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DESCRIPTION

[0001] The present invention relates to a device as defined in the preamble of claim 1, for ensuring continuous circulation in well drilling, particularly during insertion or removal of a drill string in wells for hydrocarbon exploration and production.

[0002] For simplicity, the present disclosure will be made without limitation with particular reference to the step of insertion of a new drill string, the same considerations being also applicable to the step of removal of drill strings, when the drilling bit must be removed from the well, e.g. for replacement.

[0003] When drilling a hydrocarbon well, the process of insertion of a drill string is required for increasing the well drilling depth.

[0004] During insertion of a new string, continuous circulation of drilling mud must be ensured throughout the process until a complete pipe is obtained and the whole hydraulic circuit is restored. Indeed, pressure drops or variations in mud circulation have been found to cause considerable structural stresses in the well being drilled, which involve collapse in uncased structures of the well being drilled.

[0005] In order to ensure such continuous circulation of drilling mud throughout the drilling process, and hence also during the steps of insertion of new drill strings or removal of existing strings, devices have been long provided, for ensuring steady circulation of drilling mud even during insertion or removal of a drill string.

[0006] For example, US 3,298,385 discloses a coupling device which is designed to ensure the above mentioned continuous circulation of drilling mud. Particularly, this device has an axial conduit through which the axial flow of drilling mud has to be ensured, and a lateral conduit communicating with the axial conduit through which a lateral flow of drilling mud may be fed. Valve means are inserted in the axial conduit, upstream from the lateral conduit, and have a shut-off member that can move between two distinct limit-stop positions, in which it safely closes the lateral conduit or the axial conduit. Under normal conditions, the self-weight of the movable shut-off member moves it close to the seat for the shut-off member, located at the lateral conduit.

[0007] Concerning the device of US 3,298,385, it shall be noted that, while it is able to ensure continuous circulation of drilling mud even during addition of a new drill string (the new string being namely tightened into the nut screw provided at the upper end of the axial conduit of the device), it is affected by a number of technical drawbacks, that have limited its actual employment.

[0008] Particularly, once the device is fitted into the drill equipment between strings, the position of the movable shut-off member in the axial conduit is not well-defined.

[0009] Also, it shall be noted that any vibration propagating upwards from the drilling bit along the strings might cause the shut-off member to hammer against the shut-off member located at the lateral conduit, thereby causing wear/failure of the shut-off member itself. Very often, this hammering effect is also caused by the turbulent flow of the drilling mud introduced into the axial conduit.

[0010] Therefore, there arises the need of surely checking the position of the shut-off member in the axial conduit.

[0011] Document WO 2011/047163 A2 discloses a flapper valve with magnetic field hold open arrangement including a housing; a flapper pivotally mounted to the housing; and a magnet housing slidably mounted to the housing such that a magnetic field generating configuration of the magnet housing is movable between a position where it is capable of holding the flapper in an open position and where it is incapable of holding the flapper in an open position. More precisely, from figure 5 of WO 2011/047163) it results that the magnetic means (act between the external surface of the flapper and the wall of the magnet house.

[0012] US 7,845,433 provides a different dual-closure arrangement, i.e. having two distinct shut-off members (e.g. of the so-called flapper type): a first shut-off member designed for closing the axial conduit to temporarily stop the circulation of drilling mud from above the axial conduit, and another designed for closing the lateral conduit to allow the axial conduit section placed downstream from the first shut-off member to be fed with drilling mud flowing through the lateral conduit.

[0013] The device of US 7,845,433 uses springs associated with the shut-off member to move the shut-off member itself to the rest position, in an attempt to obviate the problems noted above with reference to US 3,298,385. In this respect, it shall be only noted that the technical solution of positioning the shut-off member in the tubular body of the device by the provision of springs is rather problematic, not only due to the acidity of the drilling mud, which is aggressive for the spring metal, but also because the flow of the drilling mud impinging upon the springs causes high wear levels on the springs and hinders operation thereof.

[0014] Furthermore, the provision of two distinct shut-off members is twice as problematic, and causes undesired operating conditions in the device, with the exact position of the shut-off members and the actual opened or closed state of the axial or lateral channel being not easily checked or determined, which will cause hazards for the operators at the well head, especially during removal of strings from the drill fittings. Indeed, during removal of a string, two devices are under pressure outside the well, one at eye level, i.e. at the same height as the drilling floor or working floor, and the other at the top of the string to be removed from the drill fittings.

[0015] In this respect it shall only be noted that drilling mud pressures are of the order or 300 atmospheres or more on average, and hence before disconnecting a part of the device the designated shut-off member shall be surely determined to perform its opening or closing task

as required by the particular working step.

