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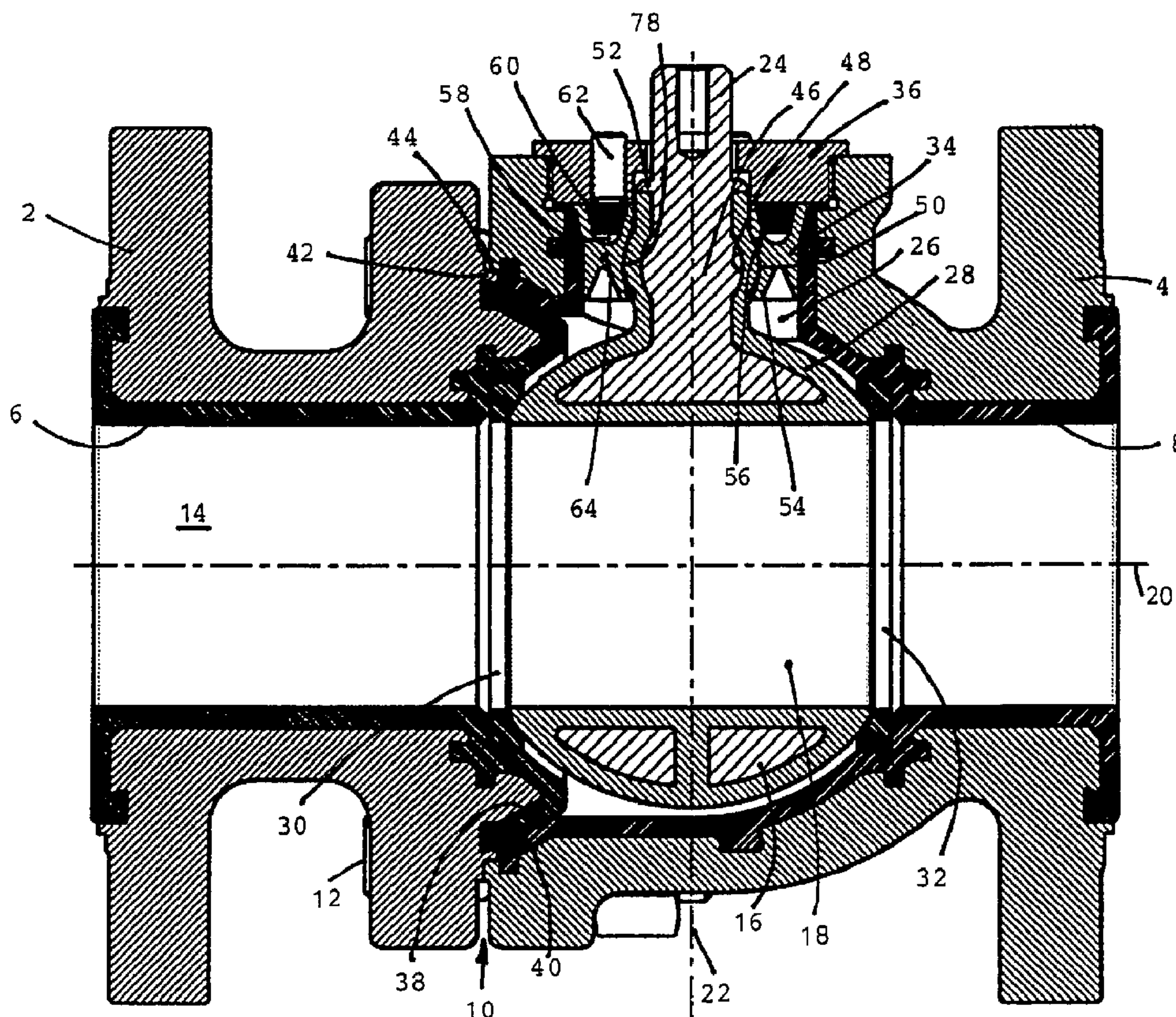
(72) Inventeurs/Inventors:
WETZEL, WINFRIED, DE;
WEIL, JOCHEN, DE;
DAVIDSON, JAMES WILLIAM, US;
FUOC, ALAIN, FR;
VORTKAMP, JAMES E., US

(73) Propriétaire/Owner:
XOMOX INTERNATIONAL GMBH & CO., DE

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : SOUPAPE

(54) Title: VALVE



(57) Abrégé/Abstract:

A valve, comprising a housing (2, 4), a preferably spherical rotating body (16) that has a through-passage (18) for a flow medium and is rotatably arranged in said housing, wherein according to the rotational angle position of the rotating body (16) about a

(57) Abrégé(suite)/Abstract(continued):

rotational axis (22) the flow path is closed off or at least partially opened. The invention further comprises two seat rings (30, 32) arranged in the housing (2, 4) at a distance from each other, said rings resting in a sealing manner on the preferably spherical outer surface of the rotating body (16). The valve also comprises a shaft (24) which is operatively connected to the rotating body (16) and extends outwards through an opening (26) of the housing, part (46) of the shaft (24) being associated with a spherical outer surface against which a sealing element (34) rests at least partially. The invention aims at developing a simple valve design that minimizes leakage rates and achieves a long service life, while ensuring high functional reliability. For that purpose, the rotating body (16) and the shaft (24) are firmly connected to each other or are configured as one piece, the sealing element (34) in the region of the aforementioned part (46) of the shaft (24) at least partially rests against the spherical outer surface (48, 50) of the shaft part (46), and the rotating body (16) together with the shaft (24) can pivot about a pivoting axis (28) associated with the spherical outer surface (48, 50), said axis being substantially orthogonal to the rotational axis (22).

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(71) **Anmelder** (für alle Bestimmungsstaaten mit Ausnahme von US): **XOMOX INTERNATIONAL GMBH & CO.** [DE/DE]; Von-Behring-Strasse 15, 88131 Lindau/Bodensee (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder (nur für US): WETZEL, Winfried [DE/DE]; Montfortstrasse 16, 88138 Hergensweiler (DE). **WEIL, Jochen** [DE/DE]; Rohrstrasse 2E, 88131 Bodolz (DE). **DAVIDSON, James William** [US/US]; 6428 Eagleview Drive, Mason, Ohio 45040 (US). **FOUC, Alain** [FR/FR]; 31, rue des Sittelles, 68110 Illzach (FR). **VORTKAMP, James E.** [US/US]; 7108 Baribill Pl., Cincinnati, Ohio 45230 (US).

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(54) Title: VALVE

(54) Bezeichnung: VENTIL

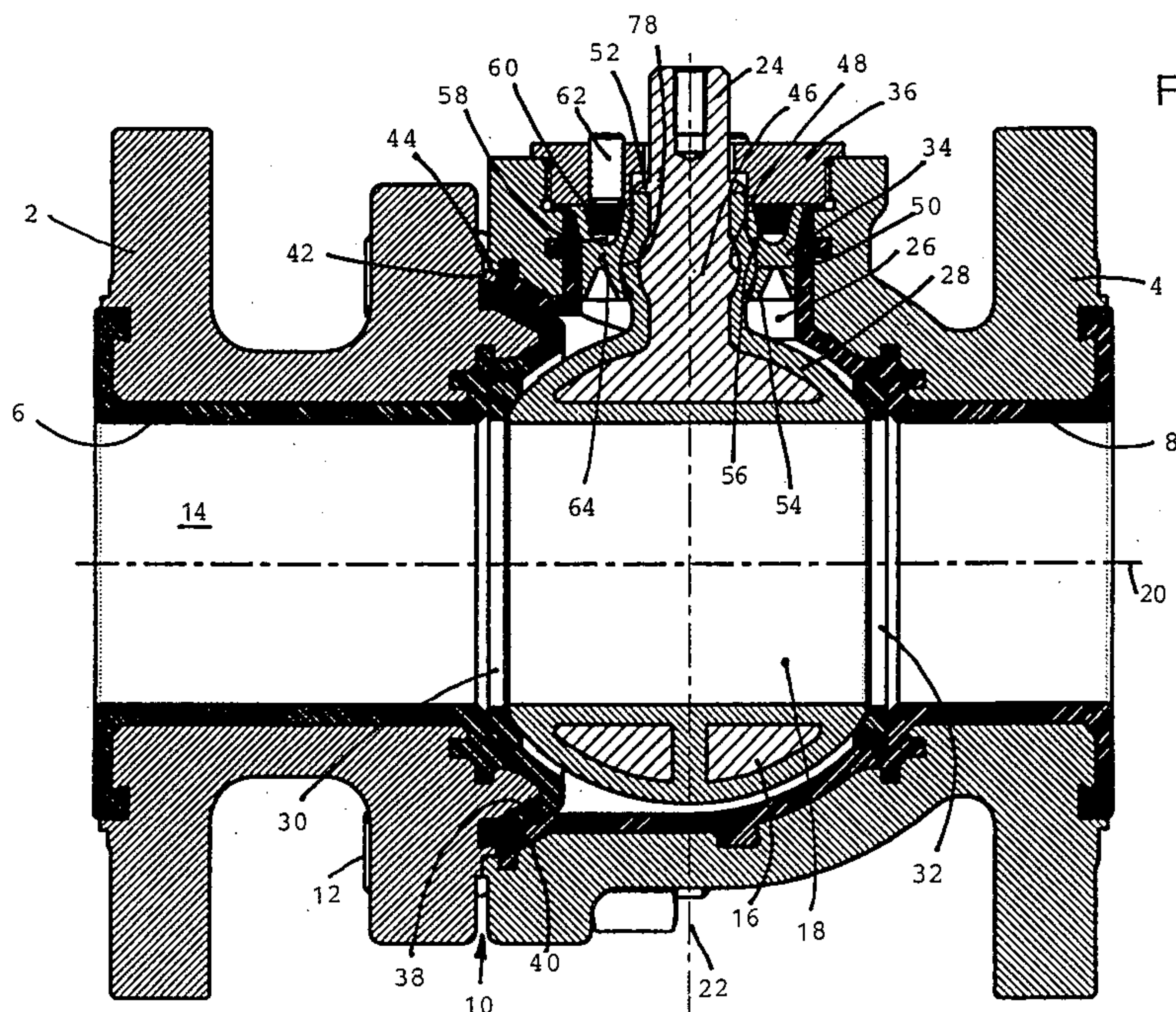


Fig. 1

(57) Abstract: A valve, comprising a housing (2, 4), a preferably spherical rotating body (16) that has a through-passage (18) for a flow medium and is rotatably arranged in said housing, wherein according to the rotational angle position of the rotating body (16) about a rotational axis (22) the flow path is closed off or at least partially opened. The invention further comprises two seat rings (30, 32) arranged in the housing (2, 4) at a distance from each other, said rings resting in a sealing manner on the preferably spherical outer surface of the rotating body (16). The valve also comprises a shaft (24) which is operatively connected to the rotating body (16) and extends outwards through an opening (26) of the housing, part (46) of the shaft (24) being associated with a spherical outer surface against which a sealing element (34) rests at

least partially. The invention aims at developing a simple valve design that minimizes leakage rates and achieves a long service life, while ensuring high functional reliability. For that purpose, the rotating body (16) and the shaft (24) are firmly connected to each other or are configured as one piece, the sealing element (34) in the region of the aforementioned part (46) of the shaft (24) at least partially rests against the spherical outer surface (48, 50) of the shaft part (46), and the rotating body (16) together with the shaft (24) can pivot about a pivoting axis (28) associated with the spherical outer surface (48, 50), said axis being substantially orthogonal to the rotational axis (22).

(57) Zusammenfassung: Ventil, enthaltend ein Gehäuse (2, 4), einen in diesem drehbar angeordneten, vorzugsweise kugelförmigen, Drehkörper (16) mit einer Durchgangsöffnung (18) für ein Strömungsmedium, wobei entsprechend der Drehwinkelstellung des Drehkörpers (16) um eine Drehachse (22) der Strömungsweg abgesperrt oder zumindest teilweise freigegeben

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(74) **Anwalt:** REBLE, KLOSE & SCHMITT; Patente + Marken, Postfach 12 15 19, D-68066 Mannheim (DE).

