 8 shows yet another perspective cross cut view of a closure device arrangement 34 with another flexible coupling between the stud 6 and mount piece 2. In this arrangement, the leaf spring members 35 are bent in shape and flexible.

[0027] Figure 9 and Figure 10 show alternative embodiments for mounting the cap 4 on the mount piece 2. In Figure 9, a mounting part 14 is provided, that compris-

es a flexible rim 36 that is brought in click contact with a fixed rim part 37 provided on the mount piece 2. Alternatively, according to Figure 10, the cap 4 is enclosed by a conical rim part 38 that is brought (see arrow P) into an inverse conical shape during folding of the rim. In this inverse configuration, the cap is fixed by the rim part.

[0028] In the remaining figures Figure 11-Figure 19, aspects of the snap behaviour of the closure cap will be discussed.

[0029] With reference to Figure 11 and Figure 12, a (part of a) fluid container 39 is diagrammatically shown. In Figure 11, the closure device 40 is shown in perspective view; Figure 12 shows a cross-sectional view. The fluid container 39 is preferably manufactured from an inexpensive plastic, for instance LEP or LLDPE, and may further comprise numerous types of fluids (not shown), while the material of the lining can be adjusted to the type of fluid enclosed. In the following, fluid will also be understood to comprise various viscous substances and semi-fluids such as soaps, shampoos and the like. The container 39 is locked by a closure device 40. For reasons of clarity, the container and closure device are shown disproportionately. The closure device 40 comprises a mount piece 41 of a relatively rigid material. The mount piece is coupled along a perimeter 42 with a flexible closure cap 43 comprising a central outflow opening 44. In Figure 12, the wall 45 is shown to form a part of the fluid container 39. This wall 45 is usually somewhat reinforced or at least manufactured from rigid material, and, according to the exemplary embodiment of Figure 12, it forms a cylindrical cavity in which the mount piece 41 and the closure cap 43 can be clamped, with the closure cap being held between the mount piece 41 and the wall 45. Although, in the side elevational view of Figure 12, the mount piece 41 and closure cap 43 appear to consist of separate components, these components are connected to one another outside the plane of the drawing and both parts are preferably formed in one whole. Through combinations of a relatively rigid mount piece and a relatively more flexible material of the closure cap 43, by means of the construction shown, a good closure can be obtained near the perimeter 42. In the preferred embodiment, the closure cap further comprises a lip 46 which, together with a slot 47 in the mount piece 41, forms a return valve 48, whose function will be further elucidated with reference to Figure 15.

[0030] In the mount piece 41, an opening 49 is formed, that is to say, fluid can flow through an opening 49 in the mount piece, and the perimeter of the mount piece is at least substantially contiguous to the wall 45 of the fluid container 39. In addition to a flow passage 49 for the fluid, the mount piece 41 further comprises a stud 50 which connected through at least one transverse part 51 to the perimeter of the mount piece 41 in order to position the stud 50. According to the example, the stud is positioned centrally in the opening 49 and fluid can flow all round through a star-shaped configuration of transverse part 51 contacting the stud 50. Other configurations are also

possible, for instance a configuration in which the stud 12 is positioned more near the perimeter of the mount and offers a passage only on one side for allowing fluid to flow through.

[0031] As will be further elucidated with reference to Figure 13 - Figure 15, the closure cap 43 is axially movably provided over the stud 50. In Fig. 2, the closure cap is shown in a closing position. In this position, the closure cap 43 closes the fluid container 39 and the fluid cannot flow out of it because the closure cap 43 fittingly closes around the stud 50. This position is the position of rest; i.e. only by providing an overpressure in the container 39, for instance by squeezing it, the closure cap can be moved out of this position.

[0032] Figure 13 shows how the closure cap 43 is brought into the outflow position. In this case, in the bottle, a relatively large overpressure is provided by squeezing it tightly for a moment. As a result, the closure cap 43 undergoes a deformation and moves from the closing position shown in Figure 12 to the outflow position shown in Figure 13. The closure cap 43 has now moved in an axial direction along the stud 50 and thereby moves away from the stud 50. As a result, a space 52 is created around the stud so that fluid can flow out of the fluid container 39. The closure cap 43 is designed so that it undergoes a relatively sudden deformation by squeezing of the fluid container 39, and moves to the second outflow position shown. Once in this position, the closure cap 43 can be kept in the outflow position under the influence of a relatively low second overpressure. It is therefore not necessary for a consumer to keep squeezing the container tightly.

[0033] Figure 14 and Figure 15 further show the return movement of the closure cap, when, after squeezing the fluid out of the container, the pressure is reduced, so that the closure cap jumps back to the position of rest shown in Figure 12 where the closure cap 43 is in the closing position. Before it is in this position, however, an amount of air can flow through the outflow opening 44 into the bottle as shown according to arrows P. In the preferred embodiment, as shown in Figure 15, a return valve 48 has been provided in the mount piece, so that air can be sucked into the fluid container 39. Although other embodiments are possible, such a return valve 48 can be formed easily by a lip 46, which is part of the closure cap 43. The lip 46 is brought into a slot 47 and closes the container from the environmental air on one side 53. In the position of rest, or while applying a certain overpressure, or when the fluid presses against it, the lip is pushed against side 53, so that the lip closes the container. However, as is illustrated in Figure 15, by the presence of an underpressure in the container, the lip 46 can move to the side 54 facing away from the side 53, so that the air flows into the container via slot 47 as shown by arrow Q. Because the air can be sucked into the container 39 already at a relatively small underpressure, the container can be manufactured from a less rigid material, which reduces production costs.

Figure 16 and Figure 17, finally, show a modification of the concept shown in Figure 15 in which the stud 50 also can move flexibly because it is mounted on a flexible transverse part 55. The flexible transverse part 55 can comprise a slightly curved, for instance star-shaped suspension, so that the rigid middle stud 50 can carry out a slight axial movement under the influence of, for instance, a sudden acceleration, for instance by a shock caused by the bottle falling on the ground or by the bottle suddenly being squeezed. This embodiment initially prevents the outflow opening 44 from being opened because, in that case, the stud moves along with the closure cap 43 so that the outflow opening 44 remains closed. Only after the stud moves back, or if the closure cap moves further in axial direction than the stud 50 can move, a outflow opening 44 is formed.

Figure 16 and Figure 17 show the stud having a conical shape. The outflow opening of the closure cap can comprise a upstanding rim 56 which, in a closing position, fittingly closes over a length around the stud. On the stud, further, a concentric thickening (not shown) can be provided for obtaining a line closure.

[0034] Figure 18 shows a further perspective view of a cross section of the closure cap 43. The closure cap 43 comprises a snap zone 57 in order to undergo a relatively sudden deformation and to move to a outflow position under the influence of a relatively high first overpressure, and to be maintained in the outflow position under the influence of a relatively low second underpressure. The snap zone 57 is shown in the Figure as an annular middle part which comprises a curve in which, during the application of an overpressure in the container, a pressure build-up may be created. Although the Figure shows a substantially uniform annular snap zone 57, other geometries like star-shaped zones or the like may achieve a similar effect. Analysis shows that *inter alia* the curve, the thickness and the geometry of the snap zone 57 influence the snap effect in connection with the invention, so that the skilled person, in practice, *inter alia* by means of finite element analysis, is capable of adjusting the perimeters mentioned in order to control an optimal snap behavior of the closure cap 43. As can be seen from the Figure, the snap zone 57 is further provided with a relatively smaller thickness than the part 58 which is located closer to the perimeter of the closure cap 43. As a result, the pressure forces can be concentrated in the snap zone, what results in a controllable and reproducible snap effect.

Figure 19a and Figure 19b, finally, show a further preferred embodiment of the closure cap 43. The upstanding rim is shortened here. Through this shortening the fluid jet is better cut off during the closing movement so that dripping or the occurrence of fluid strings is prevented. The upstanding rim 56, in the position of rest, is substantially contiguous to the wall of the stud (not shown). The shortened part 59 comprises a top surface 60 oriented substantially transverse to the upstanding wall. Between the top surface 60 and the upstanding rim 56, a sharp

transition 61 is present.

[0035] In the Figure, the closure cap 43 is illustrated in the position of rest 62 (closing position) wherein the closure cap comprises a concave conic form. In the same Figure, the outflow position 63 is illustrated. In this position a snap 64 has occurred, so that the closure cap can be kept in stable condition, by maintaining a relatively light overpressure in the container. Figure 19b shows the force-distance diagram obtained by finite element analysis in the configuration shown in Figure 19a. Here, at the position of line A-A, a thickness variation was applied. Generally, it follows from Figure 19b that a movement initially requires relatively much force (shown by the letter F), until a snap point is passed, where after the force applied relatively sudden becomes much less. By varying the thickness, the required maximum force can be adjusted, wherein the upper line 65 shows a force-distance curve with a relatively large thickness of the closure cap, and the lower line 66 shows the force-distance curve with a relatively less large thickness of the closure cap at the location of the line A-A. In similar manner, a force-distance diagram can be influenced by applying a weakening 67 which can be arranged at a certain position along the line R in the snap zone. Varying of the thickness of the closure cap 43 at the location of perimeter parts B and C also appears to influence the snap behavior.

[0036] Although the invention has been disclosed with reference to the embodiments shown in the pictures, these may comprise modifications without diverting from the spirit and scope of the invention. It is possible that the mount piece 41 and the closure cap 43 are formed from one material through molding. Also it is possible that a plurality of studs are applied. These modifications are deemed to be within the scope of the invention as is claimed by the annexed claims.

[0037] Further considerations regarding (parts of) the invention are the following: A "frog leg" effect is known in the art per se and generates a rather abrupt deformation by using specific materials and forms, while the closure cap can assume two relatively stable, mutually different forms. This behavior can be compared to snap in straight, cylindrically thin-walled objects which are pressure-loaded and suddenly collapse when the collapsing load is exceeded without preceding visible deformation. In the closing condition, the closure cap is pressed against the stud under a slight prestress. The advantage of such a closure is that a relatively large force is needed for opening the container, so that a slight increase in pressure does not directly result in a leakage of the container. However, if the bottle is opened, by using this design technique, a lower force, which is more comfortable for the user, can be applied to keep the opening opened and to more easily dose the fluid. Further, such a snap effect offers the advantage that the closure device snaps to, as it were, and is thus closed relatively quickly, so that bothersome dripping or string formation occurs hardly, if at all, because the fluid jet is cut off, as it were.

[0038] It is noted that the closure cap in patent publi-

cation EP700353 has no snap zone because this closure cap does not move between an unsnapped and a snapped condition but has a number of permanent folds.