[0016] The present invention is based on the problem of conceiving a device for ensuring continuous circulation in well drilling, particularly during insertion or removal of a drill string into and out of wells for hydrocarbon exploration and production, that has such structural and functional characteristics as to fulfill the above need, while obviating the above mentioned prior art drawbacks.

[0017] This problem is solved by a device for ensuring continuous circulation in well drilling as defined in claim 1.

[0018] Further features and advantages of the device of the present invention for ensuring continuous circulation in well drilling will be apparent from the following description of a preferred exemplary embodiment thereof, which is given by way of illustration and without limitation with reference to the accompanying figures, in which:

- Figure 1 shows a simplified longitudinal sectional view of the device of the invention, with the lateral conduit closed by the shut-off member in a longitudinal position;
- Figure 2 shows a longitudinal sectional view of the device of Figure 1, with the axial conduit closed by the shut-off member in a transverse position;
- Figure 3 is an exploded view of the main parts of figure 1;
- Figures 4a and 4b show the device of the invention in the configurations of Figure 1 and Figure 2 respectively, arrows being added to indicate the axis and direction followed by the drilling mud in two different configurations of use, according to the position assumed by the shut-off member;
- Figure 5 shows a simplified diagrammatic perspective view of the device of Figure 1, in which means for positioning and centering the tubular support for the shut-off member may be seen;
- Figure 5a only shows the detail of the tubular support for the shut-off member and its seal;
- Figure 6 only shows the detail of the tubular body of the device of Figure 5;
- Figure 7 shows a detail of the tubular support for the shut-off member of Figure 5a,
- Figure 8 diagrammatically shows the circumferential arrangement of the positioning and centering means in the tubular body of the device of Figure 5,
- Figure 9 shows a cross-sectional view of a detail of the device of Figure 1 with the shut-off member in longitudinal position;
- Figure 10 is a simplified view of the shut-off and the plug of figure 9;
- Figure 11 shows cross-sectional perspective view of the plug of the device of figure 1 and
- Figure 12 shows a plane front view of the plug of the device of figure 1.

[0019] Referring to the accompanying figures, numeral 1 generally designates an inventive device for ensuring continuous circulation in well drilling, namely a device for ensuring

continuous circulation in well drilling particularly during insertion or removal of a drill string into or out of wells for hydrocarbon exploration and production.

[0020] The device 1 comprises:

- a substantially tubular body 2 extending in a preset axial direction X-X from an upstream end 2a to a downstream end 2b, the tubular body 2 being shown as having a circular cylindrical section;
- an axial conduit extending from the upstream end 2a to the downstream end 2b, for drilling mud to flow therethrough in the device 1;
- first threaded connection means at the upstream end 2a for connection of the upstream end 2a of the device 1 to one end of a drill string;
- second threaded connection means at the downstream end 2b for connection of the downstream end 2b of the device 1 to one end of a drill string;
- a lateral opening 3 located in the tubular body 2 between the upstream end 2a and the downstream end 2b to define a lateral conduit in the device 1, in fluid communication with the above mentioned axial conduit, the axial conduit having an axis Y-Y which is preferably perpendicular to the axis X-X of the axial conduit;
- a plug 5 removably fitted into the lateral opening 3 in a pressure-tight manner by a threaded nut-screw engagement,
- valve means 6 located in the axial conduit to block the drilling mud and stop its flow from the upstream end 2a to the downstream end 2b;

wherein:

- these valve means comprise a shut-off member 6 that is movably supported in the axial conduit to move from a position transverse to the axial conduit (see Figures 2 and 4b), in which the shut-off member 6 extends transverse to the axis of the axial conduit to stop fluid continuity between the upstream end 2a and the downstream end 2b in the axial conduit, and a longitudinal position relative to the axial conduit (see Figures 1, 4a, 5 and 9), in which the shut-off member 6 substantially extends along the axis of the axial conduit and is located close to a side wall portion within the tubular body 2;
- in such transverse position (see Figures 2 and 4b) the shut-off member 6 is located between the lateral conduit and the upstream end 2a of the tubular body 2 to be placed upstream from the above mentioned lateral opening 3, relative to the flow of the drilling mud in the axial conduit from the upstream end 2a to the downstream end 2b and
- in such longitudinal position (see Figures 1, 4a and 5) the shut-off member 6 closes in a pressure-tight manner the lateral opening 3 to stop fluid continuity between the lateral conduit and the axial channel of the tubular body 2.

[0021] Concerning drill strings, it shall be noted that, according to an applicable industry standard, these have a male threaded lower end and an opposed nut threaded upper end, which is designed for nut-screw engagement with the lower end of a different drill string.

According to this standard, in the device 1 the first screw connection means of the upstream end 2a are a nut screw, and the second screw connection means of the downstream end 2b are male screw threads.