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ist, zwei im Gehäuse (2, 4) beabstandet angeordnete Sitzringe (30, 32), welche an der vorzugsweise sphärischen Außenfläche des Drehkörpers (16) dichtend anliegen, und ferner enthaltend eine mit dem Drehkörper (16) in Wirkverbindung stehende Welle (24), welche durch eine Durchführung (26) des Gehäuses nach außen geführt ist, wobei einem Teil (46) der Welle (24) eine sphärische Außenfläche zugeordnet ist, an welcher ein Dichtelement (34) zumindest teilweise anliegt. Das Ventil soll mit einem geringen konstruktiven Aufwand dahingehend weitergebildet werden, dass mit hoher Funktionssicherheit Leckraten minimiert und hohe Standzeiten erreicht werden. Hierzu wird vorgeschlagen, dass der Drehkörper (16) und die Welle (24) fest miteinander verbunden oder einteilig ausgebildet sind, dass das Dichtelement (34) im Bereich des genannten Teils (46) der Welle (24) an der sphärischen Außenfläche (48, 50) des Wellenteils (46) zumindest teilweise anliegt und dass der Drehkörper (16) gemeinsam mit der Welle (24) um eine der sphärischen Außenfläche (48, 50) zugeordnete Schwenkachse (82), welche im Wesentlichen orthogonal zur Drehachse (22) steht, schwenkbar ist.

Valve

The invention relates to a valve having a housing and a rotational body, preferably a spherical rotational body, arranged rotatably therein, in accordance with the features provided in the preamble to patent claim 1.

Known from EP 1 047 894 B1 is such a valve embodied as a ball valve, and a separately embodied shaft is mechanically linked to the spherical rotational body of the valve. The rotational body includes a passage for a flow medium, and the interior of the housing includes two seat rings that are spaced apart in the direction of flow and that are sealingly positioned against the outer spherical surface of the rotational body. A rectangular part of the shaft engages in a correspondingly embodied seat of the rotational body and is conducted through an opening in the housing to the outside so that for instance the rotational body may be rotated by means of a lever or the like into the desired position for closing or at least partially opening the flow path. Due to the embodiment of rotational body and shaft in two parts, in the closed position the floatingly arranged rotational body is pressed more strongly against the downstream seat ring because of the difference in pressure. Movements of the rotational body caused by the flow medium or the differences in pressure are to be kept away from the shaft because of the embodiment of rotational body and shaft in two parts. In the area of the housing opening the shaft includes a part having a spherical outer surface against which is positioned a sealing element arranged in the housing such that the sealing effect is heightened by the pressure of the flow medium in the housing interior and the so-called external seal is enhanced. It is intended that the spherical outer surface of the aforesaid shaft part will ensure that the external seal will not be negatively affected by axial movements of the shaft or by pivot movements introduced from outside, for instance by means of the aforesaid lever. It has been found that due to the embodiment of rotational body and shaft in two parts, practically no pivot movements or at least only negligible pivot movements, are exerted on the shaft.

Furthermore, a valve embodied as a ball valve is also known from DE 30 23 230 A1, and its rotational body and shaft are embodied integrally. The inner surfaces of the housing, which surfaces receive the spherical rotational body and the shaft, are provided with a common liner or

coating made of plastic. The outer surfaces of the rotational body and the shaft embodied integrally therewith are also provided with a coating or liner made of plastic. A gland packing seal is arranged in the housing opening for the shaft for sealing purposes. Because of the integral embodiment, forces are transmitted directly onto the shaft by the flow medium or by differences in pressure, especially when the rotational body is in the closed position, and the result is that local load peaks and quite high surface pressures occur between the shaft liner and the gland packing, and these shorten the tool life and service life and can lead to elevated leak rates, even after relatively short operating times.

Moreover, known from EP 0 809 059 B1 is a valve whose housing interior is provided with a plastic liner and whose rotational body and shaft likewise have a liner or coating made of plastic. The rotational body is borne floating in the housing by means of support rings arranged spaced apart in the direction of flow. The inner end of the shaft, which shaft is provided with the aforesaid liner or coating at least in the interior of the housing, engages in a correspondingly embodied recess of the rotational body, the recess also being lined with plastic, and specifically engages therein such that the rotational body can be rotated via the shaft for closing or opening the flow path. Sufficient clearance between the aforesaid recess of the floatingly borne rotational body and the engaging shaft end is required so that axial movements are not transmitted to the shaft, especially axial movements due to differences in pressure or pressure fluctuations in the flow medium. Production and manufacture of the aforesaid connection requires complexity that is not insignificant. Furthermore, hysteresis and/or positional differences between the angle of rotation position for the shaft and the angle of rotation position for the rotational body must be noted that are disadvantageous especially in an embodiment as a control valve and/or in automated systems in which drives are provided that are suitable for rotating the shaft and ultimately the rotational body. A special double seal is provided in the area of the shaft opening, and this seal requires a not insignificant structural volume and correspondingly complex production and assembly.

Proceeding from this, the underlying object of the invention is to refine the valve with low structural complexity such that the aforesaid disadvantages are avoided and long tool life and long service life are attained. Furthermore the valve should be optimized with respect to minimizing especially the external leak rates. The valve should be designed for aggressive media, and/or damage from the corrosive effects of the flow medium and/or external influences

so that axial movements are not transmitted to the shaft, especially axial movements due to differences in pressure or pressure fluctuations in the flow medium. Production and manufacture of the aforesaid connection requires complexity that is not insignificant. Furthermore, hysteresis and/or positional differences between the angle of rotation position for the shaft and the angle of rotation position for the rotational body must be noted that are disadvantageous especially in an embodiment as a control valve and/or in automated systems in which drives are provided that are suitable for rotating the shaft and ultimately the rotational body. A special double seal is provided in the area of the shaft opening, and this seal requires a not insignificant structural volume and correspondingly complex production and assembly.

DE 41 04 003 A1 describes the embodiment of an on/off valve in the form of a ball valve. Inserted in the ball is a rotatable actuating shaft that runs through a bore through the valve housing and that has a radial collar with an inner and an outer sealing surface that have spherical contours. The inner sealing surface is supported on an inner sealing ring and the outer sealing surface is supported on an outer sealing ring, the sealing rings being pressed against the sealing surfaces by means of a spring-actuated pressure ring. Limited tiltability of the spherically borne actuating shaft in the valve housing is made possible due to annular gaps embodied between the actuating shaft, the pressure ring, and an annular flange.

US 2005/0104026 A1 discloses a ball valve whose spherical rotational body and rotational shaft are embodied integrally. The sealing is accomplished using sealing rings that are positioned against the rotational body and supported against the housing and using seals that enclose the rotational shaft.

Proceeding from this, the underlying object of the invention is to refine the valve with low structural complexity such that the aforesaid disadvantages are avoided and long tool life and long service life are attained. Furthermore the valve should be optimized with respect to minimizing especially the external leak rates. The valve should be designed for aggressive

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media, and/or damage from the corrosive effects of the flow medium and/or external influences such as ambient humidity should be avoided. Moreover, disadvantageous influences on the sealing of the shaft are to be avoided. The valve should also ensure functionally reliable and/or optimized sealing and/or facilitate the latter with a longer tool life, especially when used at high pressures or high temperatures.

The inventive valve is distinguished by a simple and yet functionally reliable design, the rotational body and the shaft being securely joined to one another and especially embodied integrally. In the area of the opening the shaft includes a part having a spherical outer surface, the aforesaid shaft part being surrounded by a support ring that has a spherical inner surface that corresponds at least approximately to the spherical outer surface of the shaft part. The spherical outer surface of the shaft part is positioned against the spherical inner surface of the support ring, this creating a pivot bearing about pivot axes, the center of which is defined by the center point and/or the center of the aforesaid spherical.

In one preferred refinement, the rotational body and the shaft joined securely thereto have a common liner made of plastic, especially fluoroplastics such as PTFE, FEP, PFA, or TFA. Furthermore, the interior of the housing, including the shaft opening, are provided with such a plastic liner. In the area of the opening the plastic liner for the shaft has the aforesaid spherical outer surface that is positioned against the spherical inner surface of the support ring. The support ring is advantageously positioned radially outward against the liner of the housing in the area of the opening. Thus the mechanical conditions explained in the foregoing also apply for valves whose housing and shaft with rotational body have plastic liners.

The sealing element advantageously includes at least one dynamic sealing lip, preferably two dynamic sealing lips, that are positioned at least in part against the spherical outer surface of the aforesaid shaft part or against the plastic liner thereon. The adjacent inner surface of the flexible sealing lip has especially two surfaces that are preferably essentially conical or spherical and that are arranged at an obtuse angle, the contact occurring on the spherical outer surface and/or the line of intersection for the surface being located within the contact surface in the unloaded condition in the area of the line of intersection for the two aforesaid surfaces. As the load increases and/or due to the aforesaid micro-movements by the rotational body and the resultant pivot of the shaft, the contact surface shifts towards the rotational axis, the contact surface advantageously enlarging and/or the contact surface being displaced to the stiffer and/or stiffened part of the sealing element, this advantageously increasing and/or improving the support for the shaft. Moreover, in the invention the preferably V-shaped seat rings include flexible sealing lips having two preferably essentially conical or spherical surfaces that are arranged at an obtuse angle, specifically especially such that when in the unloaded condition in the area of their line of intersection the contact occurs on the spherical outer surface of the rotational body or its liner and further when loaded the contact surface for the sealing lip is shifted to an area of increased stiffness such that at increased loads and/or given larger movements the rotational body is supported on the aforesaid area.

Special refinements and embodiments of the invention are provided in the following description of exemplary embodiments and in the dependent claims. The exemplary embodiments relate to valves having a rotational body embodied as a sphere or embodiment as a ball valve, but it is expressly stated that the invention furthermore includes valves having other rotational bodies such as conical cock plugs or flaps. Regardless of the embodiment of the valve, whether ball valve, tap cock, flap valve, or the like, the critical factor is the fixed and preferably integral embodiment of shaft and rotational body in combination with pivotability in the area of the shaft opening, about axes that run essentially orthogonal to the rotational axis.

The invention shall be explained in greater detail in the following using the special exemplary embodiments depicted in the drawings, but this shall not constitute a limitation.

- Fig. 1 depicts an axial section of a valve that is embodied as a ball valve and that has a plastic liner, an X-shaped sealing element with integrated support ring being associated with the spherical part of the shaft embodied integrally with the rotational body;
- Fig. 2 depicts an axial section of another exemplary embodiment of the ball valve;
- Fig. 3 depicts the principle for the shaft including spherical rotational body in the closed position;
- Fig. 4 depicts an axial section of an exemplary embodiment of the valve without plastic liner;
- Fig. 5 is a perspective and partial cut-away view of the sealing element with integrated support ring;
- Fig. 6 depicts part of the sealing element in accordance with Fig. 5 in a cut-away view;
- Figs. 7 –14 are partial axial sections and views of additional exemplary embodiments.

In accordance with Fig. 1, the valve embodied as a ball valve includes a housing that preferably comprises metal and has two housing parts 2, 4 that are interiorly lined with plastic liners 6, 8. The housing parts 2, 4 are joined to one another by means of screws 12 in a connecting area 10 like a flange connection. The liners 6, 8 delimit the flow channel 14 that is for a flow medium and that is disposed in the interior of the housing, and furthermore arranged in the interior of the housing is a spherical rotational body 16 that includes a through-opening 18 and that can be rotated about a rotational axis 22 that is orthogonal to the longitudinal axis 20 of the housing. In the depicted open position the flow medium can flow freely through the through-opening 18 and thus through the valve. After the rotational body 16 has been rotated 90° with respect to the rotational axis 22, the rotational body 16 assumes its closed position for closing the flow path.

A shaft 24 is securely joined to the rotational body 16, the rotational body 16 and the shaft 24 preferably being embodied integrally. The shaft 24 penetrates an opening 26 in the housing part 4 to the outside, it being possible to connect a suitable actuating element such as a lever, hand wheel, or for instance an electrical rotational drive to the free end of the shaft 24 that is disposed on the outside in order to rotate the rotational body 16 into the desired position. The rotational body 16 and the shaft 24 are enclosed in a common liner or covering 28, this liner also being present inside the rotational body 16 in the through-opening 18, as well. The rotational body 16 is supported by means of two seat rings 30, 32 that are spaced apart from one another in the direction of the longitudinal axis 20 and that are fixed in the liner 6, 8 such that inner sealing of the ball valve is assured when the rotational body 16 is in the closed position. Furthermore, arranged in the area of the opening 26 is an annular sealing element 34 made of elastomer and/or elastic material, especially plastic, that has an X-shaped cross-section and that is fixed by means of a cover 36 that is preferably detachably connected to the housing part 4 by means of screws or the like (not shown).