[0039] In a preferred embodiment, the snap zone comprises an annular middle part, which comprises a curve in which, during the provision of overpressure in the container, a pressure build-up may be created. The snap zone may comprise a weakening. Such a weakening offers the opportunity to achieve a more reliable and reproducible snap, which always occurs under roughly the same conditions at virtually always the same location.

[0040] Analysis shows that a concentration of pressure forces occurs therein, so that the closure cap can spontaneously deform due to increasing pressure, virtually without a gradual change preceding this. Preferably, the snap zone has a smaller thickness than a part of the closure cap located closer to the perimeter. The closure cap preferably has an inward conical form in the closing position and an outward conical shape in the outflow position. By such an inward conical shape, upon axial movement, the closure cap will be slightly compressed, so that the pressure build-up can be increased.

[0041] This makes it possible that the closure device comprises a return valve so that air can be sucked into the fluid container to compensate for the fluid flown out. In the conventional closures, it was usually necessary to use relatively rigid container walls to promote this return flow. By use of the return valve as mentioned above, the container can have a thinner and therefore less expensive design because the return flow is more easily effected, without there being a risk of leaking. In this context, the return valve serves as a so-called "double ventilation", with air flowing in via the outflow opening, when the overpressure in the bottle falls out because the user stops squeezing it. Because of the semi-stable opening position of the closure cap, the air can initially flow back via the outflow opening, so that the fluid jet is interrupted. The ventilation is then taken over by opening the return valve, so that the pressure is normalized. This allows the air to flow into the container and the fluid jet is interrupted in an abrupt movement, without bothersome dripping or the formation of fluid strings occurring. The return valve may be designed with a slot provided in a mount piece which connects to the perimeter of the closure cap, which slot can be closed by a strip connected to the flexible closure cap.

[0042] In a further embodiment, the stud comprises means for carrying out a slight axial movement. Such means may comprise a flexible transverse part on which the stud is provided. Such a stud with a flexible design may function as a return valve in that, when the air flows back and due to underpressure in the container, the stud carries out a slight inward movement. Further, such a flexible stud can prevent that, with too large pressure increases or accelerations, the closing device could be opened undesirably so that fluid could flow away in too large a dose. By using the flexible suspension, in such a case, the stud initially moves along with the closure cap

and a delay or slowing down of such phenomena is effected, so that the closure device has a slight lagging effect on the forces applied on it. This promotes the ease of use and prevents the container from being emptied undesirably.

[0043] For improvement of the closure and dosing possibilities, the stud may have a conical design. Here, the outflow opening of the closure cap may comprise an upstanding rim which, in closing position, fittingly closes over a length around the stud. Preferably, the upstanding rim is shortened in order to cut the fluid jet during the closing movement and thus create a clean closure without dripping or drawing fluid strings.

[0044] Although the invention has been described with reference to the preferred embodiments shown in the drawing, it may contain modifications without departing from the spirit and scope of the invention. For instance, it is possible for mount piece 3 and closure cap 5 to be formed from one material by injection molding. Further, it is also possible that multiple studs are used. Such modifications are considered to be within the scope of the invention as defined in the following claims.

Claims

1. A closure device (1) for closing a fluid container (3), comprising :
 - a mount piece (2) for fixing the device (1) to said fluid container (3);
 - a closure cap (4) fixed to said mount piece (2) along a perimeter of said cap (4), the closure cap (4) provided with an outflow opening (5);
 - a stud (6) coupled to said mount piece (2), corresponding with said outflow opening (5) of said closure cap (4) for closing said outflow opening (5) in a closing position,
 - said closure cap (4) being movable, under the influence of overpressure in the fluid container, in axial direction of the stud (6) between said closing position and an outflow position freeing the outflow opening (5) with respect to the stud (6), **characterized in that**
 - said mount piece (2) comprises an enclosure (7) arranged around said closure cap (4) and housing a valve member (11) that is seated against a wall of said enclosure (7) to form a valve arrangement for return air flow (12) into the container (3), said enclosure (7) comprising a micro perforation (13) permitting airflow into said container and shielding said valve member (11) from said fluid in said container (3).
2. A closure device (1) according to claim 1, wherein said cap (4) is clamped on an inner wall of said enclosure (7) and said valve member (11) is monolithically formed concentric with said cap (4).

3. A closure device (1) according to claim 1 or 2, wherein said valve member (11) is decoupled from said movable portion of said cap (4) by a weakening.
4. A closure device (1) according to claim any of the preceding claims, wherein said valve member (11) is conically extending outward to be seated against an outer cylindrical wall of said enclosure (7).
5. A closure device (1) according to any of the preceding claims, wherein said enclosure (7) is U shaped in cross sectional view.
6. A closure device (1) according to claims 1-3, wherein said enclosure (7) extending below said cap (4) and said valve member (11) is extending curvedly inward to be seated against a seat provided below said cap (4) by said enclosure (7).
7. A closure device (1) according to any of the preceding claims, wherein said closure device (1) is shaped to form a stand for said fluid container, and wherein said enclosure is vented via an air feed that is distanced from a base plane of said stand.
8. A closure device (1) according to any of the preceding claims, wherein said movable portion comprises a snap zone (57) to undergo a relatively sudden deformation and move to the outflow position under the influence of a first overpressure and to be maintained in the outflow position under the influence of a second overpressure smaller than said first overpressure.
9. A closure device (1) according to claim 8, **characterized in that** the snap zone (57) comprises an annular middle part comprising a curve in which, during the provision of overpressure in the container, a pressure build-up can occur.
10. A closure device (1) according to claim 8 or 9, **characterized in that** the snap zone (57) comprises a weakening (67).
11. A closure device (1) according to claim 8-10, **characterized in that** the snap zone (57) has a smaller thickness than a part of the closure cap (4) located closer to the perimeter of said cap (4).
12. A closure device (1) according to at least one of the preceding claims, **characterized in that** the closure cap (4) has an inward conical shape in the closing position and that the closure cap has an outward conical shape in the outflow position.
13. A closure device (1) according to at least one of the preceding claims, **characterized in that**, on the stud (17), a concentric thickening has been provided for obtaining a line closure.
14. A closure device (1) according to at least one of the preceding claims, **characterized in that** the closure cap (4) is an injection-molding product of a thermoplastic elastomer.
15. A closure device (1) according to at least one of the preceding claims, **characterized in that** the container (3) is manufactured from a relatively thin flexible material.
16. A closure device (1) according to at least one of the preceding claims, **characterized in that** the stud (6) comprises a flexibly coupling to said mount piece (2) for providing a slight axial movement.
17. A closure device (29) according to claim 16, wherein said flexible coupling comprises a plurality of radial leaf spring members (30) coupling said stud (6) to said mount piece (2).
18. A closure device (29) according to claim 17, wherein said leaf spring members (30) are bent in shape and flexible.
19. A closure device (29) according to claim 17, wherein said leaf spring members (30) comprise rigid parts (31) connected via fold hinges (32).
20. A closure device (29) according to claim 19, wherein at least one of said spring members (30) comprises a stop element (33) for abutting against an inner wall (8) of said mount (2) thus limiting an axial movement of the stud (6).
21. A closure device (1) according to claim 16, wherein said stud (6) comprises a plurality of radially extending rigid members (27) abutting an inner wall (8) of said mount piece (2) thereby defining axial movement of the stud (6) in said mount piece (2), said inner wall (8) of said mount piece (2) comprising stop members (28) for enclosing said rigid members (27) in limited axial movement, and said rigid members (27) flexibly coupled to said mount piece (2) by tangential leaf spring members (26).
22. A closure device (1) according to claim 21, wherein said tangential leaf spring members (26), in a production configuration, are oriented in a conical form in axial direction along the stud (6), and wherein the leaf spring members (26), in working configuration, via axial movement of the stud (6), are brought in an inverse conical form, thereby rotating said rigid members (27) and said stop members (28) relative to each other to enclose said rigid members (27) by said stop members (28).

Patentansprüche

1. Verschlussvorrichtung (1) zum Verschließen eines Flüssigkeitsbehälters (3) mit:

- einem Anbringteil (2) zum Befestigen der Vorrichtung (1) an dem Flüssigkeitsbehälter (3);
 - einer Verschlusskappe (4), die entlang dem Umfang der Kappe (4) an dem Anbringteil (2) befestigt ist, wobei die Verschlusskappe (4) eine Ausfließöffnung (5) aufweist;
 - einem Stutzen (6), der mit dem Anbringteil (2) gekoppelt ist und zum Verschließen der Ausfließöffnung (5) in einer Schließposition der Ausfließöffnung (5) der Verschlusskappe (4) entspricht;
 - wobei die Verschlusskappe (4) unter Einfluss eines Überdrucks in dem Flüssigkeitsbehälter in axialer Richtung des Stutzens (6) zwischen der Schließposition und einer Ausfließposition, in der die Ausfließöffnung (5) relativ zu dem Stutzen (6) offen ist, bewegbar ist,

dadurch gekennzeichnet, dass

- das Anbringteil (2) eine Einfassung (7) aufweist, die um die Verschlusskappe (4) herum angeordnet ist und ein Ventilelement (11) enthält, das an einer Wand der Einfassung (7) anliegt, um eine Ventileinrichtung zum Rückführen eines Luftstroms (12) in den Behälter (3) zu bilden, wobei die Einfassung (7) eine Mikroperforation (13) aufweist, die einen Luftstrom in den Behälter ermöglicht und das Ventilelement (11) gegen die Flüssigkeit in dem Behälter (3) abschirmt.

2. Verschlussvorrichtung (1) nach Anspruch 1, bei der die Kappe (4) an einer Innenwand der Einfassung (7) festgeklemt ist und das Ventilelement (11) konzentrisch mit der Kappe (4) monolithisch ausgebildet ist.
3. Verschlussvorrichtung (1) nach Anspruch 1 oder 2, bei der das Ventilelement (11) durch eine Verschwächung von dem bewegbaren Teil der Kappe (4) getrennt ist.
4. Verschlussvorrichtung (1) nach einem der vorhergehenden Ansprüche, bei der das Ventilelement (11) konisch nach außen verläuft, um an einer zylindrischen Außenwand der Einfassung (7) anzuliegen.
5. Verschlussvorrichtung (1) nach einem der vorhergehenden Ansprüche, bei der die Einfassung (7) einen U-förmigen Querschnitt aufweist.
6. Verschlussvorrichtung (1) nach Anspruch 1-3, bei

der die Einfassung (7) unterhalb der Kappe (4) verläuft und das Ventilelement (11) gekrümmt nach innen verläuft, um an einem unterhalb der Kappe (4) in der Einfassung (7) ausgebildeten Sitz anzuliegen.

7. Verschlussvorrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Verschlussvorrichtung (1) derart ausgebildet ist, dass sie einen Fuß für den Flüssigkeitsbehälter bildet, und bei der die Einfassung über eine von einer Grundebene des Fußes beabstandete Luftzuführung belüftet wird.
8. Verschlussvorrichtung (1) nach einem der vorhergehenden Ansprüche, bei der der bewegbare Teil einen Schnappbereich (57) aufweist, der eine relativ plötzliche Verformung erfährt und sich unter Einfluss eines ersten Überdrucks in die Ausfließposition bewegt und unter Einfluss eines zweiten Überdrucks, der kleiner ist als der erste Überdruck, in der Ausfließposition gehalten wird.
9. Verschlussvorrichtung (1) nach Anspruch 8, **dadurch gekennzeichnet, dass** der Schnappbereich (57) einen ringförmigen Mittelteil mit einer Krümmung aufweist, in dem beim Erzeugen eines Überdrucks in dem Behälter ein Druckaufbau erfolgen kann.
10. Verschlussvorrichtung (1) nach Anspruch 8 oder 9, **dadurch gekennzeichnet, dass** der Schnappbereich (57) eine Verschwächung (67) aufweist.
11. Verschlussvorrichtung (1) nach Anspruch 8-10, **dadurch gekennzeichnet, dass** der Schnappbereich (57) eine kleinere Dicke aufweist als ein Teil der Verschlusskappe (4), der sich näher am Umfang der Kappe (4) befindet.
12. Verschlussvorrichtung (1) nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verschlusskappe (4) in der Schließposition eine nach innen konisch verlaufende Form aufweist und dass die Verschlusskappe in der Ausfließposition eine nach außen konisch verlaufende Form aufweist.
13. Verschlussvorrichtung (1) nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** an dem Stutzen (17) eine konzentrische Verdickung zum Erhalten eines Leitungsverchlusses vorgesehen ist.
14. Verschlussvorrichtung (1) nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verschlusskappe (4) ein Spritzgussprodukt aus einem thermoplastischen Elastomer ist.

15. Verschlussvorrichtung (1) nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Behälter (3) aus einem relativ dünnen flexiblen Material gefertigt ist. 5
16. Verschlussvorrichtung (1) nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Stutzen (6) zum Bewirken einer leichten axialen Bewegung eine flexible Kupplung zu dem Anbringteil (2) aufweist. 10
17. Verschlussvorrichtung (29) nach Anspruch 16, bei der die flexible Kupplung mehrere radiale Blattfederelemente (30) zum Koppeln des Stutzens (6) mit dem Anbringteil (2) aufweist. 15
18. Verschlussvorrichtung (29) nach Anspruch 17, bei der die Blattfederelemente (30) eine gebogene Form aufweisen und flexibel sind. 20
19. Verschlussvorrichtung (29) nach Anspruch 17, bei der die Blattfederelemente (30) über Klappscharniere (32) miteinander verbundene starre Teile (31) aufweisen. 25
20. Verschlussvorrichtung (29) nach Anspruch 19, bei der mindestens eines der Federelemente (30) ein Anschlagelement (33) zum Anliegen an einer Innenwand (8) des Anbringteils (2) aufweist, wodurch eine axiale Bewegung des Stutzens (6) begrenzt wird. 30
21. Verschlussvorrichtung (1) nach Anspruch 16, bei der der Stutzen (6) mehrere radial verlaufende starre Elemente (27) aufweist, die an einer Innenwand (8) des Anbringteils (2) anliegen und **dadurch** eine axiale Bewegung des Stutzens (6) in dem Anbringteil (2) definieren, wobei die Innenwand (8) des Anbringteils (2) Anschlagelemente (28) zum Einfassen der starren Elemente (27) bei einer begrenzten axialen Bewegung aufweist und die starren Elemente (27) über tangential Blattfederelemente (26) flexibel mit dem Anbringteil (2) gekoppelt sind. 35 40
22. Verschlussvorrichtung (1) nach Anspruch 21, bei der die tangentialen Blattfederelemente (26) in einer Produktionskonfiguration in axialer Richtung entlang dem Stutzen (6) in einer konischen Form ausgerichtet sind, und bei der die Blattfederelemente (26) in einer Arbeitskonfiguration über eine axiale Bewegung des Stutzens (6) in eine umgekehrte konische Form gebracht werden, wodurch die starren Elemente (27) und die Anschlagelemente (28) relativ zueinander gedreht werden, damit die starren Elemente (27) von den Anschlagelementen (28) einge- 45 fasst sind. 50 55

Revendications

- Dispositif de fermeture (1) pour fermer un récipient de fluide (3) comprenant :
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- une pièce de montage (2) pour fixer le dispositif (1) audit récipient de fluide (3) ;
- un bouchon de fermeture (4) fixé à ladite pièce de montage (2) le long d'un périmètre dudit bouchon (4), le bouchon de fermeture (4) étant muni d'une ouverture de déversement (5) ;
- un goujon (6) couplé à ladite pièce de montage (2) correspondant à ladite ouverture de déversement (5) dudit bouchon de fermeture (4) pour fermer ladite ouverture de déversement (5) dans une position de fermeture,
- ledit bouchon de fermeture (4) étant mobile, sous l'influence d'une surpression dans le récipient de fluide, dans la direction axiale du goujon (6) entre ladite position de fermeture et une position de déversement libérant l'ouverture de déversement (5) par rapport au goujon (6), **caractérisé en ce que**
- ladite pièce de montage (2) comprend une enceinte (7) disposée autour dudit bouchon de fermeture (4) et logeant un élément de vanne (11) qui est placé contre une paroi de ladite enceinte (7) pour former un agencement de vanne pour renvoyer un flux d'air (12) dans le récipient (3), ladite enceinte (7) comprenant une micro perforation (13) admettant le flux d'air dans ledit récipient et protégeant ledit élément de vanne (11) dudit fluide dans ledit récipient (3).
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- Dispositif de fermeture (1) selon la revendication 1, dans lequel ledit bouchon (4) est attaché sur une paroi interne de ladite enceinte (7) et ledit élément de vanne (11) est formé monolithiquement de manière concentrique avec ledit bouchon (4). 35
- Dispositif de fermeture (1) selon la revendication 1 ou 2, dans lequel ledit élément de vanne (11) est découplé de ladite partie mobile dudit bouchon (4) par un affaiblissement. 40
- Dispositif de fermeture (1) selon l'une quelconque des revendications précédentes, dans lequel ledit élément de vanne (11) s'étend de manière conique vers l'extérieur pour être placé contre une paroi cylindrique externe de ladite enceinte (7). 50
- Dispositif de fermeture (1) selon l'une quelconque des revendications précédentes, dans lequel ladite enceinte (7) est en forme de U en vue en coupe transversale. 55
- Dispositif de fermeture (1) selon les revendications 1 à 3, dans lequel ladite enceinte (7) s'étend en des-

- sous dudit bouchon (4) et ledit élément de vanne (11) s'étend de manière courbée vers l'intérieur pour être placé contre une embase prévue en dessous dudit bouchon (4) par ladite enceinte (7).
7. Dispositif de fermeture (1) selon l'une quelconque des revendications précédentes, dans lequel ledit dispositif de fermeture (1) est formé pour former un support pour ledit récipient de fluide, et dans lequel ladite enceinte est aérée via une admission d'air qui se trouve à distance d'un plan de base dudit support.
8. Dispositif de fermeture (1) selon l'une quelconque des revendications précédentes, dans lequel ladite partie mobile comprend une zone d'encliquetage (57) pour subir une déformation relativement soudaine et se déplacer vers la position de déversement sous l'influence d'une première surpression et pour être maintenue dans la position de déversement sous l'influence d'une seconde surpression inférieure à la première surpression.
9. Dispositif de fermeture (1) selon la revendication 8, **caractérisé en ce que** la zone d'encliquetage (57) comprend une partie médiane annulaire comprenant une courbe dans laquelle, durant la fourniture d'une surpression dans le récipient, il peut se produire une accumulation de pression.
10. Dispositif de fermeture (1) selon la revendication 8 ou 9, **caractérisé en ce que** ladite zone d'encliquetage (57) comprend un affaiblissement (67).
11. Dispositif de fermeture (1) selon les revendications 8 à 10, **caractérisé en ce que** la zone d'encliquetage (57) comporte une épaisseur inférieure à une partie du bouchon de fermeture (4) située plus près du périmètre dudit bouchon (4).
12. Dispositif de fermeture (1) selon au moins l'une des revendications précédentes, **caractérisé en ce que** le bouchon de fermeture (4) comporte une forme conique vers l'intérieur dans la position de fermeture et **en ce que** le bouchon de fermeture comporte une forme conique vers l'extérieur dans la position de déversement.
13. Dispositif de fermeture (1) selon au moins l'une des revendications précédentes, **caractérisé en ce que**, sur le goujon (17), un épaississement concentrique a été prévu pour obtenir une fermeture linéaire.
14. Dispositif de fermeture (1) selon au moins l'une des revendications précédentes, **caractérisé en ce que** le bouchon de fermeture (4) est un produit de moulage par injection d'un élastomère thermoplastique.
15. Dispositif de fermeture (1) selon au moins l'une des revendications précédentes, **caractérisé en ce que** le récipient (3) est fabriqué à partir d'un matériau flexible relativement mince.
16. Dispositif de fermeture (1) selon au moins l'une des revendications précédentes, **caractérisé en ce que** le goujon (6) comprend un couplage flexible à ladite pièce de montage (2) pour fournir un léger mouvement axial.
17. Dispositif de fermeture (29) selon la revendication 16, dans lequel ledit couplage flexible comprend une pluralité d'éléments de ressort à lame radiaux (30) couplant ledit goujon (6) à ladite pièce de montage (2).
18. Dispositif de fermeture (29) selon la revendication 17, dans lequel lesdits éléments de ressort à lame (30) sont de forme pliée et flexibles.
19. Dispositif de fermeture (29) selon la revendication 17, dans lequel lesdits éléments de ressort à lame (30) comprennent des parties rigides (31) raccordées via des articulations pliées (32).
20. Dispositif de fermeture (29) selon la revendication 19, dans lequel au moins l'un desdits éléments de ressort (30) comprend un élément d'arrêt (33) pour faire butée contre une paroi interne (8) dudit montage (2), limitant ainsi un mouvement axial du goujon (6).
21. Dispositif de fermeture (1) selon la revendication 16, dans lequel ledit goujon (6) comprend une pluralité d'éléments rigides s'étendant de manière radiale (27) faisant butée contre une paroi interne (8) de ladite pièce de montage (2) définissant ainsi un mouvement axial du goujon (6) dans ladite pièce de montage (2), ladite paroi interne (8) de ladite pièce de montage (2) comprenant des éléments d'arrêt (28) pour enfermer lesdits éléments rigides (27) dans un mouvement axial limité, et lesdits éléments rigides (27) étant couplés de manière flexible à ladite pièce de montage (2) par des éléments de ressort à lame tangentiels (26).
22. Dispositif de fermeture (1) selon la revendication 21, dans lequel lesdits éléments de ressort à lame tangentiels (26), dans une configuration de production, sont orientés dans une forme conique dans la direction axiale le long du goujon (6), et dans lequel les éléments de ressort à lame (26), dans la configuration fonctionnelle, via le mouvement axial du goujon (6), sont amenés dans une forme conique inverse, faisant ainsi tourner lesdits éléments rigides (27) et lesdits éléments d'arrêt (28) les uns par rapport aux autres pour enfermer lesdits éléments rigides (27).

par lesdits éléments d'arrêt (28).