[0022] At the lateral opening 3, the tubular body 2 of the device 1 has a seat for the shut-off member which is designed for pressure-tight engagement by the shut-off member 6, when such shut-off member is in the above mentioned longitudinal position (see Figures 1, 4a and 5), such seat for the shut-off member allowing the lateral opening 3 and the lateral channel defined thereby to be closed in a pressure-tight manner, as mentioned above.

[0023] Preferably, such seat for the shut-off member is an inserted seat 7, and is associated in integral and pressure-tight fashion with the tubular body 2. In accordance with the illustrated embodiment, the inserted seat 7 for the shut-off member is defined by a threaded ring nut, having:

- an outer portion with male screw threads, for pressure-tight nut-screw engagement with corresponding nut threads provided at the lateral opening 3, and
- an inner portion with nut threads, for pressure-tight screw engagement with the male screw threads of the plug 5.

[0024] Alternatively, the above-mentioned inserted seat for the shut-off member may be formed as a one-piece with the tubular body 2, and an inserted seat for the shut-off member welded to the tubular body or secured thereto in a manner other than the above described screw connection, may be also used.

[0025] Similarly, it shall be noted that the screw engagement between the plug 55 and the inserted seat 7 for the shut-off member is a preferred embodiment, although different removable pressure-tight connection arrangements may be provided.

[0026] In any case, both the inserted seat 7 and the plug 5 should have small dimensions, and be at the most flush with the footprint of the outer wall of the tubular body 2, to prevent any radially projecting portion of the tubular body 2 of the device from creating interferences in the well being drilled.

[0027] Preferably, the shut-off member 6 comprises a convex, preferably a partially spherical portion/wall, whose convexity faces the lateral opening 3. This spherical portion/wall engages such inserted seat 7 for the shut-off member in a pressure-tight manner, when the shut-off member 6 is in the above mentioned longitudinal position (see Figures 1, 4a and 5).

[0028] Preferably, the above-mentioned valve means consist of a flapper valve having a diaphragm shut-off member 6, which is connected by hinge connection means, at a peripheral portion thereof, to an axis of rotation 8, said diaphragm 6 moving from such longitudinal position (see Figures 1, 4a and 5) to such transverse position (see Figures 2 and 4b), and vice

versa, by rotating about such axis of rotation 8. Such axis of rotation 8:

- extends transverse, preferably perpendicular, to the longitudinal axis X-X of said axial conduit;
- is placed close to the inner wall of said tubular body 2;
- is circumferentially placed to be substantially located at said lateral opening 3 and
- is located substantially proximate to said lateral opening 3 in the portion of the tubular body 2 located between said lateral opening 3 and the upstream end 2a of the tubular body 2.

[0029] As a result, when the tubular body 2 is placed with the longitudinal axis substantially in a vertical orientation, with the upstream end 2a located at a higher level than the downstream end 2b:

- the above mentioned hinge connection means and the axis of rotation 8 are placed above the through opening 3 and
- due to its weight force the diaphragm tends to move to the above mentioned longitudinal position (see Figures 1, 4a and 5), in which it seals the lateral opening 3.

[0030] According to the preferred embodiment of the figures, the shut-off member 6 and the hinge connection means are supported by a tubular support 9 for the shut-off member, which is diagrammatically shown in Figure 5a, and is concentrically fitted in a pressure-tight manner into the tubular conduit defined in the tubular body 2 from the upstream end 2a to an axial end-of stroke position as defined by positioning and centering means 11, 12.

[0031] As shown in the figures, seal means 24 are provided between the tubular support 9 and the inner tubular wall of the tubular body, to afford pressure tightness. For this purpose, an annular seat is provided in the exterior of the tubular support 9, in which the seal means 24 are housed in outwardly projecting arrangement for interference with the inner tubular wall of the tubular body 2.

[0032] Preferably, these positioning and centering means 11, 12 define a polarized insertion key, which is adapted to allow insertion of the tubular support 9 into the tubular conduit defined in the tubular body 2 to said limit stop axial position only when the tubular support 9 is properly angularly rotated relative to the axis X-X of the axial conduit X-X such, in the above mentioned longitudinal position (see Figures 1, 4a and 5) the shut-off member 6 is located over said lateral opening 3 (namely in pressure-tight engagement relationship with the seat 7 for the shut-off member) for pressure-tight closure thereof.

[0033] According to the illustrated embodiment, the above mentioned positioning and centering means comprise a plurality of supporting pawls 11, which radially project out of the

inner tubular wall of the tubular body 2 into the axial conduit, as well as a corresponding plurality of recesses 12 provided in the outer wall of the tubular support 9.

[0034] More in detail, the tubular body 2 comprises three distinct supporting pawls 11, preferably located on the same diametral plane, which are in such position that a first pawl 11a is circumferentially spaced from the two remaining pawls 11b by a first angle, other than a second angle that circumferentially separates the two remaining pawls 11b. In the example of Figure 8, the first angle is 130° and the second angle is 100°.