It is particularly significant that the liners 6 and 8 for the housing parts 2, 4 extend into the area of the opening 26, specifically in the housing part 4 up to the cover 36. Moreover, the liners 6, 8 are each provided with end parts 38, 40 from the opening 26 approximately down to the connecting area 10 and are preferably embodied conically, the end parts 38, 40 being positioned tight against one another and due to the pre-specified and preferably conical overlapping reliably absorbing especially changes in temperature. Additional loading or overloading and/or impermissible deformation of the liner during assembly and operation, especially by pipe forces,

are advantageously functionally reliably prevented due to the pre-specified metal overlay of the housing parts 2, 4. In the connecting area 10 the metal housing parts 2, 4 include centering collars 42, 44 coaxial with the longitudinal axis 20 to assure precise coaxial alignment of the housing parts 2, 4 and also to assure a connection that can withstand high loads. Because of the end parts 38, 40 of the liners 6, 8 that are positioned tightly against one another and/or that are overlapping, the housing interior is encapsulated in a functionally reliable manner and sealed against the outside, even at high pressures and/or when there are changes in temperature.

In the area of the opening 26 the shaft 24 includes an expanded part 46 having a spherical outer surface 48 and the liner 28 for the shaft 24 includes a correspondingly embodied spherical outer surface 50. The shaft 24 furthermore has a flange 52 at which the liner 28 terminates and is supported. The liner 28, which is especially made of a durable fluoroplastic that is resistant to high temperatures, has an propensity for cold flow and for enlargement given the effects of heat and is held in a functionally reliable manner by means of the flange 52. Two sealing lips 54, 56 of the sealing element 34 are sealingly positioned against the liner 28 in the area of the spherical outer surface 50. The outer sealing lip 56 that faces the cover 36 is surrounded by an annular space 58 in which an annular body 60 is arranged. The cover 36 includes adjusting elements 62, for instance embodied as screws, that act on the annular body 66 such that the pre-stress or the pressure of the outer sealing lip 56 is adjustable with respect to the liner 28. It is particularly significant that the shaft seal is embodied adjustable and/or self-adjusting.

Furthermore, a support ring 64 is provided that surrounds the shaft part 49 and is integrated into the X-shaped sealing element 34. The support ring 64 is arranged in the area of the radial expansion of the shaft 24 and/or between the spherical outer surface 50 of the liner 28 and the inner surface of the liner 8 and is embodied as an annular part of the sealing element 34. Radially inward the support ring 64 has a spherical inner surface 78 that conforms with and/or corresponds to the spherical outer surface 50 of the liner 28. The inner and outer sealing lips 54, 56, whose inner surfaces are especially continuously connected to the inner surface 78 of the support ring 64, are connected in both directions to the integrated support ring 64 coaxial with the rotational axis 22. The support ring 64 has significantly greater stiffness than the sealing lips 54, 56 of the sealing element and thus in accordance with the invention facilitates radial support of the shaft 24. The annular part 64 of the sealing element 34 forms the support ring for the shaft 24 and in combination with the aforesaid spherical outer surface 50 of the liner 28 for the shaft

24 the shaft 24 can thus pivot, as shall be explained in greater detail in the following. It is noted that the annular part or support ring 64 has the inner surface 78 that conforms with the spherical outer surface 50 and/or is embodied corresponding thereto.

Fig. 2 depicts another exemplary embodiment that is similar to that in accordance with Fig. 1, and the information in the foregoing applies for equivalent components. A sealing ring 66 in the cover 36 seals the housing part 4 against the outside. The sealing ring 66 in particular prevents liquid from penetrating from outside and prevents the thread in the cover 36 or the threaded connection between the cover 36 and the housing 2 and 4 from corroding. The annular body 60 includes in a groove an in particular elastic ring 68 for acting on and pre-stressing the outer sealing lip 56. Furthermore, the inner sealing lip 54 is surrounded by an annular space 72 in which another in particular elastic ring 70 is arranged for pre-stressing and/or additional sealing. As can be seen, two arms 74, 76 of the sealing element 34 are positioned against the inner surface of the liner 6, 8. The annular part 64 or support ring is also positioned radially outward against the inner surface of the liner 8 and furthermore radially inward its spherical inner surface 78 is positioned against the correspondingly embodied spherical outer surface 50 of the liner 28, and this attains defined and/or functionally reliable support and/or bearing of the shaft 24 in the housing or in the housing part 4.

Regardless of whether the integral embodiment of the annular part or support ring 64 with the sealing element 34 proved particularly useful, in the invention the support ring 64 may also be embodied independent of the sealing element, it being possible to advantageously arrange a separate sealing element, preferably having sealing lips and arms as in the foregoing, immediately on such a separate support ring 64 in the direction of the rotational axis 22 inward and/or outward. In accordance with the invention, the support ring, which in comparison to the sealing lips has significantly greater stiffness and is preferably just as elastic, forms a bearing for the expanded shaft part 46 with the preferred spherical outer surface 48 and/or the surrounding liner 28 with the spherical outer surface 50.

Fig. 3 provides schematic depictions of the spherical rotational body 16 and the shaft 24, which is securely joined thereto and preferably embodied integrally, with the rotational body in the closed position, the liner 28 for the shaft 24 being indicated merely with a dashed line for the sake of simplicity. Alternatively, the spherical inner surface 78 of the support ring 64 may be

positioned directly against the spherical outer surface of the shaft part 46, supporting it. The support ring or the annular part 64 of the sealing element in the area of the expanded part 46 of the shaft 24 is positioned against the spherical outer surface 50 of the liner, and it is noted that the spherical inner surface 78 of the support ring 64 is embodied corresponding to the spherical outer surface 50 of the liner 28. Moreover, the one seat ring 30 that is fixed in the liner of the housing part shown on the left in Fig. 1 is depicted. The rotation body 16 is pressed more strongly against the seat ring 30 because of the pressure from the flow medium acting on the rotation body 16 in the closed position or because of the changes in pressure P. The rotational body 16 can perform pivot movements about a pivot axis 82 in accordance with the dot-dash line 80, as indicated by the arrow 84 due to the bearing and/or support of the shaft by means of the support ring 64. The pivot axis 82 runs essentially orthogonal to the rotational axis 22 of the rotational body 16 due to the spherical embodiment of the outer surface 50 of the liner 28 for the shaft 24. The pivot axis 82 runs at least approximately through the center and/or center point of the spherical and/or ball-shaped outer surface 50. Furthermore, in accordance with the invention the support ring 64 surrounds the expanded shaft area 46 with a pre-determined axial extension, with respect to the rotational axis 22, such that the pivot axis 82 running through the aforesaid center runs radially through the support ring 64. Thus in accordance with the invention the rotational body 16 is floatingly borne in the housing without the shaft 24 being embodied as a separate component that enables relative movements.

Fig. 4 depicts a section through an axial plane of an exemplary embodiment whose housing parts 2, 4, rotational body 16, and shaft 24 connected thereto do not have any plastic liners. The support rings 30, 32 are fixed directly in the metal surfaces or areas of the housing parts 2 and 4. The spherical outer surface 48 of the expanded part 46 of the shaft 24 is positioned against the support ring 64. Furthermore, the inner and outer sealing lips of the sealing element 34 are positioned directly against the associated metal outer surfaces of the shaft 24 and/or its expanded part 46. The outer sealing lip of the sealing element 34 is pressed with adjustable pre-tension against the outer surface of the shaft 74 by means of the annular body 60, it being possible to adjust the sealing force as needed using adjusting elements 62 that are arranged in the cover 36 and that are embodied for instance as screws. In addition the information in the foregoing for the exemplary embodiments of the valves that are provided with liners applies analogously to the depicted exemplary embodiment of the valve without liners.

The micro-movements that occur essentially in the longitudinal direction of the valve housing are limited by means of the seat rings 30, 32 while the sealing effect is retained for a long service life. The movements are reduced to a minimum by means of the seat rings 30, 32, and consequently this minimizes the pivot movements, depicted greatly enlarged in Fig. 3, of the shaft 24 that is integrally joined to the rotational body 16. A functionally reliable seal for the shaft opening that results in long tool life is attained using the inventive combination of the seat rings with the shaft being supported by means of the support ring 64 that is preferably integrated into the sealing element. In accordance with the invention, a significantly improved and/or optimized seal and/or long service life for the shaft opening is provided, with a simultaneous floating arrangement of the rotational body 16 in the valve housing 2, 4 and secure connection to the shaft 24, using the inventive combination of the seat rings 30, 32 with which the excursion and/or movements of the rotational body 16 are limited and/or reduced as the pressure increases, and the support ring 64 in the area of the shaft opening.

The annular sealing element 34 with the inner sealing lip 54, the outer sealing lip 56, and the support ring 64, which is continuous in the radial direction relative to the rotational axis of the rotational body, can be visualized well in the perspective and partial cut-away view in Fig. 5. A radially extending flange 116 is arranged integrally on the end of the outer arm 76 and is embodied as a sealing membrane between the housing part and the cover connected thereto for additional sealing against the outside. It should be noted that the inner sealing lip 54 is provided and embodied for dynamically sealing the shaft opening and the housing interior, while the outer sealing lip 56 is arranged and/or embodied for sealing against the outside. Thus functionally reliable and/or self-adjusting sealing of the shaft is attained in the area of the shaft opening using the two dynamic sealing lips 54 and 56.

Fig. 6 is a schematic depiction of the sealing element 34 with the inner and outer sealing lips 54, 56, the integrated annular part or support ring 64, and the inner and outer arms 74, 76. The free ends of the inner sealing lip 54 and of the inner arm 74 point towards the interior of the valve housing, while the free ends of the outer sealing lip 56 and the outer arm 76 point outward or towards the cover that closes off the housing opening. The contact surfaces 86, 88 of the sealing lips 54, 56 basically conform to the spherical outer surface of the liner for the expanded shaft part and in the area of their free ends preferably conform at least in part to the essentially cylindrical shaft areas connected to the expanded shaft area that are disposed radially outward or

inward. The contact surfaces 86, 88 of the inner and outer sealing lips 54, 56 are positioned especially with pre-specified pre-tension against the outer surfaces of the associated shaft areas or against the liner that is present on the shaft. A self-adjusting shaft seal is advantageously created in particular by means of the resilient rings or spring elements explained using the various exemplary embodiments. Additionally or alternatively, in accordance with the invention it is possible to adjust the sealing force or the shaft seal by means of the annular body explained in Figs. 1, 4, and 14 and/or by means of the adjusting elements. The sealing element 34 is embodied and associated with the spherical outer surface of the liner such that as the pressures increase the load, the contact area increases in size and/or is displaced towards the support ring 64 as a result of an increased load, increasing the sealing effect. Thus a pressure-dependent change and/or increase in sealing power and/or increase in the size of the contact area is attained in a preferable manner.

In the exemplary embodiment in accordance with Fig. 7 the cover 36 is screwed into the housing part 4 by means of a thread 118 and is disposed with a bar 120 on the metal housing 4. The flange or the membrane seal 116 of the sealing element 34 is clamped between the bottom of the cover 36 and the housing 4 and also overlaps the outer end of the liner 8 so that a reliable seal is attained. The outer sealing lip 56 of the sealing element 34 is surrounded in the annular space 58 by a resilient ring 122 that presses the outer sealing lip 56 with a therefore pre-specified pre-tension against the liner 28 for the shaft 24. The end part 38 of the liner 6 and the end part 40 of the liner 8 are arranged at a pre-specified angle to the connecting area 10, preferably at an angle of about 30° to 40° to the longitudinal axis of the housing, and are sealingly positioned overlapping one another with pre-tension. Thus a functionally reliable seal is attained even when there is high pressure in the interior of the housing and/or given high temperatures or changes in temperature. When the temperature increases the inner end part 38 is pressed more strongly against the outer end part 40, and when the temperature decreases the outer end part 40 is pressed against the inner end part 38. The centering collar 42 for the housing part 2 fits exactly against the centering collar 44 for the housing part 4, the metal housing parts 2, 4 furthermore being positioned directly against one another in a radial plane, relative to the longitudinal axis of the housing, in the connecting area 10.