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Figure 1

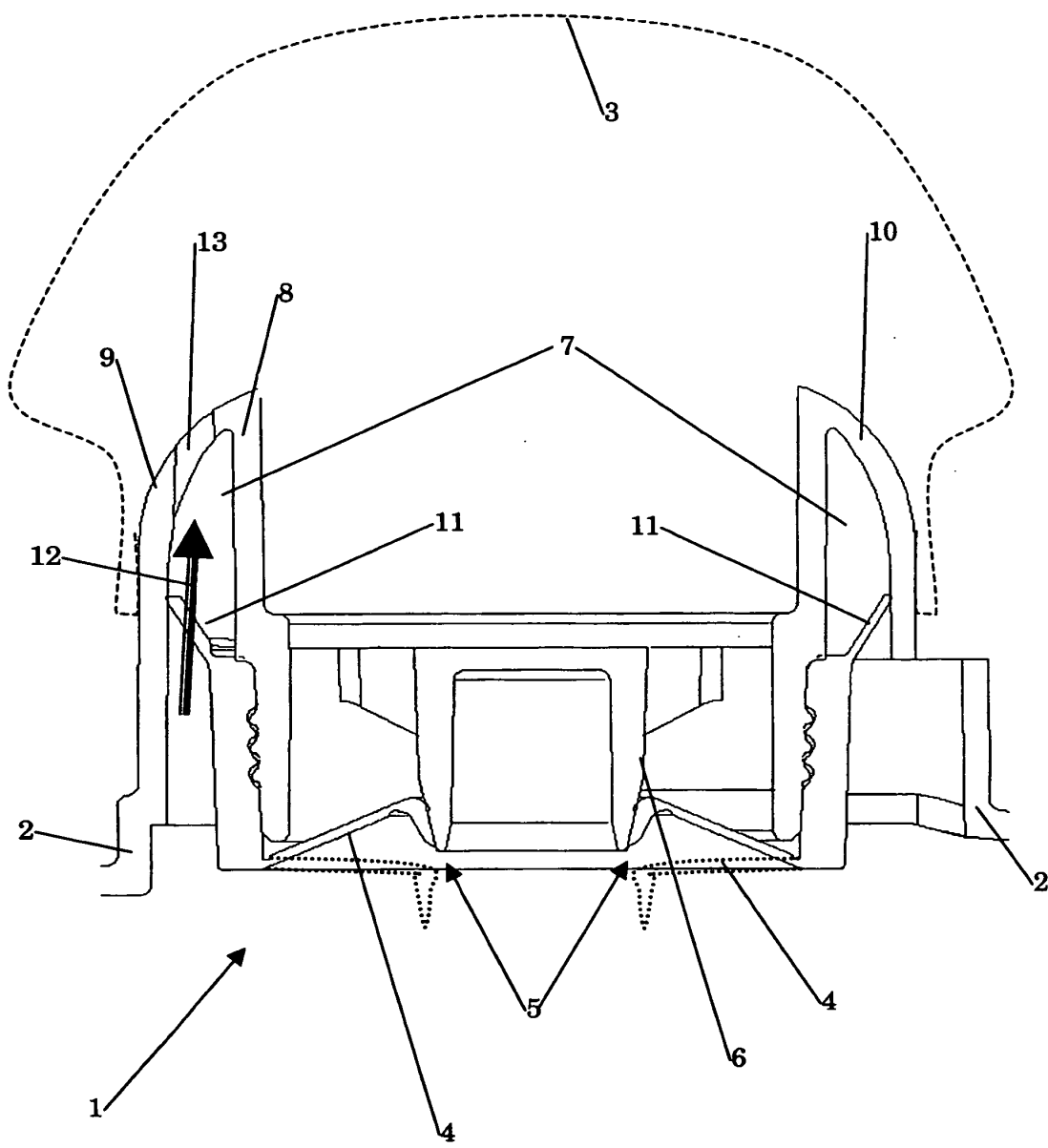


Figure 2

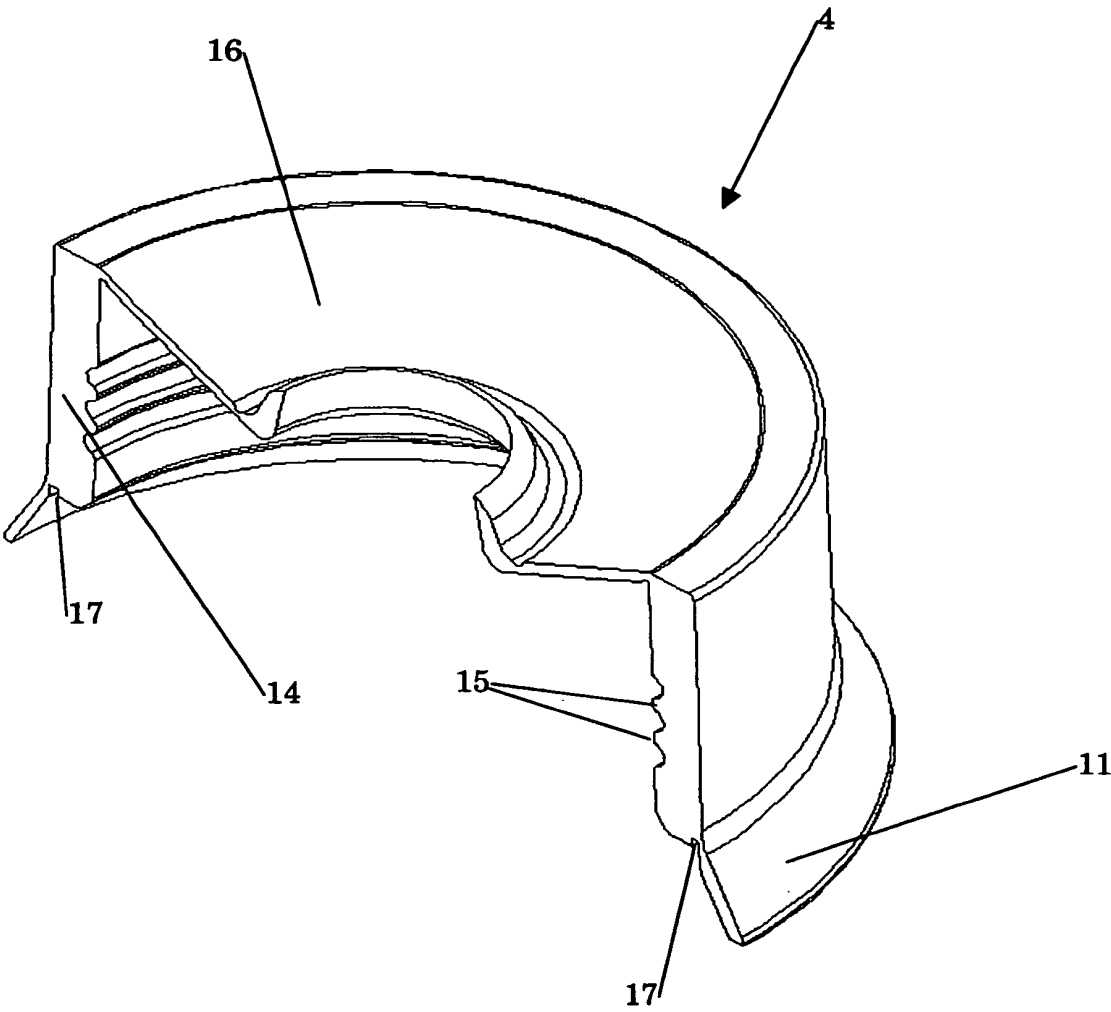


Figure 3

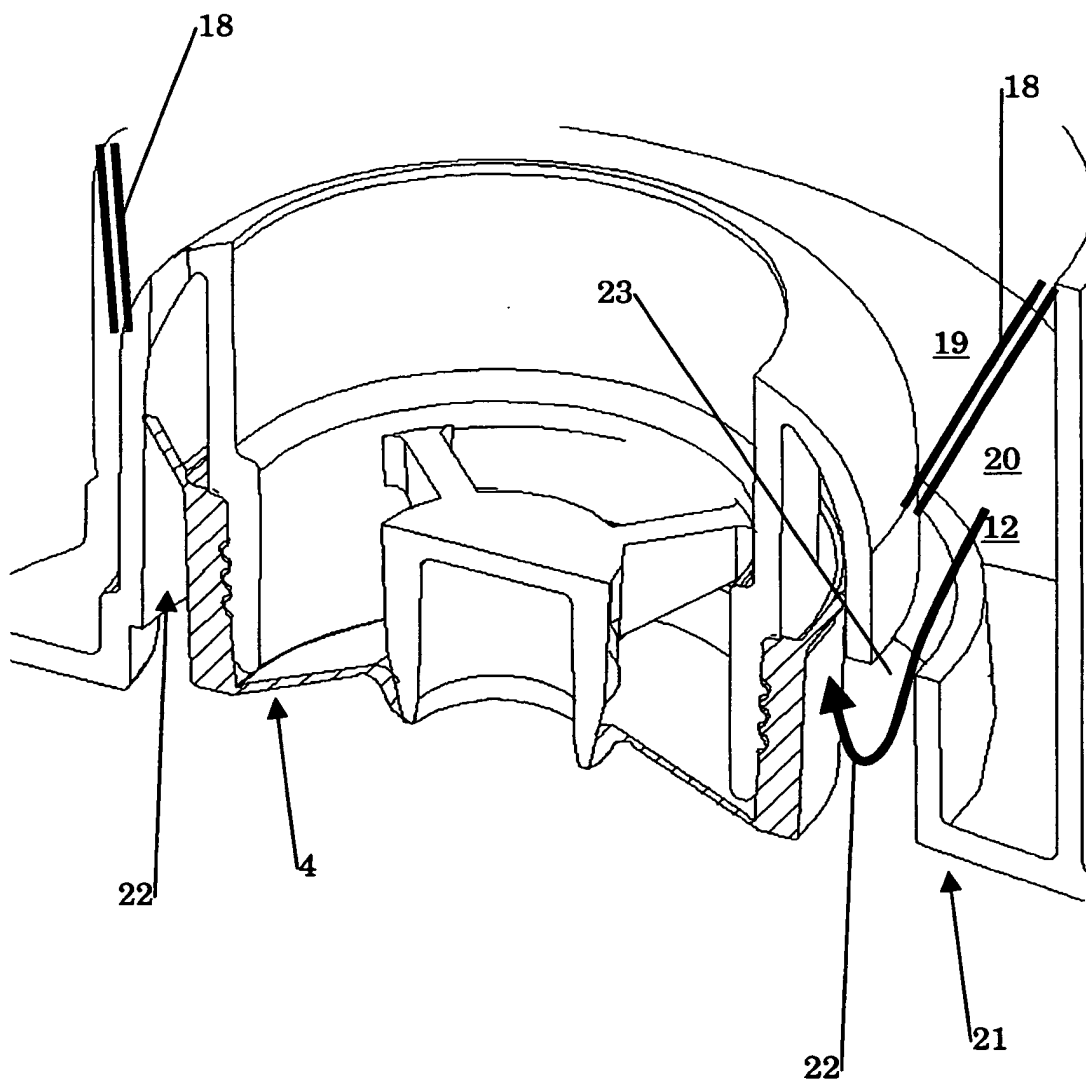


Figure 4