[0035] Likewise, the tubular support 9 comprises three recesses 12, i.e. a first recess designed for engagement by the first pawl 11a and two remaining recesses designed for engagement by the remaining pawls 11b.

[0036] It shall be noted that the above mentioned recesses 12 consist of grooves formed in the outer tubular wall of the tubular support 9 from the head end 9b of such support facing the downstream end 2b of the tubular body 2.

[0037] With the above described circumferential arrangement of the supporting pawls 11 and the recesses 12, it will be appreciated that the introduction of the tubular support 9 into the conduit of the tubular body 2 from the upstream end 2a thereof until the head ends 23 of the recesses 12 abut their respective pawls is only allowed at a single particular circumferential position of the tubular support 9 about the axis X-X of the tubular body 2.

[0038] This arrangement is the above mentioned polarized insertion key, which is adapted to ensure that, in such longitudinal position (see Figures 1, 4a and 5), the shut-off member 6 will be located exactly at the lateral opening 3, thereby providing the above mentioned pressure-tight engagement with the seat 7 for the shut-off member.

[0039] Preferably, the two remaining recesses have such a circumferential width as to allow insertion of their respective supporting pawls 11b with a circumferential clearance, whereas the circumferential width of the recess 12a allows its respective supporting pawl 11a to fit therein with a reduced clearance. Preferably, the above mentioned recess 12a is shaped with a lead-in flare (see Figure 7) at the head end 9b of the tubular support 9, for facilitated insertion of the supporting pawl 11a into the recess 12a.

[0040] As an alternative to the above, the positioning and centering means may have different shapes and/or the polarized insertion key between the tubular body 2 and the tubular support 9 may be obtained in a structurally or functionally different manner, the above arrangement having the advantage of being simple, reliable, easily connectable and inexpensive.

[0041] The device 1 further comprises retainer means 13 for maintaining the tubular support 9 inserted in the axial conduit, in the above mentioned limit stop axial position.

[0042] The retainer means 13 comprise:

- a plurality of retainer elements 14, placed in said tubular conduit in a circumferentially offset position and close to the head end 9a of the tubular support 9 facing the upstream end 2a of the tubular body 2, said retainer elements 14 acting as retainer means to prevent the tubular support 9 from axially moving toward the upstream end 2a of the tubular body 2;
- an inner seat 15 provided in the inner tubular wall of said tubular body 2 in which a first portion of said retainer elements 14 is accommodated and
- a locking guide 16 for maintaining said first portion of the retainer elements within the inner seat 15.

[0043] According to a preferred and advantageous embodiment, the above mentioned retainer elements 14 (e.g. a plurality of rollers located with their respective axes parallel to the longitudinal axis X-X of the tubular body 2) comprise a great number of retainer elements 14, approximately more than ten, preferably at least fifteen, for covering substantially the entire circumferential extent of the inner annular seat 15.

[0044] In practice, the above mentioned retainer elements 14 are circumferentially offset along the inner annular seat 15 in substantially juxtaposed relationship, to define as a whole an annular retainer element whose inside diameter is smaller than the inside diameter of the lateral opening 3.

[0045] According to a preferred and advantageous different embodiment, said retainer elements 14 have a spherical shape or comprise spherical surface portions. In this embodiment said above inner annular seat 15 may comprises an hemispherical shape complementary to the shape of the first portion of said retainer elements 14.

[0046] Preferably, the above mentioned first portion of the spherical retainer elements 14 inserted in the inner seat 15 is about 40-55% of the volume of the retainer elements 14. More preferably, the above mentioned first portion of the retainer elements 14 is substantially the half part of each retainer elements 14.

[0047] Preferably, the above mentioned inner seat 15 is an annular seat.

[0048] Preferably, a circumferential groove 26 is provided in the inner annular seat 15, for receiving magnets, preferably in the form of annular sectors or an open ring 18, whereby the retainer elements 14 can be held in position in the inner annular seat 15 during assembly of the device 1, namely prior to positioning of the locking guide 16.

[0049] Instead of or in addition to the provision of the above mentioned magnets in the inner annular seat 15, the retainer elements 14 may be provided in the form of magnetic elements. This may be achieved by magnetizing the retainer elements 14 or associating magnets therewith.

[0050] Concerning the above mentioned locking guide 16 for locking the retainer elements 14, it will be appreciated that it may conveniently be held in position within the tubular conduit 2, against the inner wall of the tubular conduit 2, using a Seeger ring 19, which engages in part an inner circumferential groove 20 provided in the inner tubular wall of the tubular body 2 and in part a circumferential groove 21 provided in the outer wall of the locking guide 16.