The exemplary embodiment depicted in Fig. 8 is essentially the same as the exemplary embodiment in accordance with Fig. 2, the annular body 60 being provided in the annular space

58, especially for the purpose of specifically fixing the resilient ring 68, which pre-stresses the outer sealing lip 56. Furthermore, the lower sealing lip 54 is surrounded by a ring 124 that is also preferably resilient. This ring 124 is also supported on an annular shoulder 126 of the liner 28 and furthermore on the inner arm 74 of the sealing element 34. As in Fig. 7, the cover 36 is joined to the housing part 4 via the thread connection 118.

The exemplary embodiment depicted in Figs. 9 and 10 includes a spring element 128 that surrounds the outer sealing lip 116 of the sealing element 34 and that is embodied essentially in a V-shape and usefully comprises spring steel. The spring element 128 is positioned on one side against the outer sealing lip 56 and on the other side against the outer arm 76 of the sealing element 34 under pre-tension. Moreover, a curved connecting part 130 of the spring element 128 is positioned on the annular part or support ring 64, the latter thereby being additionally stiffened for the purpose of reliable support and/or bearing for the shaft 24. The connecting part 130 is embodied closed across the circumference, while the parts of the spring element arranged toward the cover 36 essentially in a V shape are divided into segments 136, 138 in a sector-like manner by slits 132, 134 in order to facilitate the necessary conformability and/or movability for the sealing element 34.

One special exemplary embodiment of the sealing element 34 is depicted in a perspective view in Fig. 11 and enlarged and in partial cut-away in Fig. 12. The sealing element 34 includes an X-shaped spring element or sealing element or two spring elements 128, 140 that are surrounded by the plastic and/or elastomer material of the sealing element 34 and/or are integrated in the plastic and/or the elastomer material. The first spring element 128, which is integrated in the outer sealing lip 56, is essentially embodied as in the prior exemplary embodiment with the annular connecting part 130 closed across the circumference. The part integrated in the outer arm 76 is extended radially outward up to the flange 116 and is free of plastic to the outside and upward in accordance with the drawing. The aforesaid division into segments 136, 138 is also provided. The second spring element 140 is essentially correspondingly embodied, but is completely integrated in the inner sealing lip 54 and the inner arm 74 and consequently protected from the flow medium. The second spring element 140 is also embodied essentially in a V shape with a connecting part 142 that is closed across the circumference, this attaining additional stiffening of the annular part 64 that is embodied as a support ring. In addition, the second spring element 140 is also divided into segments. Both the segments 136, 138 of the first spring element 128 and the

segments of the second spring element 140 include through-holes 144, 146 that are filled with plastic from the sealing element, this ensuring overall a functionally reliable connection between the spring elements 128, 140 and the sealing element 34 and integration therein.

Figs. 13 and 14 depict a special embodiment of the inventive valve, the cover 36 that closes off the opening 26 from the outside not being shown in Fig. 13. The spherical inner surface 78 of the support ring 64 that is integrated in the sealing element 34 is positioned against the spherical outer surface 50, like the inner sealing lip 54 and the outer sealing lip 56. The inner and outer arms 74, 76 of the X-shaped sealing element and furthermore also the support ring 64 are positioned radially outward against the liner 8 of the housing part and are thus supported indirectly in the housing part 4. The spring element 128 is arranged in the annular space 58 between the outer sealing lip 56 and the outer arm 76. The spring element 128 includes an annular bar 148 that faces the cover 36 and a first leg 150 that is positioned radially inwardly against the outer sealing lip 56 and a second leg 152 that is positioned against the outer arm 76 and that is preferably embodied closed across its circumference. The bar 148 and the first leg 150 include through-slits 132 such that a number of spring segments 154 are present distributed across the circumference. The annular spring element 128 is fixed in the annular space 58 by means of the cover 36, the spring element 128 having radially outward an annular shoulder 156 that is supported on the cover 36. The outer sealing lip 56 is pressed with pre-specified spring force against the spherical outer surface 50 by means of the spring element 128, the free end of the outer sealing lip 56 also being pressed against the essentially cylindrical part of the liner 28 and thus also indirectly against the shaft 24 with a pre-specified pre-tension. Because the first leg 150 is divided into the spring segments 154, the latter can be deflected independently of one another and/or as a function of the pivot angle and/or they can exert the pre-tension on the outer sealing lip 56 as indicated by the double arrow 158. Moreover, a self-adjusting shaft seal is attained with the spring element 128, and specifically especially with its first leg 150 and/or the aforesaid spring segments 154, so that a durable and functionally reliable seal is assured by means of the sealing element 34 despite abrasion or wear of the inner surface of the outer sealing lip 56 and/or the liner 28.

Furthermore, with the invention the pre-tension and/or the spring element 128 can be adjusted. As the dot-dash line 160 indicates, adjusting elements as explained for Fig. 1 are provided in the cover 36, usefully distributed across the circumference. When needed, the pre-tension acting on

the outer sealing lip 56 by means of the spring element 128 can be changed and especially increased by means of such adjusting elements, which cooperate with the annular shoulder 156 of the spring element or support the spring element. Long tool times for the valve, with minimized leak rates, are ensured using the shaft seal that is self-adjusting in this manner and that is preferably also adjustable.

Legend

2, 4	Housing part
6,8	Liner
10	Connecting area for 2, 4
12	Screw
14	Flow channel
16	Rotational body
18	Through-opening in 16
20	Longitudinal axis of 2, 4
22	Rotational axis of 16
24	Shaft
26	Opening
28	Liner/covering for 16, 24
30, 32	Seat ring
34	Sealing element
36	Cover
38	End part of 6
40	End part of 8
42	Centering collar for 2
44	Centering collar for 4
46	Expanded part of 24
48	Spherical outer surface of 24 and 46
50	Spherical outer surface of 28
52	Flange of 24
54	Inner sealing lip of 34
56	Outer sealing lip of 34
58	Annular space about 56
60	Annular body in 58
62	Adjusting element
64	Support ring/annular part of 34
66	Sealing ring
68	Resilient ring

- 70 Additional ring in 72
- 72 Annular space about 54
- 74 Inner arm of 34
- 76 Outer arm of 34
- 78 Spherical inner surface of 64
- 80 Pivot movement/dot-dash line
- 82 Pivot axis
- 84 Arrow
- 86 Contact surface for 54
- 88 Contact surface for 56
- 116 Flange/membrane seal on 76
- 118 Thread connection
- 120 Bar of cover 36
- 122 Resilient ring about 56
- 124 Resilient ring about 54
- 126 Annular shoulder
- 128 First spring element
- 130 Connecting part for 128
- 132, 134 Slit in 128
- 136, 138 Segment for 128
- 140 Second spring element
- 142 Connecting part for 140
- 144, 146 Through-hole in 136, 138
- 148 Annular bar for 128
- 150 First leg of 128
- 152 Second leg of 128
- 154 Spring segment of 128
- 156 Annular shoulder
- 158 Double arrow
- 160 Dot-dash line

CLAIMS:

1. A valve having a flow path for a flow medium, comprising:

a housing having a first opening and a through-opening;

a rotational body arranged rotatably in the housing and having a through-opening;

first and second seat rings spaced apart in the housing, each positioned against an outer surface of the rotational body to seal against leakage of the flow medium;

a shaft fixedly linked to the rotational body and extending outwardly through the first opening in the housing, the shaft having a spherical outer surface over at least a part of the shaft; and

a sealing element, positioned against the spherical outer surface, comprising a sealing lip and a support ring, the support ring being significantly stiffer than the sealing lip, the support ring having a spherical inner surface with a curvature corresponding to a curvature of the shaft part's spherical outer surface, the shaft being supported on the support ring via the shaft part's spherical outer surface;

wherein the flow path is defined by the housing through-opening and the rotational body through-opening and is either one of closed or at least partially open as determined by rotational angle position of the rotational body about a rotational axis; and

wherein the rotational body and fixedly linked shaft move in unison to pivot about a pivot axis that is orthogonal to the rotational axis, the pivot axis being associated with the shaft part's spherical outer surface.

2. The valve of claim 1, wherein the support ring is located in the first opening and surrounds at least a portion of the shaft part.

3. The valve of claim 1, wherein a cross section of the sealing element has an X shape.

4. The valve of claim 1, wherein the sealing lip is a first sealing lip, the sealing element further comprising a second sealing lip, the first and second sealing lips being spaced apart relative to the rotational axis.

5. The valve of claim 1, wherein said significantly greater stiffness of the support ring occurs radially.

6. The valve of claim 1, wherein the support ring is an integral component of the sealing element, an outer surface and an inner surface of the support ring each being curved and each having a center of curvature at the rotational axis.

7. The valve of claim 1, wherein the sealing element further comprises at the sealing element's outer surface a resilient element which forms a self-adjusting, shaft seal.

8. The valve of claim 1, wherein the sealing element further comprises an annular body that allows a sealing force between the shaft portion and the sealing element to be adjustable.

9. The valve of claim 1, wherein an interior of the housing at the first opening is lined with a fluoroplastic liner over an area closed off from outside the valve.
10. The valve of claim 1, wherein the housing comprises two housing parts joined at a connecting area, wherein an interior of the housing is lined with a fluoroplastic liner, end parts of the liner reaching from the first opening to at least the connecting area, the end parts arranged conically relative to a housing longitudinal axis and overlapping one another.
11. The valve of claim 1, wherein the housing comprises two metal housing parts coaxially arranged along a longitudinal axis of the housing, the two housing parts each having a centering collar and being located adjacent to one another in a connecting area.
12. The valve of claim 1, wherein the sealing lip is pressed toward the shaft with a resilient spring to a pre-specified pre-tension.
13. The valve of claim 1, wherein a cross-section of the sealing element has an X-shape with an outer arm, the sealing element further comprising a flange at the outer arm oriented radially relative to the rotational axis, the flange providing a membrane seal between a cover of the first opening and a surrounding part of the housing.
14. The valve of claim 1, wherein a pivot bearing having a pivot axis is arranged in the first opening, the pivot bearing comprising the support ring and allowing relative movement between the shaft and the housing at the first opening, the support ring having a radially inner surface positioned against the outer spherical surface of the shaft part and having a radially outer surface toward a wall of the first opening.

15. The valve of claim 1, wherein the support ring includes an axial extension for surrounding the shaft part's spherical outer surface with respect to the rotational axis, wherein the pivot axis is in a direction radially through the support ring, and wherein with the shaft being supported on the support ring via the shaft part's spherical outer surface said rotational body and the shaft fixedly linked to the rotational body, the rotational body is floatingly borne in the housing.

16. The valve of claim 1, wherein the shaft bulges along at least a partial length of the shaft to define an outer surface contour having a spherical arc shape in a shaft lengthwise direction.