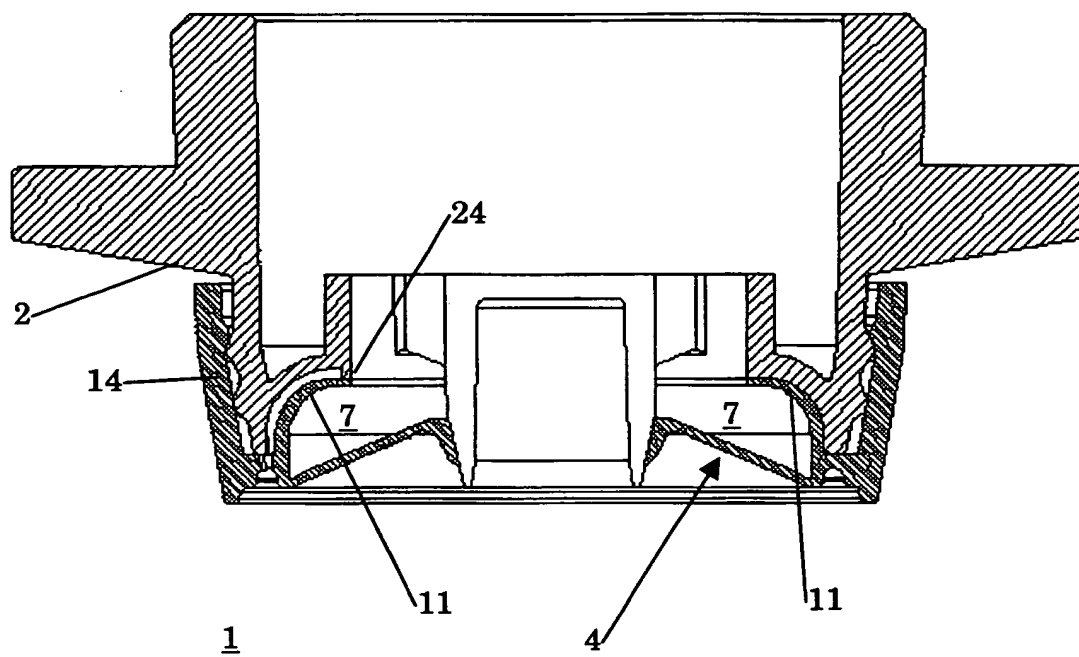


Figure 5

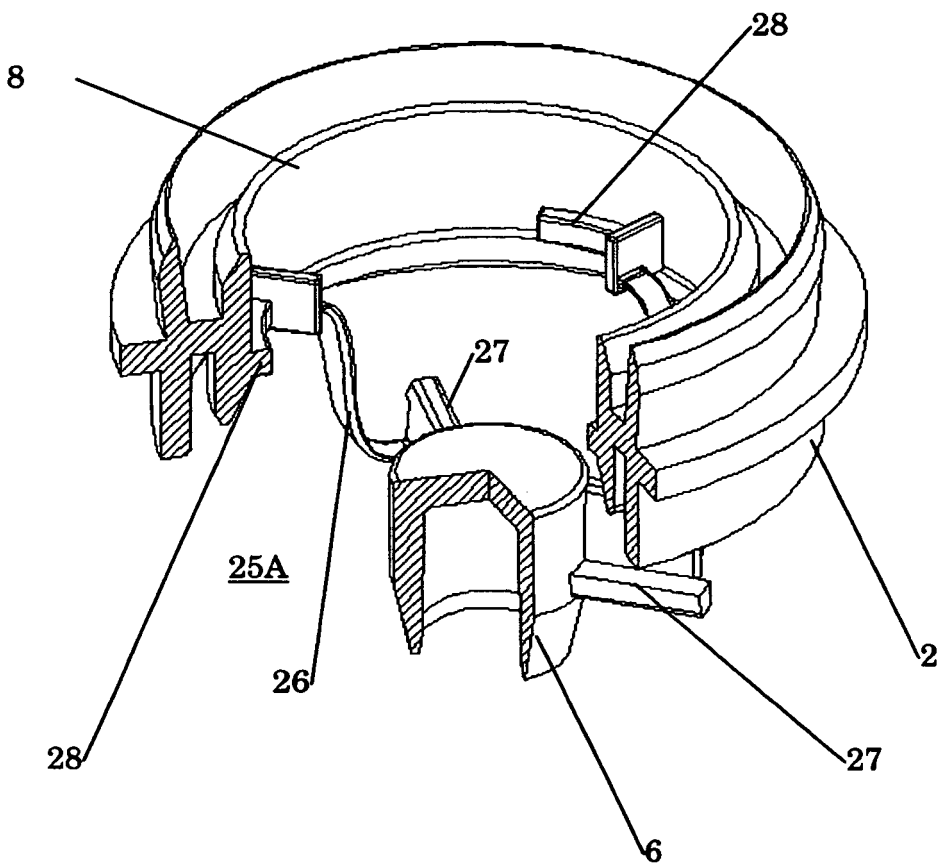


Figure 6

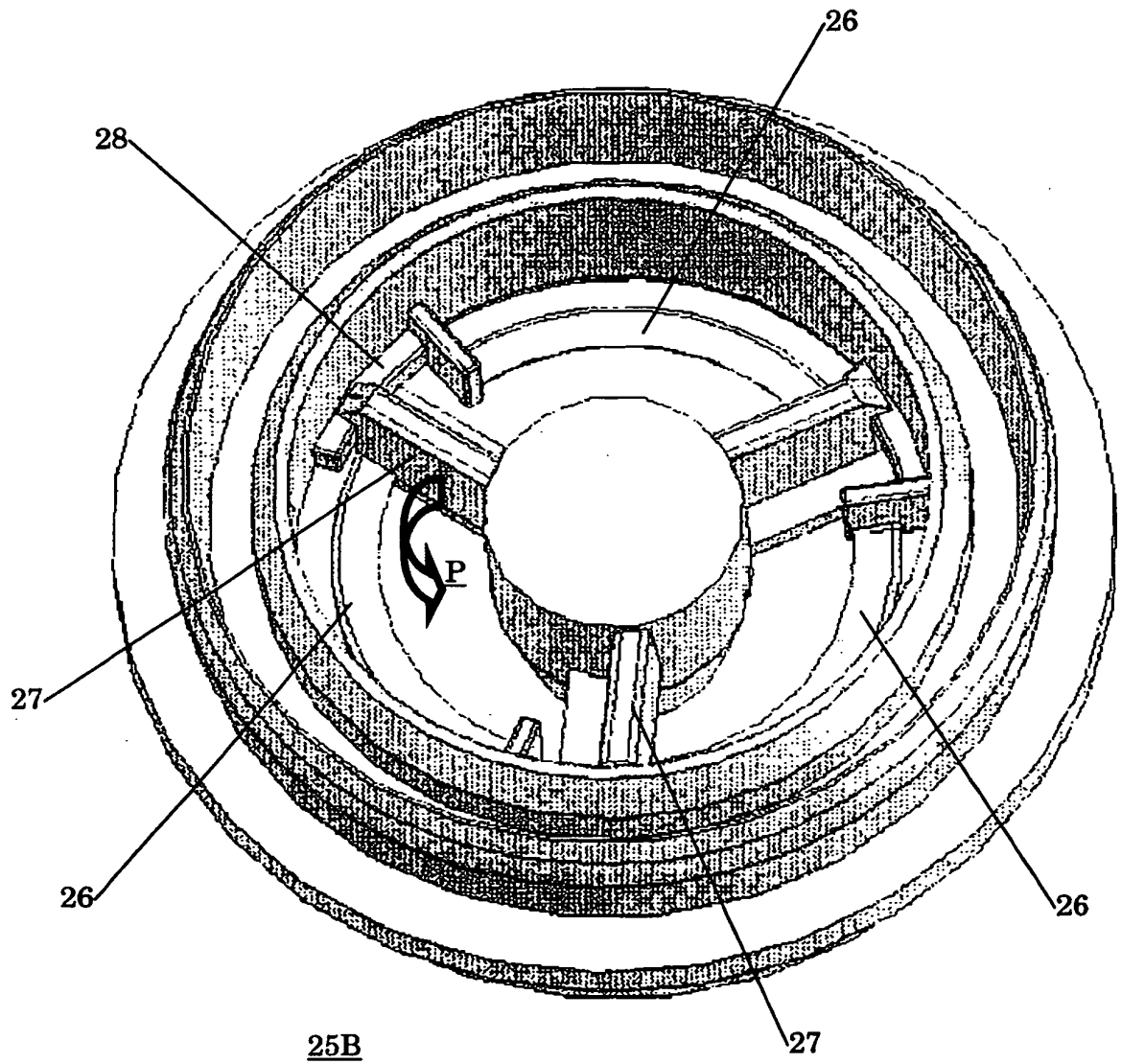


Figure 7

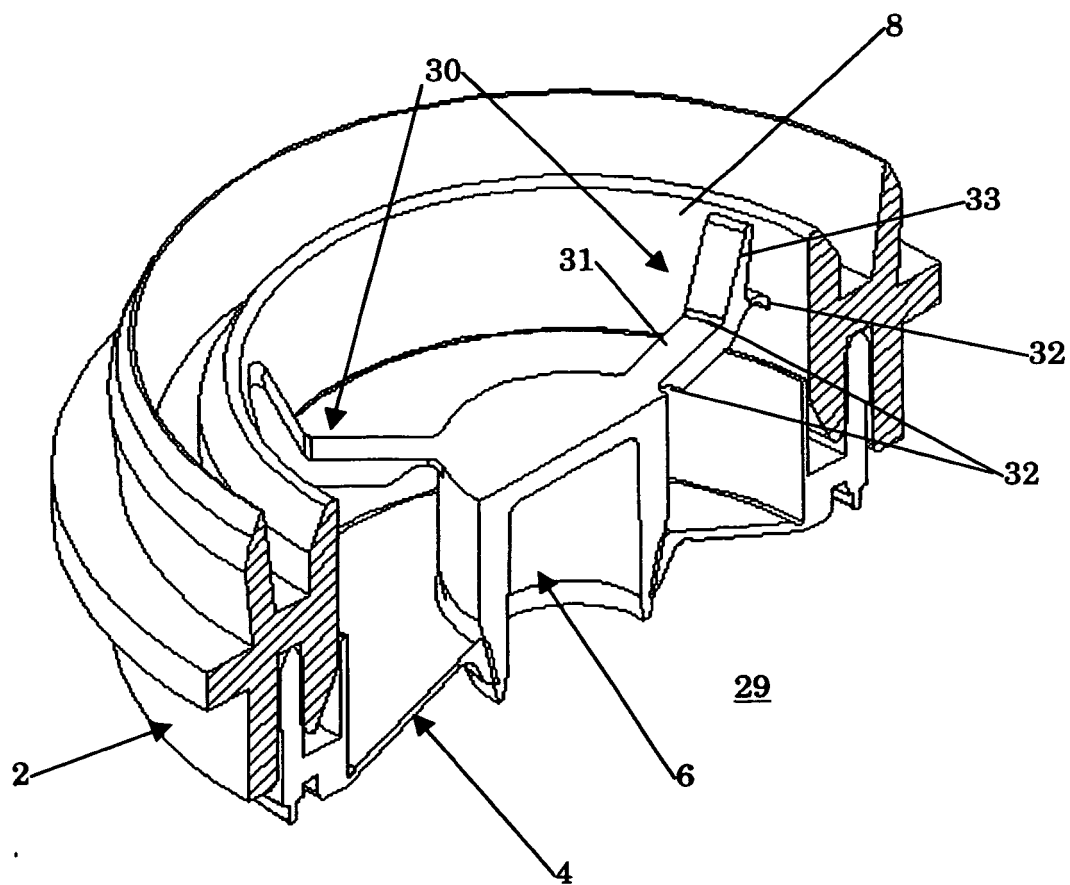


Figure 8

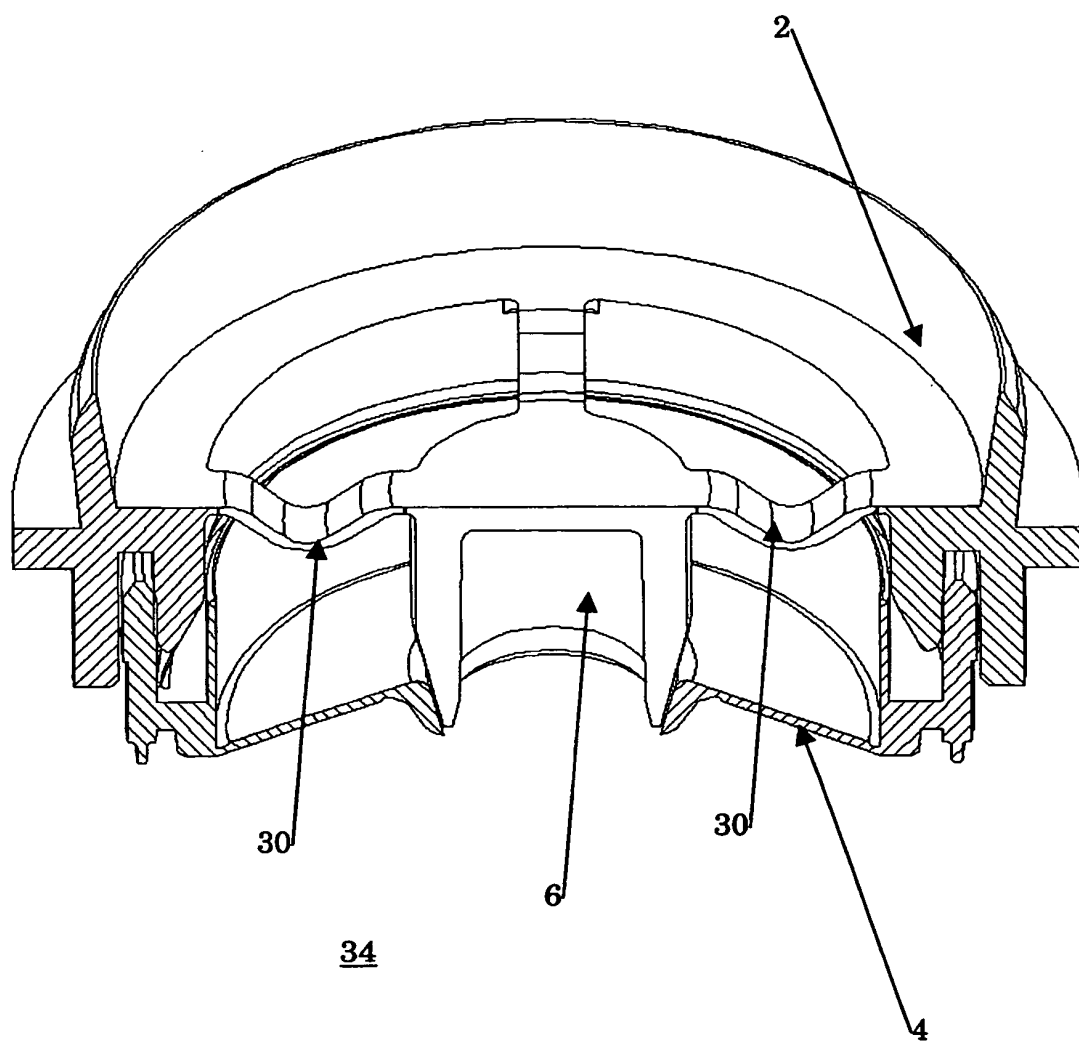


Figure 9