[0051] Advantageously, the device 1 comprises magnetic means for acting upon the shut-off member 6 when it is in the longitudinal position (see Figures 1, 4a and 5) or in a position close thereto, and holding it in the longitudinal position (see Figures 1, 4a and 5) with a preset load, with the shut-off member 6 being only allowed to move toward said transverse position when such load is exceeded (see Figures 2 and 4b).

[0052] According to an embodiment that is not shown in the figures, the above mentioned magnetic means may comprise one or more magnets carried by the shut-off member at the side of the shut-off member 6 facing the lateral opening 3 when the shut-off member 6 is in the above mentioned longitudinal position, whereby such magnets may interact with the inner wall of the tubular body 2, with the seat 7 for the shut-off member and/or preferably with a portion of the plug 5.

[0053] Preferably, the magnets carried by the shut-off member have a ring shape and are applied to the side of the shut-off member 6 that faces the lateral opening 3 when the shut-off member 6 is in the longitudinal position. This is particularly advantageous when the shut-off member 6 has a substantially circular shape, because the magnetic ring may be applied to the shut-off member 6 in concentric arrangement.

[0054] According to the illustrated embodiment, these magnetic means are magnetic means 22 carried by the plug 5, preferably at the inner side of the plug 5, i.e. the one that faces the above mentioned axial channel.

[0055] Preferably, the magnetic means 22 have a ring shape, as shown in figure 12, although magnets having the shape of annular sectors, disks or others may be used and placed on/in the plug 5.

[0056] Possibly, the above mentioned magnetic means may be arranged to be carried both by the plug 5 and by the shut-off member 6, in which case the magnets of the plug and the shut-off member should be arranged in substantially facing positions, for mutual magnetic attraction when the shut-off member 6 is in the above mentioned longitudinal position (see Figures 1, 4a and 5).

[0057] Preferably, there is no direct contact between the plug 5 and the shut-off member 6, a minimum distance being always provided therebetween, to avoid that residual mud prevents the shut-off member to reach the above identified longitudinal position (see Figures 1, 4a and 5 for the first embodiment and Figures 11 and 14a for the second embodiment) in which it

seals the lateral opening.

[0058] As a result, when the shut-off member 6 is in the above mentioned longitudinal position (see Figures 1, 4a, 5, 9 and 10), a closed chamber is defined between the shut-off member 6 and the plug 5. In order to provide depressurization of such chamber.

[0059] According to a preferred embodiment the plug 5 comprises an axial through opening 25 (see figures 9 to 12) at which a discharge valve (not shown) is located, which is adapted to be actuated in a pressure-tight closed state and an open state, for respectively obstructing and allowing the passage of fluid through the through opening, in the latter case allowing the passage of the drilling mud.

[0060] Therefore, by opening the above mentioned discharge valve, any drilling mud retained thereby may be evacuated, which will improve the stability of the shut-off member in the longitudinal position (see Figures 1, 4a, 5, 9 and 10), and will ensure pressure-tight closure of the lateral passage.

[0061] Preferably, the above identified magnetic means 22 are applied to the plug 5 in such a way to be disposed around said through opening where the discharge valve is housed (see figures 11 and 12).

[0062] As clearly shown in the above description, the device 1 of the present invention fulfills the above mentioned need and also obviates prior art drawbacks as set out in the introduction of this disclosure. Due to the provision of the magnetic means the shut-off member may be locked and stabilized with a preset load in its longitudinal position, while preventing undesired hammering of the shut-off member, and without requiring the presence of springs or other biasing means.

[0063] Advantageously, due to the possibility of applying the magnetic means to the plug, magnet efficiency may be checked from time to time before mounting the plug, the whole plug being possibly replaced with a fully efficient one, when needed, while the plug with the imperfectly efficient magnets may be serviced for magnet replacement.

[0064] It shall be noted that the use of commonly available "super-strong magnets" allows the device of the invention to be also employed at operating temperatures of the order of 80-90°C, which are only rarely found in drilling.

[0065] Furthermore, it shall be noted that the use of a plurality retainer elements obviates the problems that occur upon sticking and cementation thereof in the inner annular seat of the tubular body when the tubular support must be removed for maintenance.