17. A valve having a flow path for a flow medium, comprising:

a housing having a first opening and a through-opening;

a rotational body arranged rotatably in the housing and having a through-opening;

first and second seat rings spaced apart in the housing, each positioned against an outer surface of the rotational body to seal against leakage of the flow medium;

a shaft fixedly linked to the rotational body and extending outwardly through the first opening in the housing; and

a sealing element, positioned against the spherical outer surface, comprising a sealing lip and a support ring, the support ring being significantly stiffer than the sealing lip;

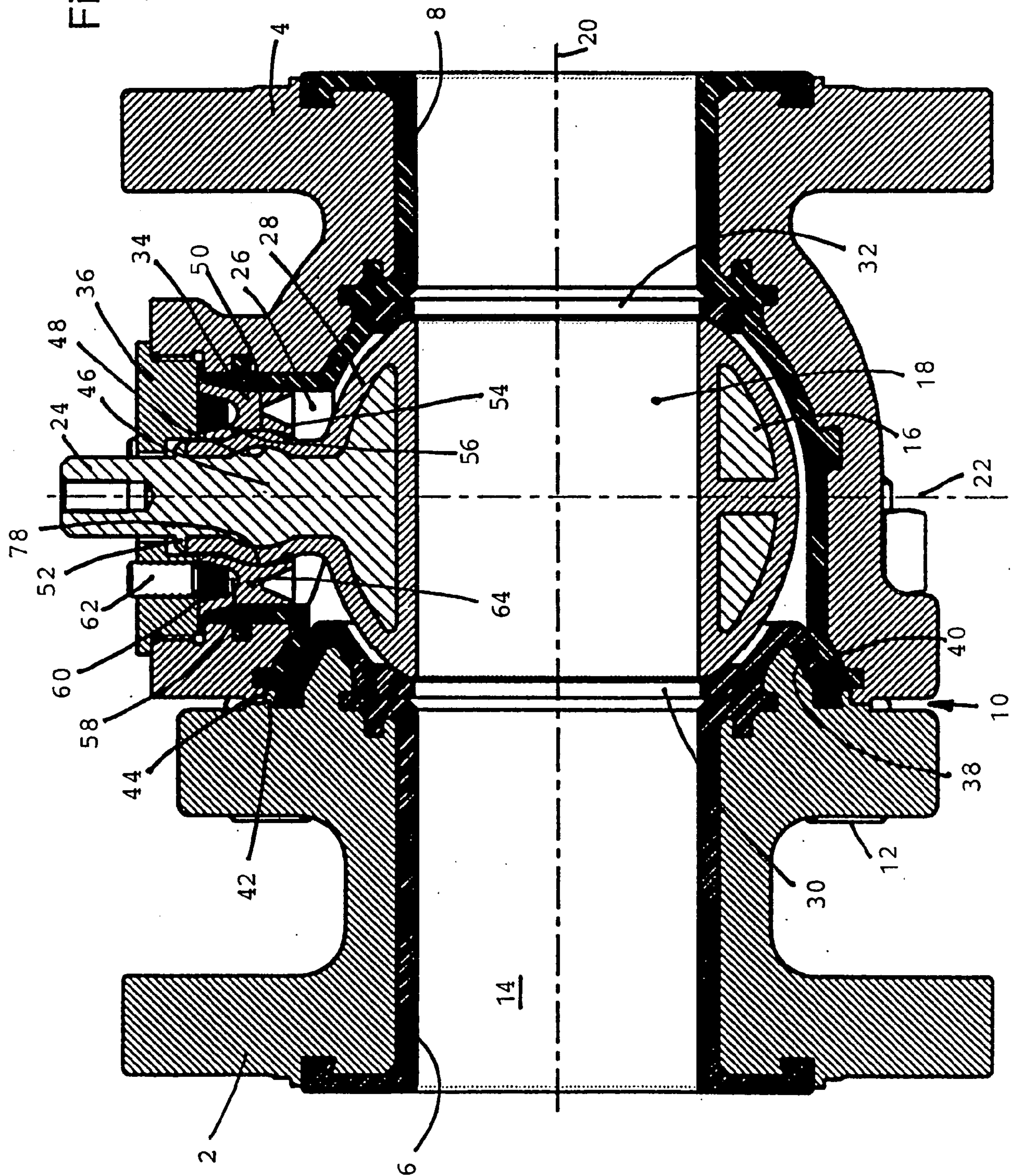
wherein the shaft has a cross sectional area along a first partial length of the shaft defined by a first perimeter, and has an increased cross sectional area along a second partial length of the shaft defined by a second perimeter greater than said first perimeter, and wherein the support

ring has an inner surface that conforms to at least said second perimeter for restricting axial and linear displacement of the shaft, while allowing rotational motion of the shaft, the shaft being supported on the support ring at the shaft part's second partial length;

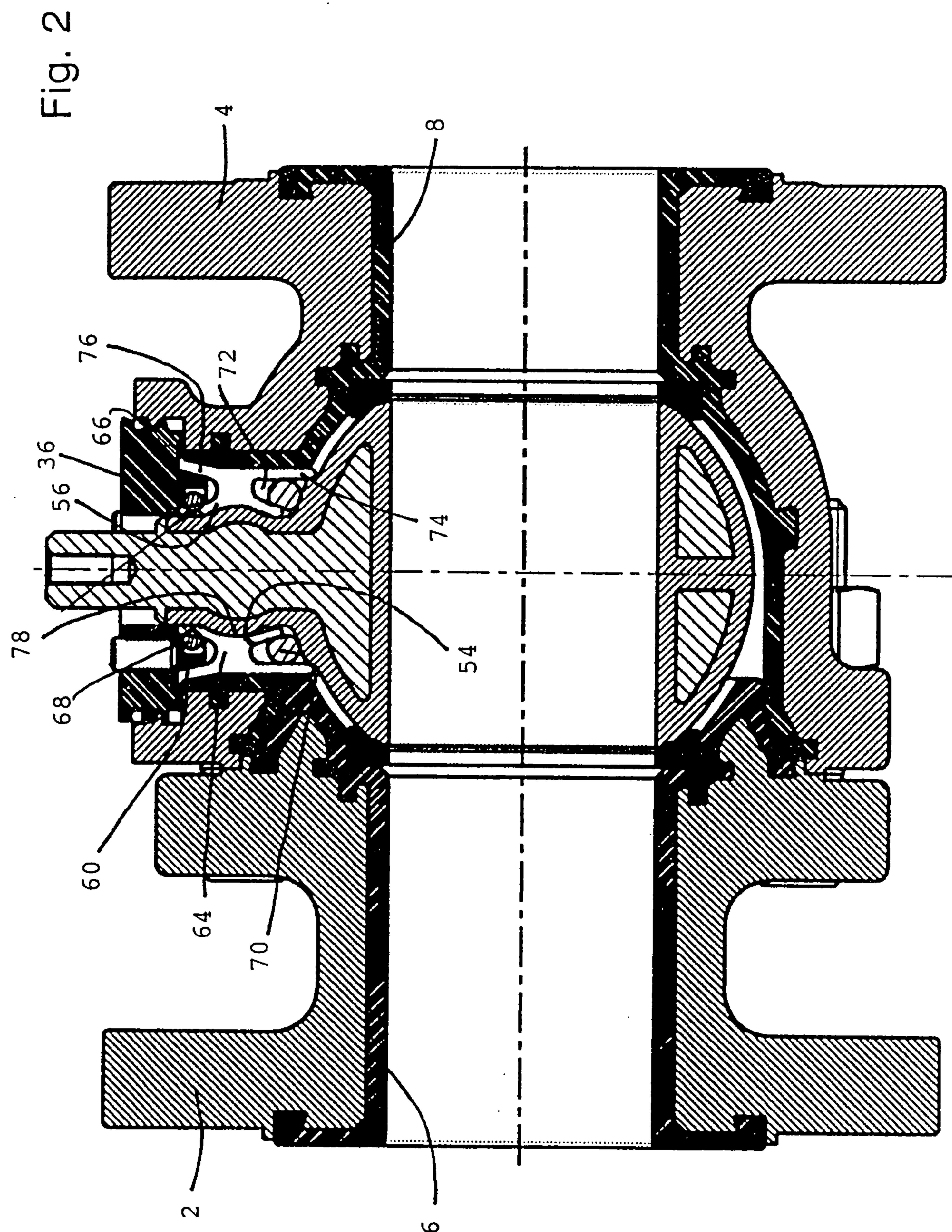
wherein the flow path is defined by the housing through-opening and the rotational body through-opening and is either one of closed or at least partially open as determined by rotational angle position of the rotational body about a rotational axis; and

wherein the rotational body and fixedly linked shaft move in unison to pivot about a pivot axis that is orthogonal to the rotational axis, the pivot axis being associated with the shaft part's second partial length.