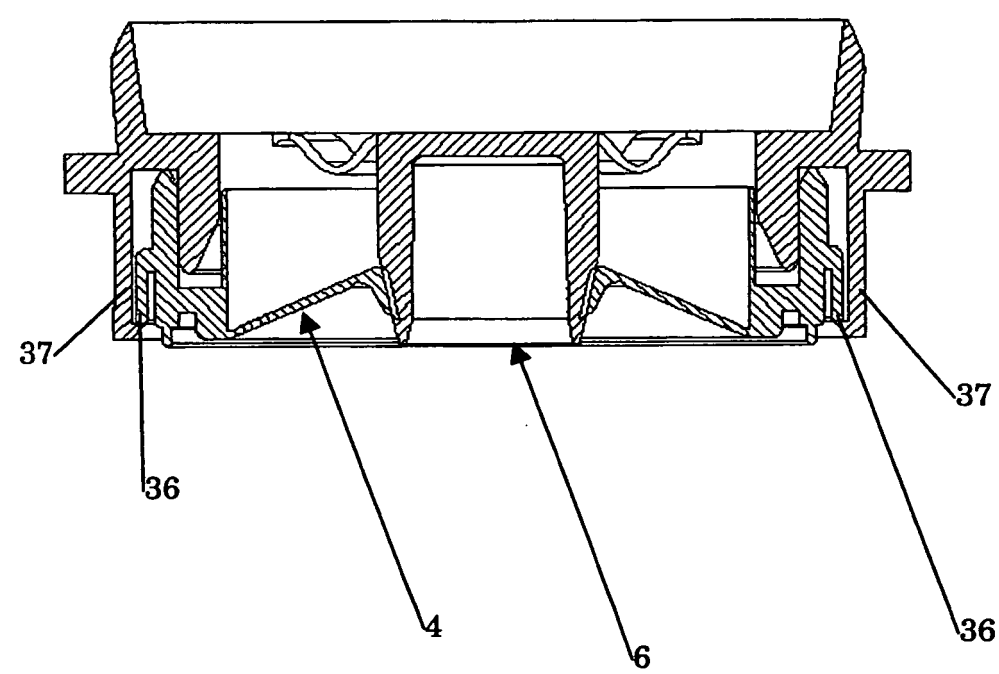


Figure 10

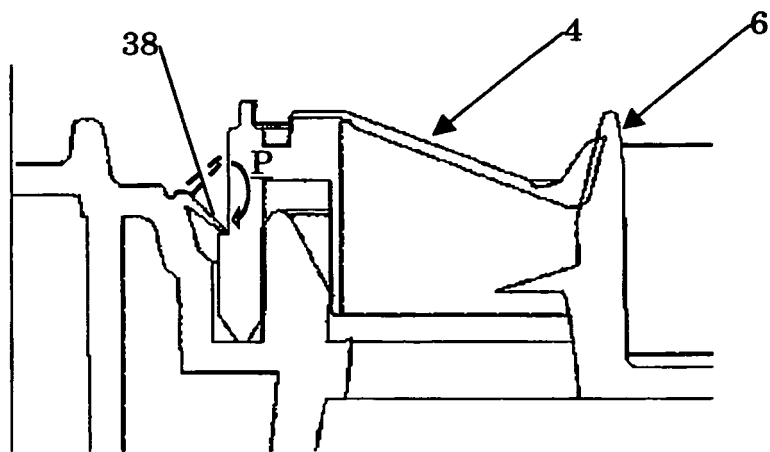


Figure 11

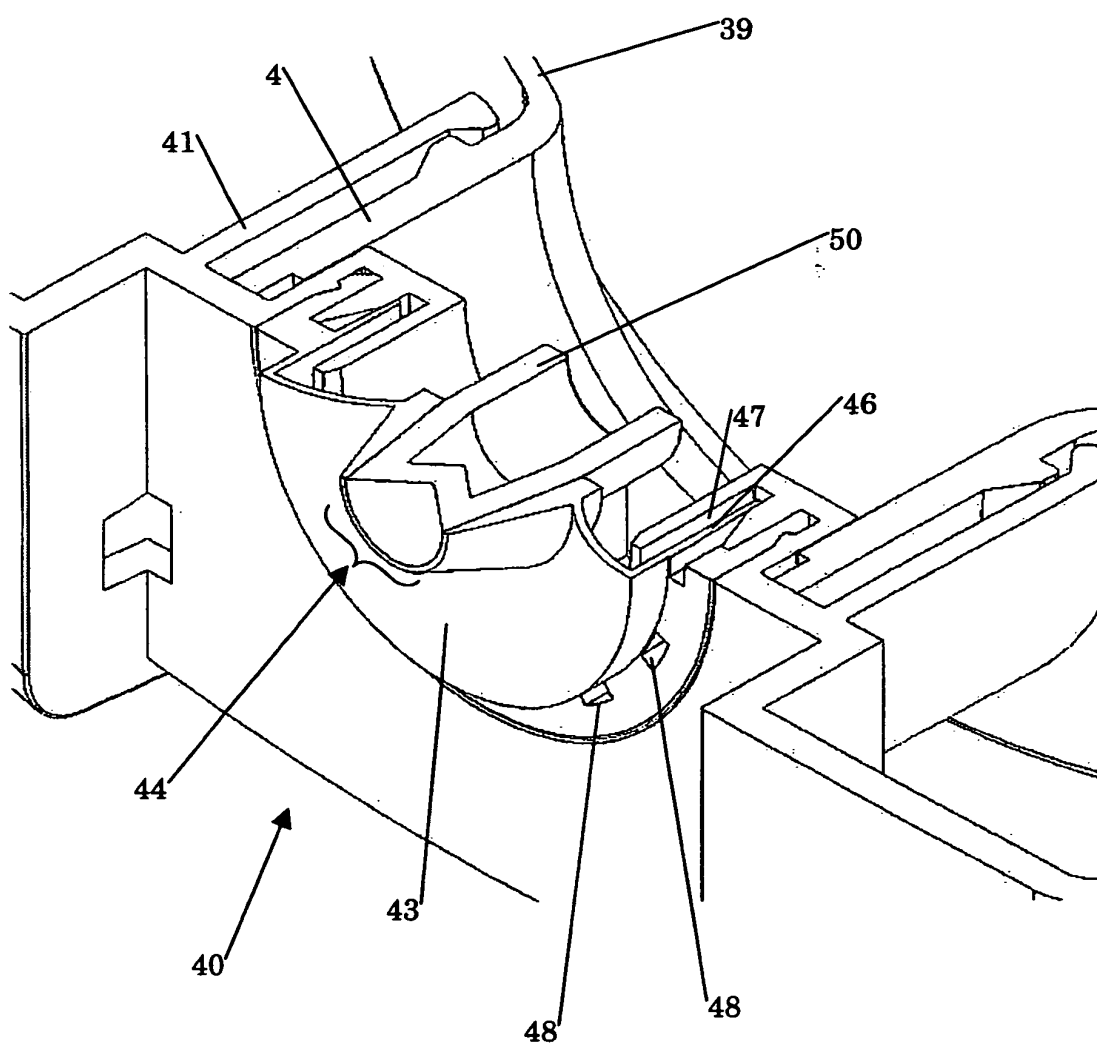


Figure 12

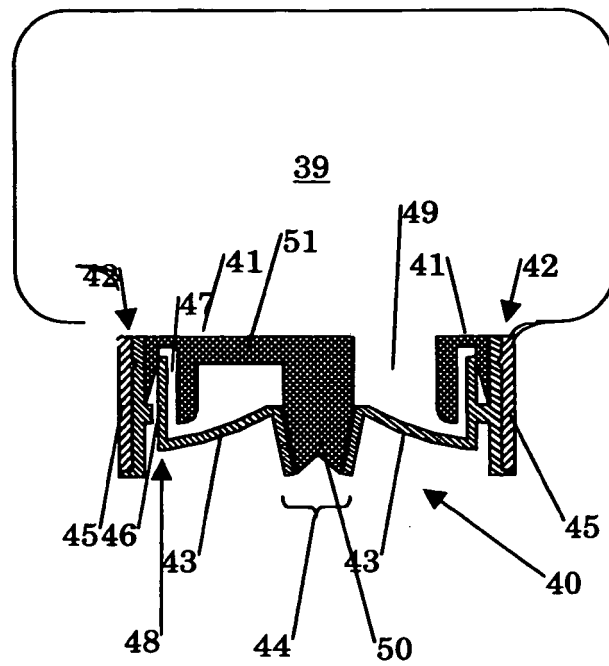


Figure 13

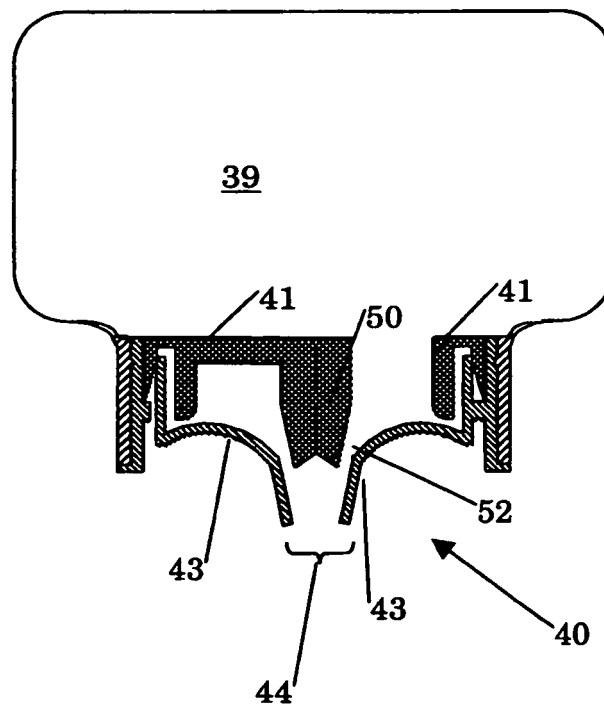