[0066] Those skilled in the art will obviously appreciate that a number of changes and variants may be made to the above device, still within the scope of the invention, as defined in the following claims.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- WO2011047163A2 [0011]
- WO2011047163A [0011]
- US7845433B [0012] [0013]

Patentkrav

1. Indretning til at sikre kontinuerlig cirkulation i brøndboring, i særdeleshed under indsættelse eller fjernelse af en borestreng i brønde til carbonhydridefterforskning og -produktion, omfattende:

- 5 - et rørformet legeme (2) der strækker sig i en forudindstillet aksial retning fra en opstrømsende (2a) til en nedstrømsende (2b);
- en aksial ledning der strækker sig i nævnte rørformede legeme (2) fra nævnte opstrømsende (2a) og nævnte nedstrømsende (2b), som muliggør boremudder at strømme igennem indretningen (1);
- 10 - første gevindforbindelsesorgan ved nævnte opstrømsende (2a) for forbindelse af nævnte opstrømsende (2a) af indretningen til en ende af en borestreng;
- andet gevindforbindelsesorgan ved nævnte nedstrømsende (2b) for forbindelse af nævnte nedstrømsende (2b) af indretningen til en ende af en
- 15 borestreng;
- en lateral åbning (3) tilvejebragt i nævnte rørformede legeme (2) mellem nævnte opstrømsende (2a) og nævnte nedstrømsende (2b), for at definere en lateral ledning i nævnte indretning, i fluidforbindelse med nævnte aksiale ledning;
- 20 - en prop (5) aftageligt tilpasset i nævnte laterale åbning (3) på en tryktæt måde af et gevindmøtrikskrueindgreb,
- ventilorganer (6) lokaliseret i denne aksiale ledning for at blokere nævnte boremudder og stoppe dets strømning fra nævnte opstrømsende (2a) til nævnte nedstrømsende (2b);
- 25 hvor:
- nævnte ventilorganer (6) omfatter et spærreelement (6), som er bevægeligt støttet i nævnte aksiale ledning til at bevæge sig fra en position tværgående til nævnte aksiale ledning, i hvilken nævnte spærreelement (6) strækker sig tværgående til akse af nævnte aksiale ledning for at stoppe
- 30 fluidkontinuitet mellem nævnte opstrømsende (2a) og nævnte nedstrømsende (2b) i nævnte aksiale ledning, og en langsgående position i forhold til nævnte aksiale ledning, i hvilken nævnte spærreelement (6)

strækker sig langs akse af nævnte aksiale ledning tæt på en sidevægsdel i nævnte rørformede legeme (2);

- i nævnte tværgående position, nævnte spærreelement (6) er lokaliseret mellem nævnte laterale ledning og nævnte opstrømsende (2a) af det rørformede legeme (2) for at blive placeret opstrøms fra nævnte laterale åbning (3), i forhold til strømningen af boremudderet i nævnte aksiale ledning fra nævnte opstrømsende (2a) til nævnte nedstrømsende (2b) og
- i nævnte langsgående position nævnte spærreelement (6) lukker på en tryktæt måde nævnte laterale åbning (3) for at stoppe fluidkontinuitet mellem nævnte laterale ledning og nævnte aksiale kanal,

kendetegnet ved, at:

- nævnte indretning omfatter magnetiske organer (22) til at virke på nævnte spærreelement (6) i nævnte langsgående position og holde nævnte spærreelement (6) i nævnte langsgående position med en forudindstillet belastning, og idet sidstnævnte er oversteget nævnte spærreelement (6) bevæges til nævnte tværgående position og
- nævnte prop (5) har en gennemgående åbning ved hvilken en mudderudledningsventil er lokaliseret, som er indrettet til at blive aktueret mellem en lukket tilstand og en åben tilstand, for at blokere nævnte gennemgående åbning eller rydde den, for at muliggøre passagen af boremudderet.

2. Indretning ifølge krav 1, hvor:

- nævnte magnetiske organer bæres af nævnte prop (5) for magnetisk tiltrækkende interaktion med nævnte spærreelement (6) når nævnte spærreelement (6) er i nævnte langsgående position og
- nævnte magnetiske organer er placeret på siden af nævnte prop (5), som vender mod nævnte aksiale kanal.

- 3. Indretning ifølge krav 2, hvor nævnte magnetiske organer båret af nævnte prop (5) definerer en ring.**

4. Indretning ifølge et hvilket som helst af kravene fra 1 til 3, hvor nævnte magnetiske organer inkluderer en eller flere magneter båret af nævnte spærreelement (6) på siden af nævnte spærreelement der vender mod nævnte laterale åbning (3) når nævnte spærreelement (6) er i nævnte langsgående position.

5. Indretning ifølge krav 4, hvor nævnte en eller flere magneter båret af nævnte spærreelement (6) omfatter en magnetisk ring anvendt på siden af nævnte spærreelement (6) der vender mod nævnte laterale åbning (3) når nævnte spærreelement (6) er i nævnte langsgående position, fortrinsvis nævnte spærreelement (6) har en cirkulær form og nævnte magnetiske ring er anvendt på nævnte spærreelement (6) koncentrisk med cirklen defineret af nævnte spærreelement (6).

6. Indretning ifølge kravene 2 og 5, hvor, når nævnte spærreelement (6) er i nævnte langsgående position, nævnte magnetiske organer båret af nævnte spærreelement (6) og nævnte magnetiske organer båret af nævnte prop (5) er i et forhold, hvor de vender mod hinanden og er anbragt med afstand, hvor nævnte magneter, der vender mod hinanden, magnetisk tiltrækker hinanden.