Fig. 1



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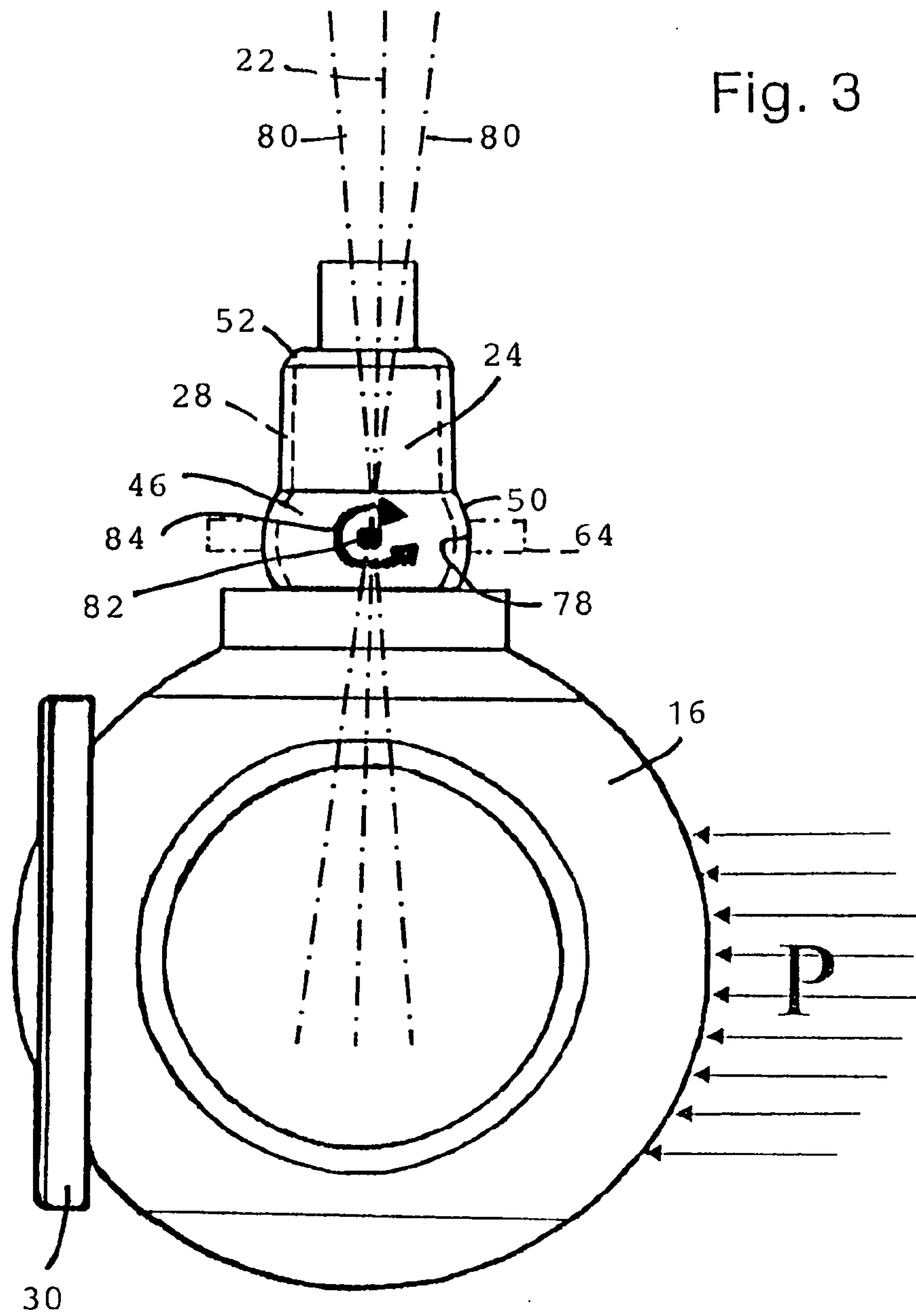
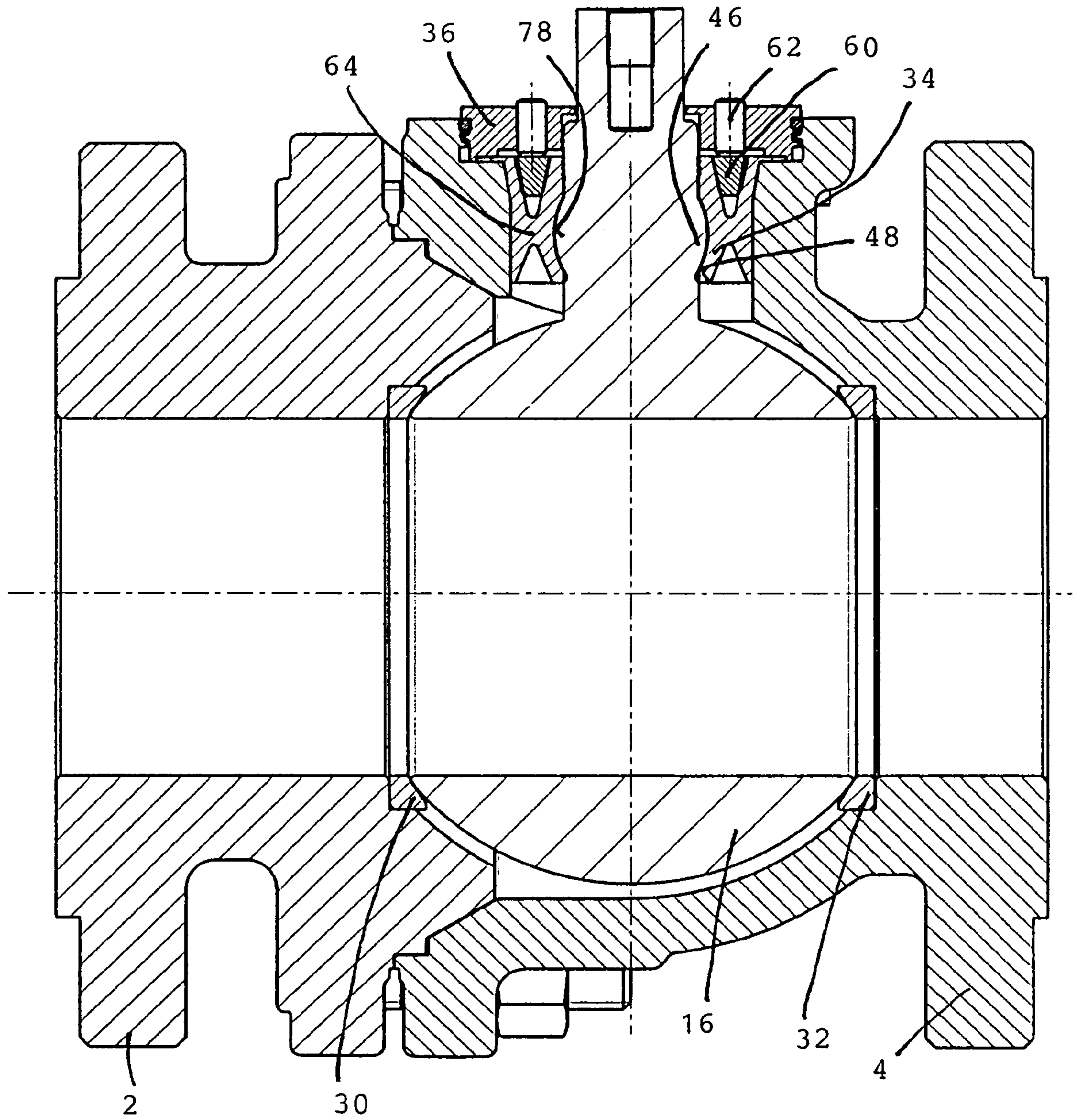
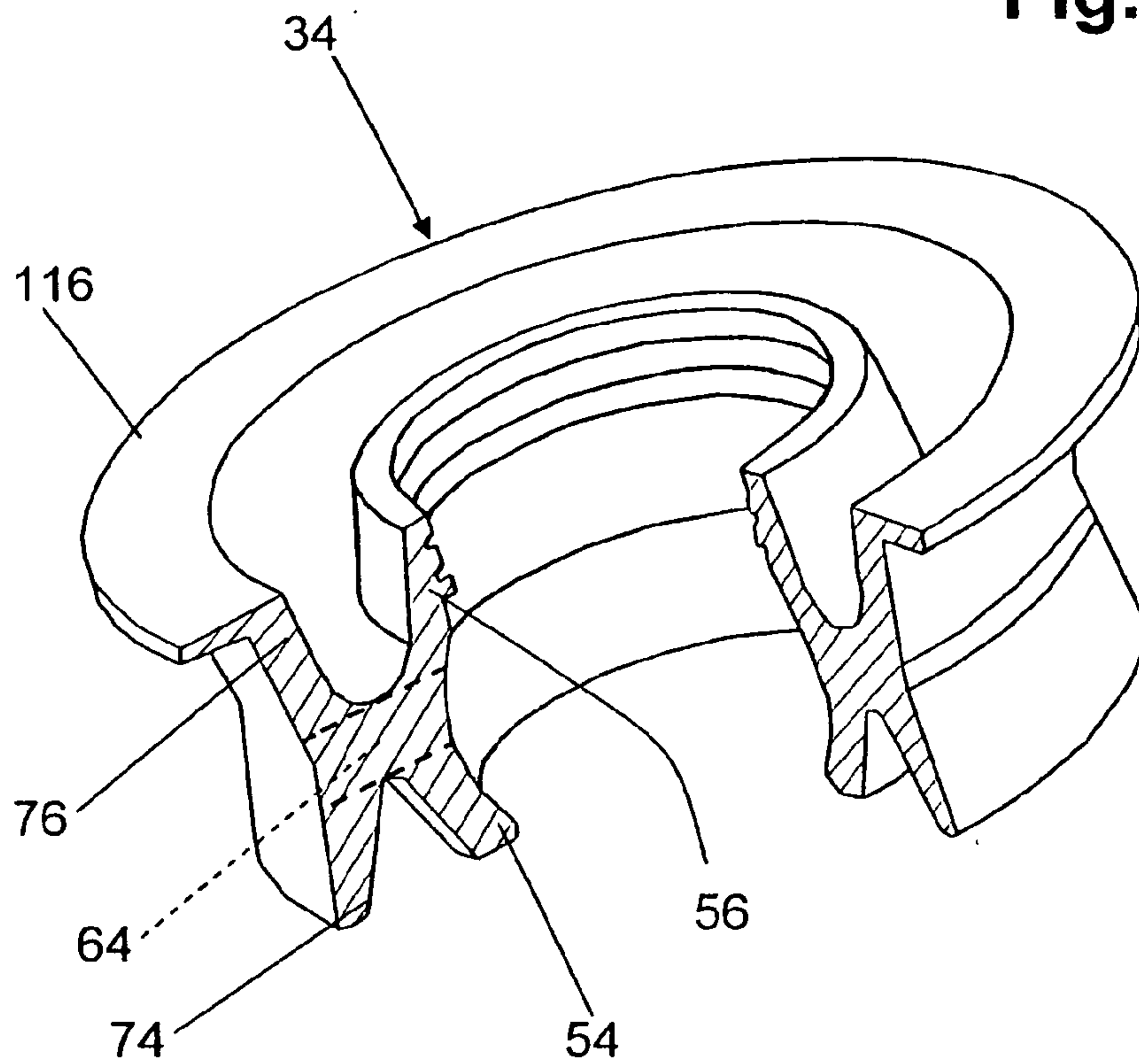
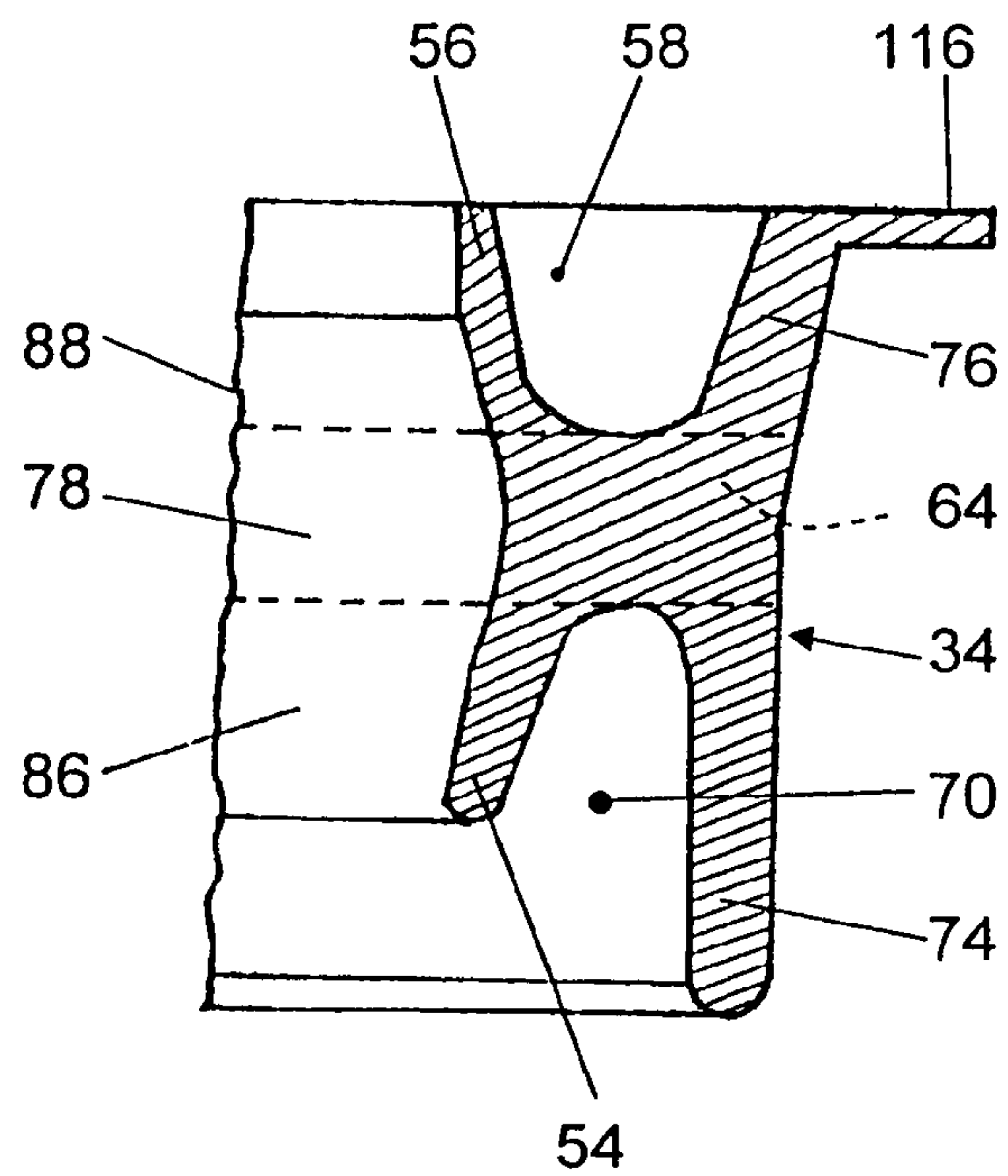