Figure 14

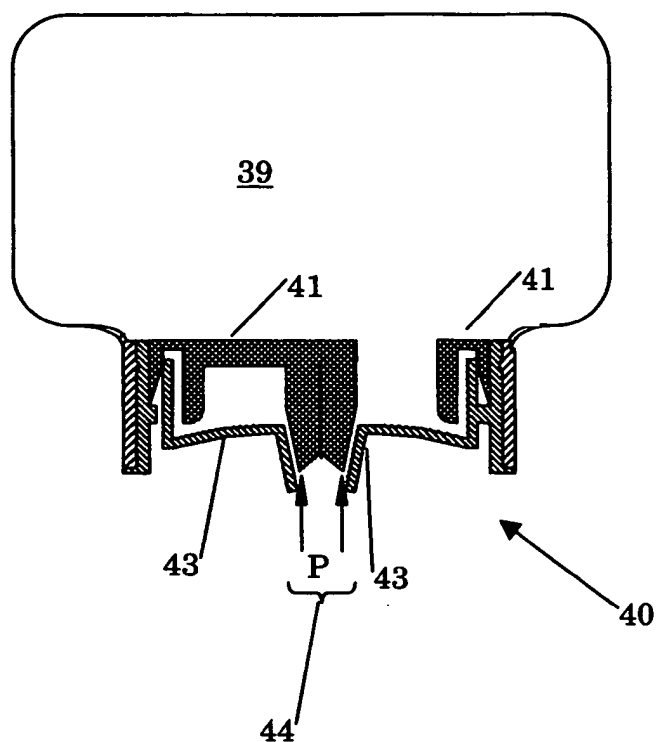


Figure 15

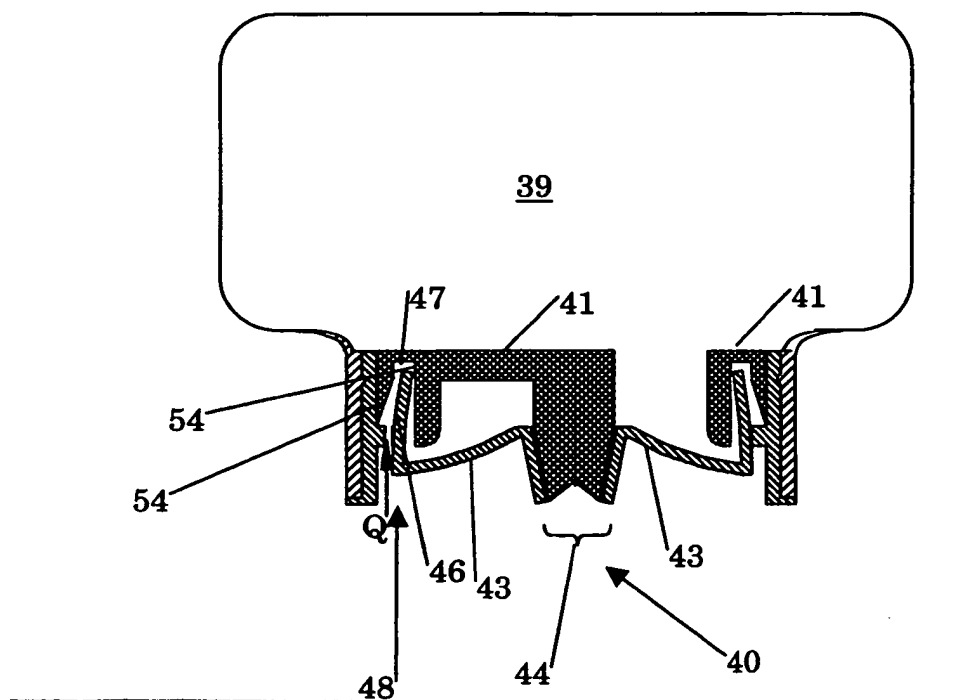


Figure 16

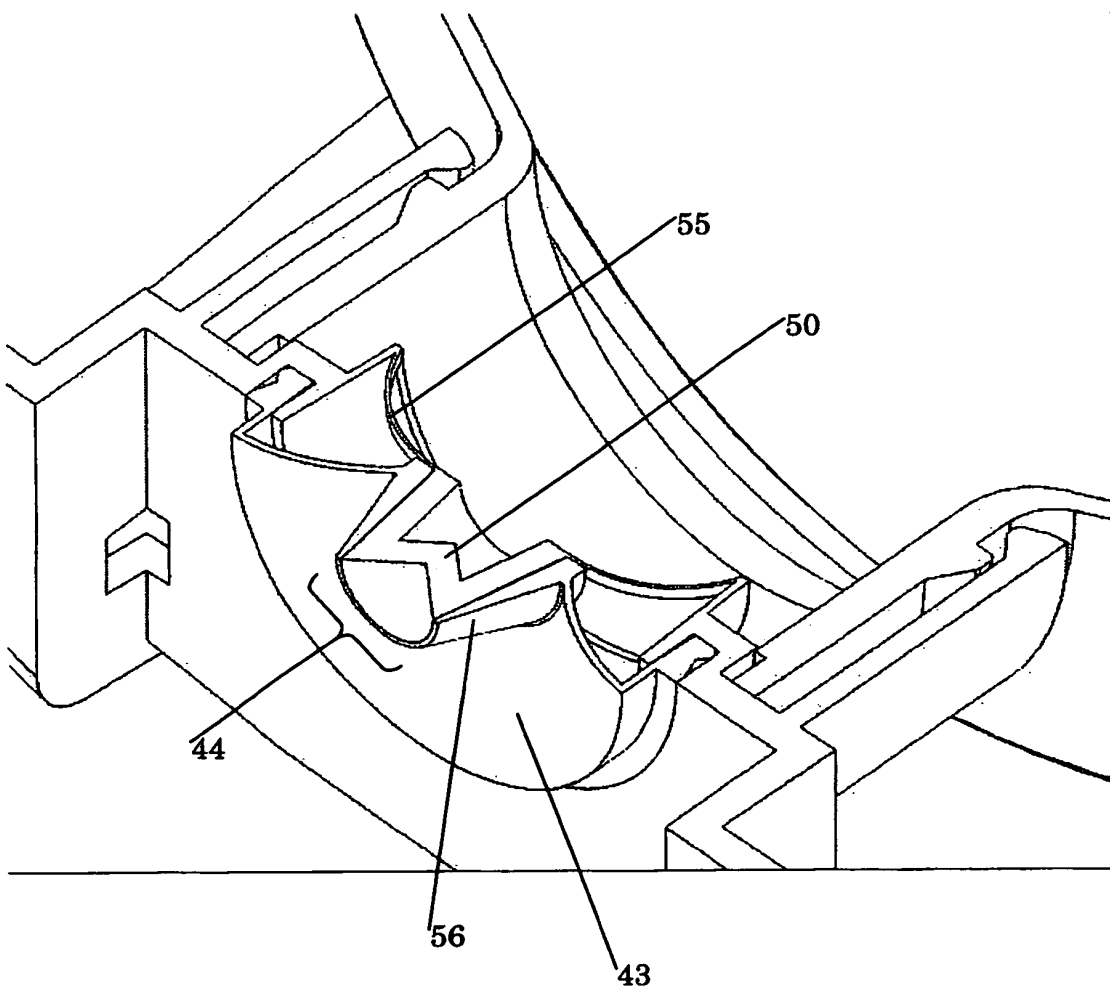


Figure 17

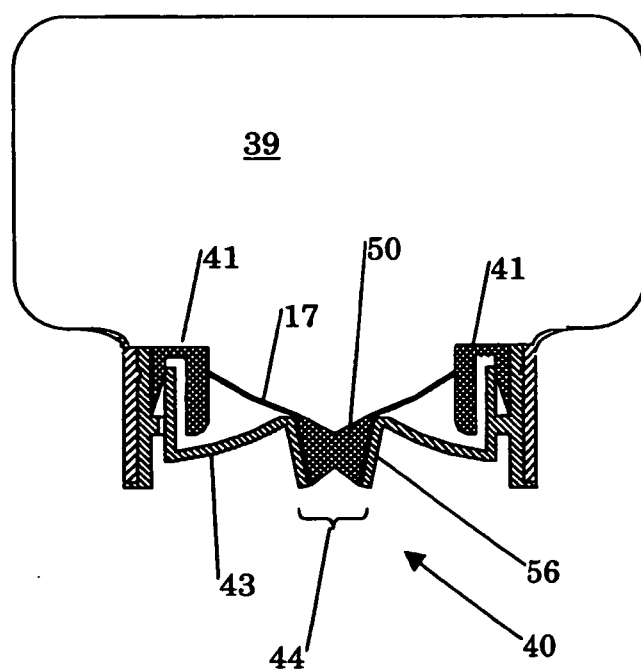


Figure 18