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7. Indretning ifølge et hvilket som helst af kravene fra 1 til 6, hvor nævnte spærreelement (6) omfatter et konveks, fortrinsvis en delvist sfærisk del/væg, hvis konveksitet vender mod den laterale åbning (3), hvor nævnte sfæriske del/væg indgriber på en tryktæt måde et sæde (7) til spærreelementet, som er tilvejebragt i nævnte rørformede legeme (2) omkring nævnte laterale åbning (3).

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8. Indretning ifølge et hvilket som helst af kravene fra 1 til 7, omfattende et indsat sæde (7) til spærreelementet, som er integreret associeret, på en tryktæt måde, med nævnte rørformede legeme (2) omkring nævnte laterale åbning (3), hvor nævnte indsatte sæde (7) til spærreelementet definerer en gevindringmøtrik, som har:

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- en indvendig gevinddel, som tilvejebringer nævnte gevindindgreb med nævnte aftagelige prop (5) og

- en udvendig gevinddel, som er indgrebet på en tryktæt måde med nævnte rørformede legeme (2).

9. Indretning ifølge et hvilket som helst af kravene fra 1 til 8, hvor nævnte spærreelement (6) omfatter en membran (6) forbundet via hængselforbindelsesorganer ved en perifer del deraf til en rotationsakse (8), hvor nævnte membran (6) bevæger sig fra nævnte langsgående position til nævnte tværgående position, og vice versa, ved at rotere omkring nævnte rotationsakse (8), hvor nævnte rotationsakse (8):

- 10 - strækker sig tværgående, fortrinsvis vinkelret på, til den langsgående akse (X-X) af nævnte aksiale ledning;
- er placeret tæt på den indvendige væg af nævnte rørformede legeme (2);
- er periferisk placeret til at blive lokaliseret ved nævnte laterale åbning (3) og
- 15 - er lokaliseret i nærheden af nævnte laterale åbning (3) i delen af nævnte rørformede legeme (2) lokaliseret mellem nævnte laterale åbning (3) og nævnte opstrømsende (2a) af nævnte rørformede legeme (2),

således at, når nævnte rørformede legeme (2) er placeret med den langsgående akse (X-X) i en vertikal orientering, med opstrømsenden (2a) lokaliseret på et højere niveau end nedstrømsenden (2b), nævnte hængselforbindelsesorganer og nævnte rotationsakse (8) er placeret over nævnte gennemgående åbning og, på grund af vægtekraften, nævnte membran (6) tenderer til at bevæge sig mod nævnte langsgående position.

10. Indretning ifølge krav 9, hvor nævnte hængselforbindelsesorganer er støttet af en rørformet støtte (9) der bærer spærreelementet, som er koncentrisk indsat på en tryktæt måde i nævnte rørformede ledning, fra nævnte opstrømsende (2a) til en aksial grænse-stopposition defineret af positionerings- og centreringsorganer (11, 12).

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11. Indretning ifølge krav 10, hvor nævnte positionerings- og centreringsorganer (11, 12) definerer en polariseret indsættelsesnøgle, som er indrettet til at

muliggøre indsættelse af nævnte rørformede støtte (9) i nævnte rørformede ledning til nævnte aksiale grænse-stopposition kun når nævnte rørformede støtte (9) er vinkelroteret i forhold til akse af nævnte aksiale ledning (X-X) således at nævnte spærreelement (6) i nævnte langsgående position er lokaliseret over 5 nævnte laterale åbning (3) for at sikre tryktæt lukning deraf.

12. Indretning ifølge krav 10 eller 11, omfattende holdeorgan (13) til at fastholde nævnte rørformede støtte (9) indsat i nævnte aksiale ledning i nævnte aksiale grænse-stopposition, hvor nævnte holdeorgan (13) omfatter:

- 10 - en flerhed af holdeelementer (14), placeret i nævnte rørformede ledning i en periferisk forskudt position og tæt på en ende (9a) af nævnte rørformede støtte (9) der vender mod nævnte opstrømsende (2a) af det rørformede legeme (2), hvor nævnte holdeelementer (14) virker som holdeorgan til at forhindre nævnte rørformede støtte (9) i at bevæge sig
- 15 aksialt mod nævnte opstrømsende (2a) af det rørformede legeme (2);
- et indvendigt sæde (15) tilvejebragt i den indvendige rørformede væg af nævnte rørformede legeme (2) i hvilken en første del af nævnte holdeelementer (14) er akkommoderet og
- 20 - en låseføring (16) indgrebet med nævnte indvendige rørformede væg af nævnte rørformede legeme (2) for at fastholde nævnte del af nævnte holdeelementer i nævnte indvendige sæde (15) .