Fig. 4



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Fig. 5**Fig. 6**

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Fig. 7

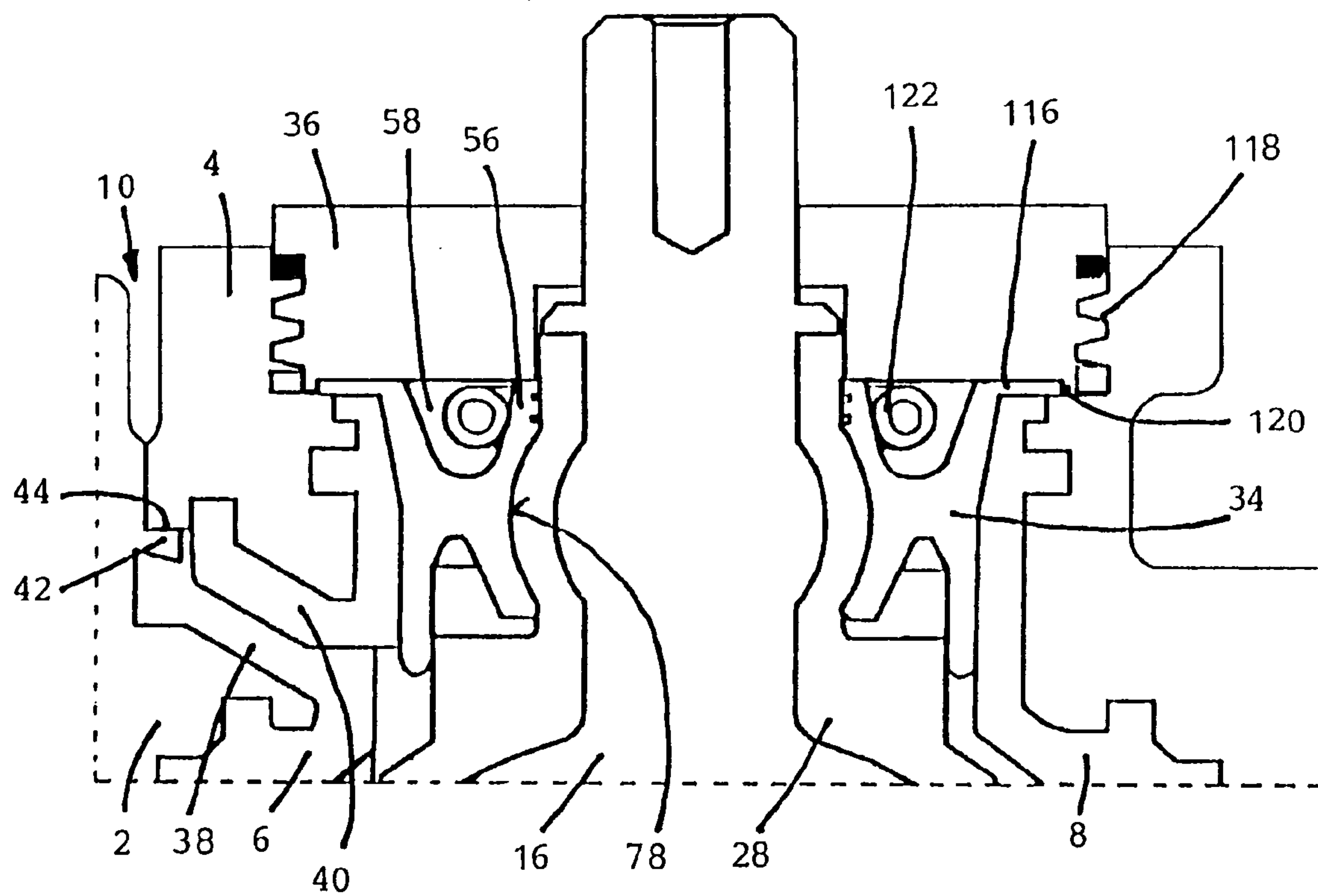
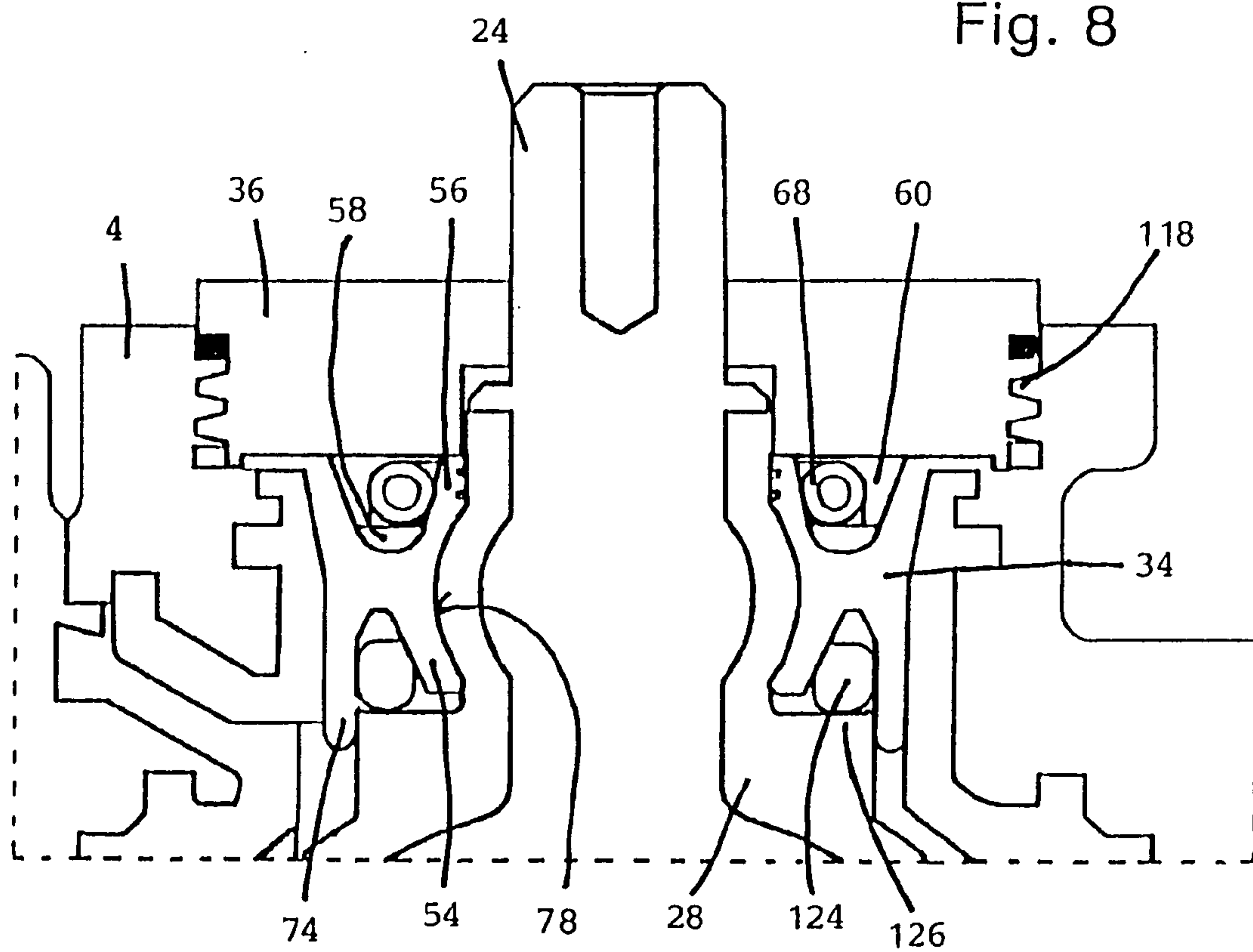


Fig. 8



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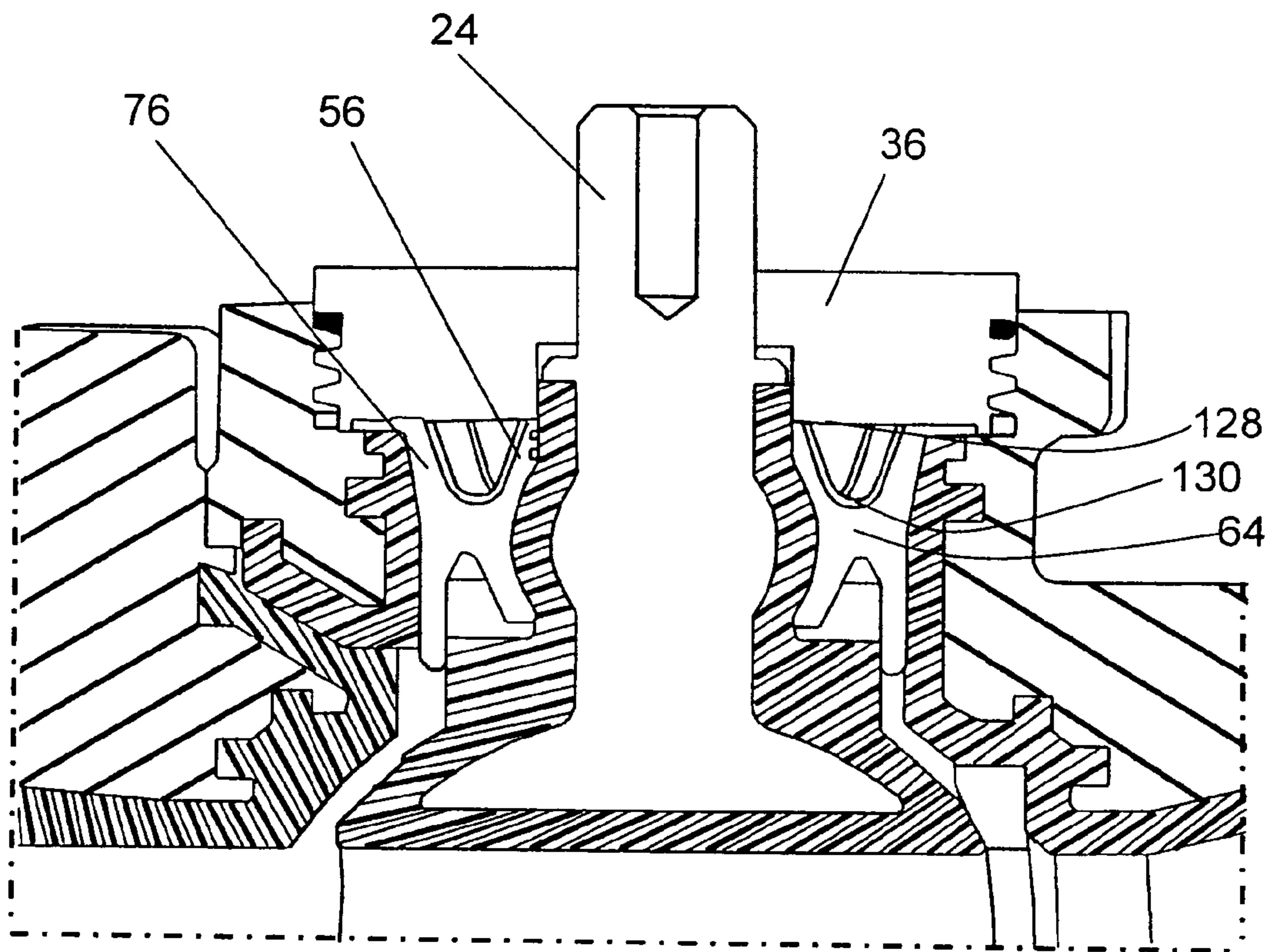
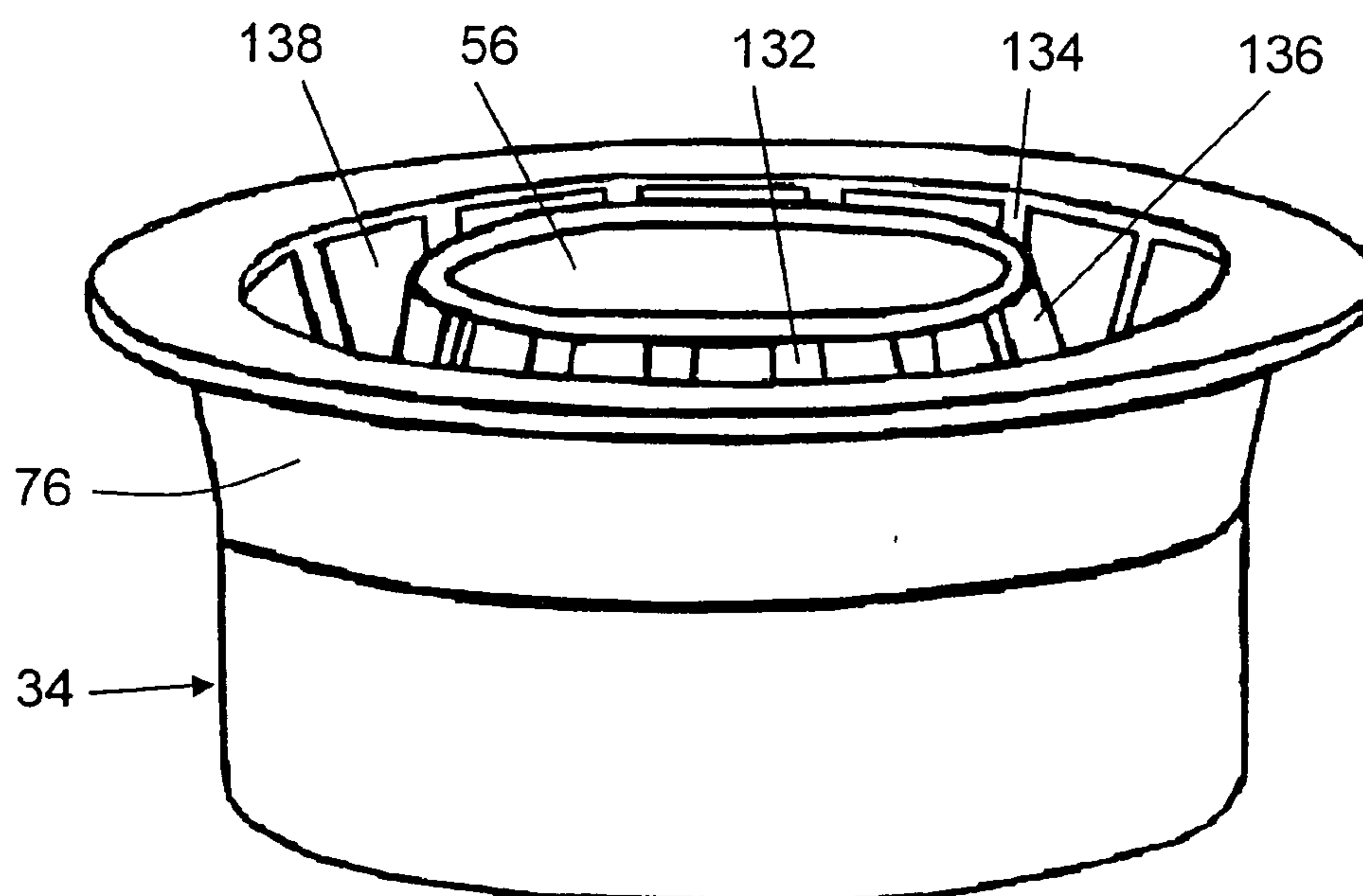
Fig. 9**Fig. 10**