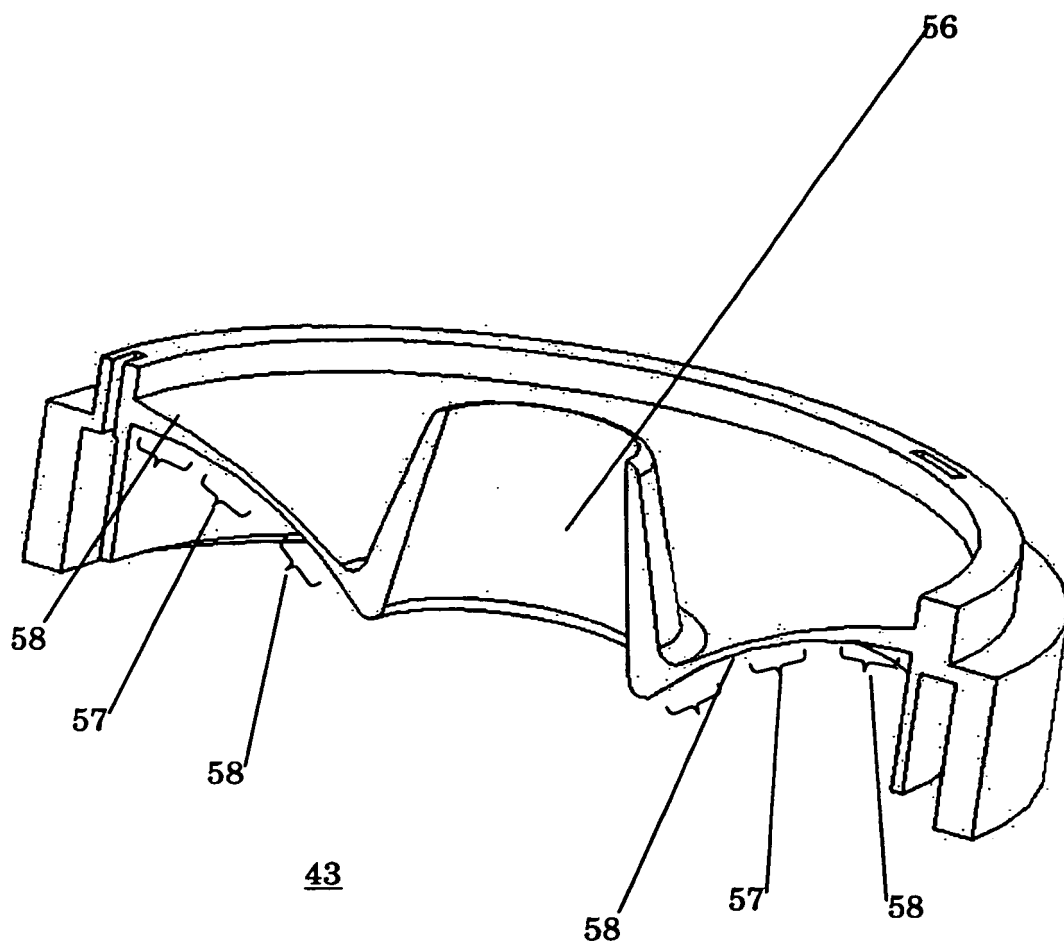


Figure 19

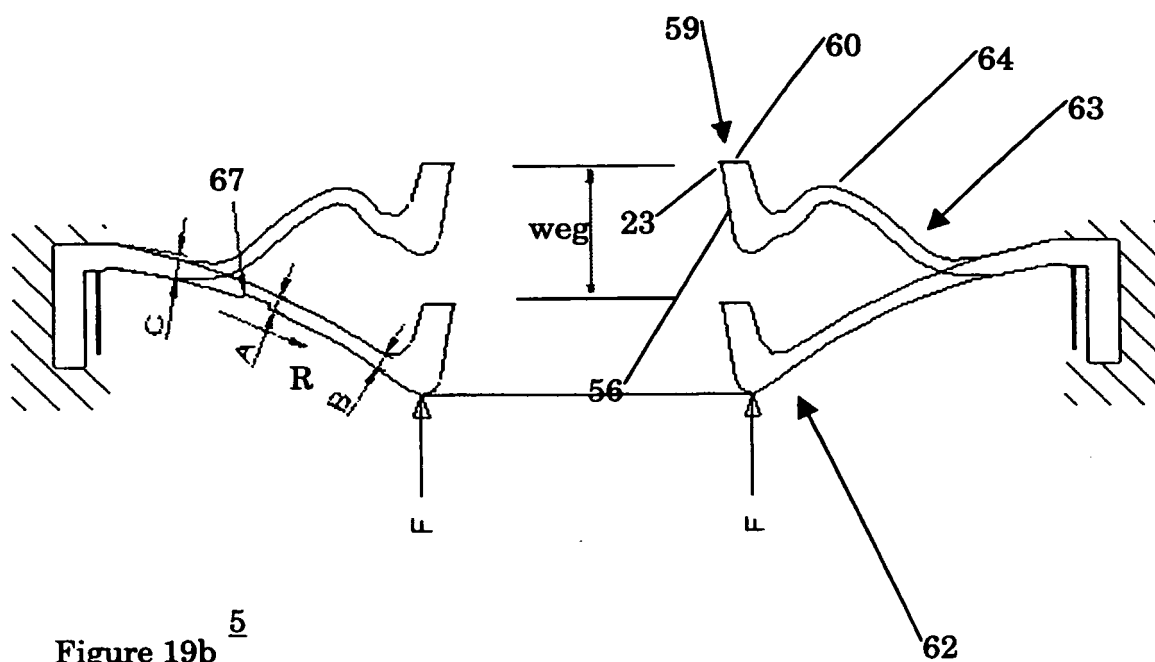
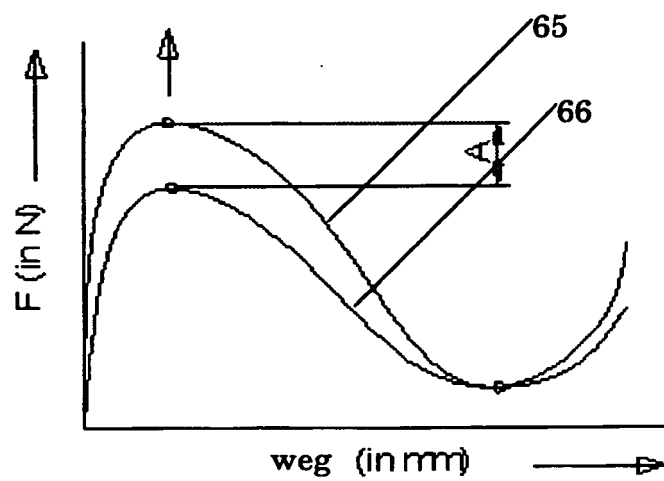


Figure 19b ⁵



REFERENCES CITED IN THE DESCRIPTION

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