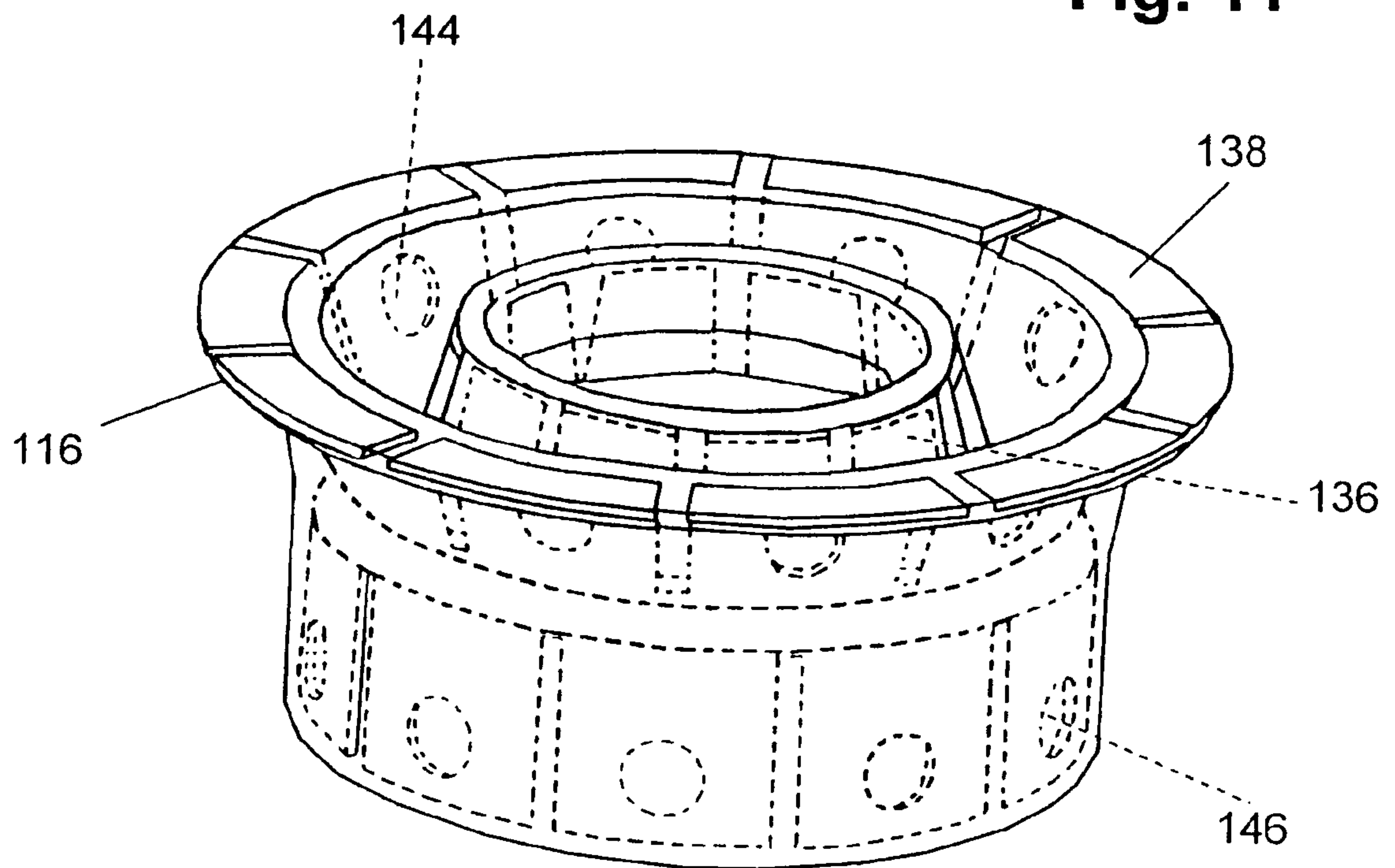
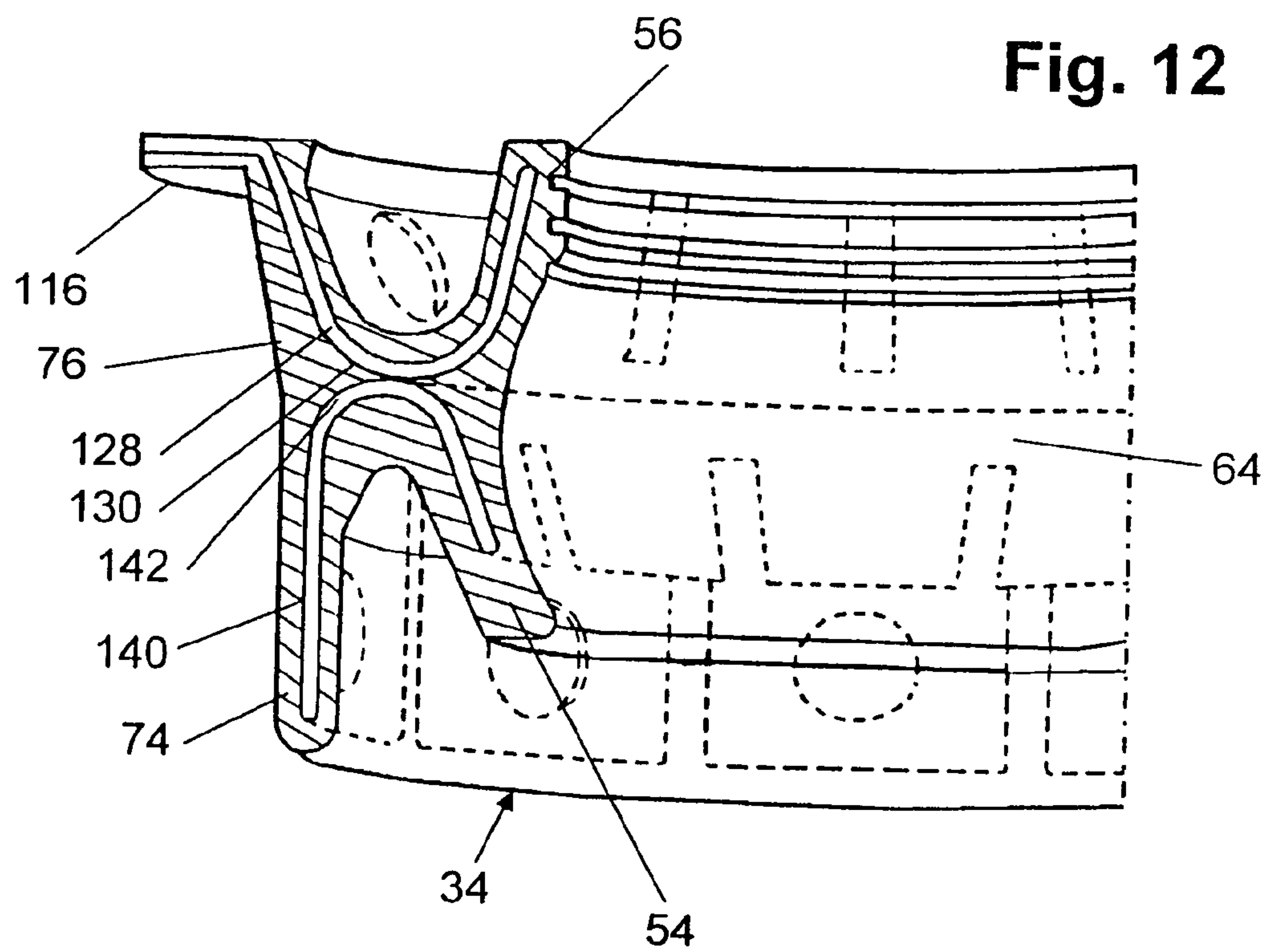
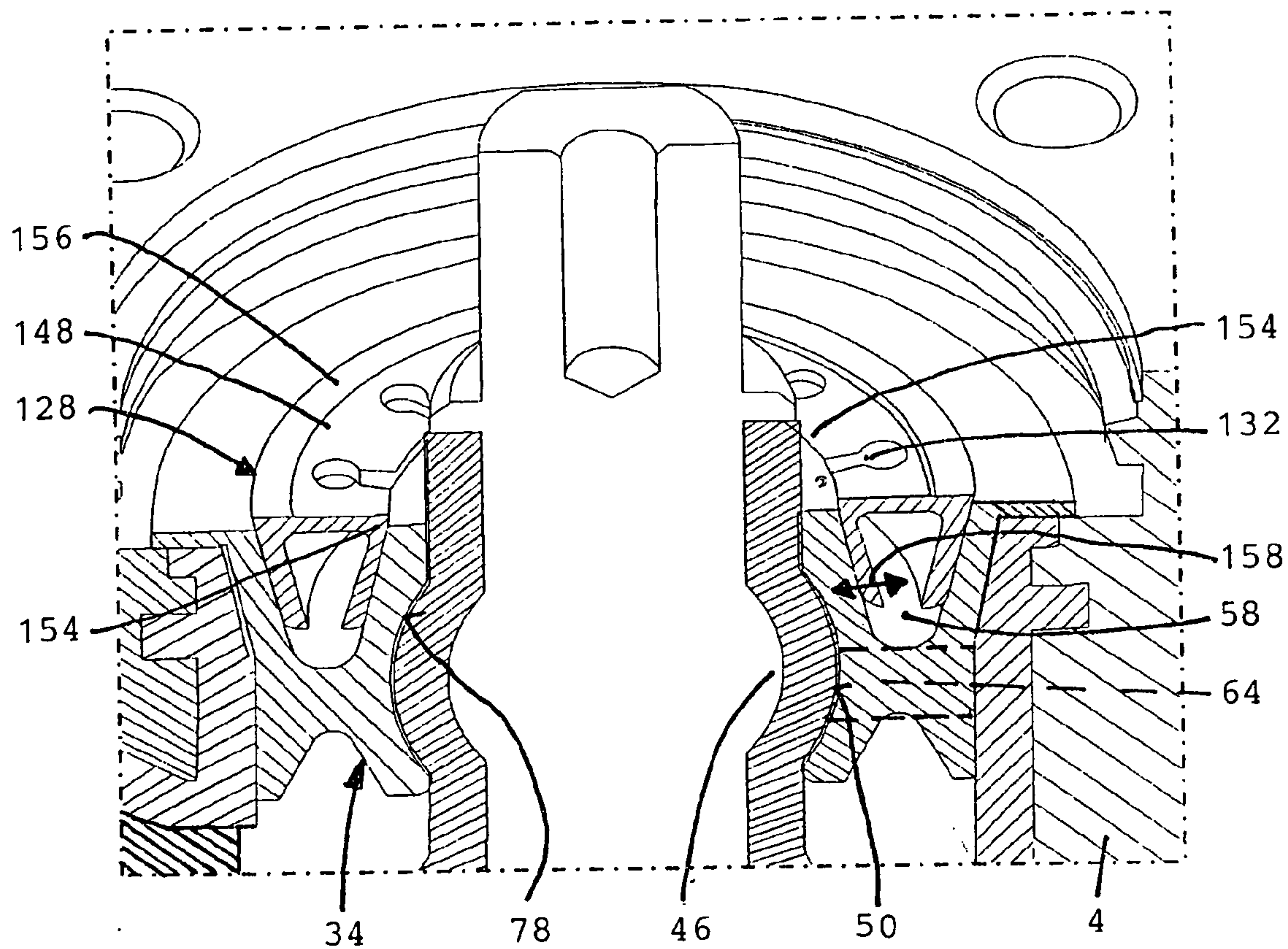
Fig. 11**Fig. 12**

Fig. 13**Fig. 14**