13. Indretning ifølge et hvilket som helst af kravene fra 1 til 12, hvor nævnte prop (5) omfatter en aksial gennemgående åbning (25) ved hvilken en 25 udledningsventil er lokaliseret, hvor nævnte udledningsventil er indrettet til at blive aktueret i en tryktæt lukket tilstand og en åben tilstand, for henholdsvis at blokere og muliggøre passagen af fluid igennem den gennemgående åbning, i sidstnævnte tilfælde muliggøre passagen af boremudderet.

30 **14.** Indretning ifølge krav 13, hvor nævnte magnetiske organer (22) anvendes på proppen (5) på sådan en måde til at blive anbragt omkring nævnte gennemgående åbning (25), hvor udledningsventilen er huset.

DRAWINGS

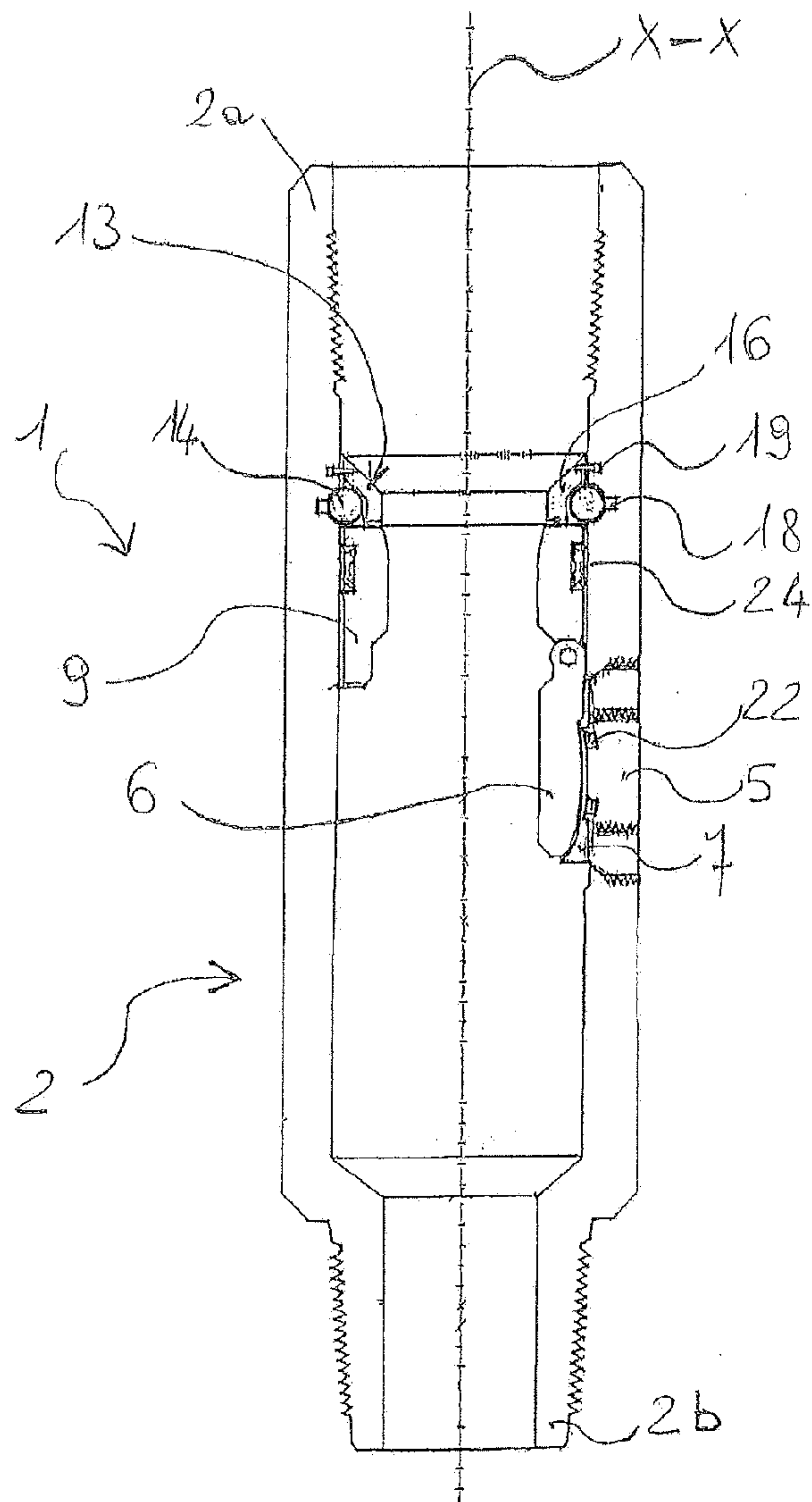


Fig. 1

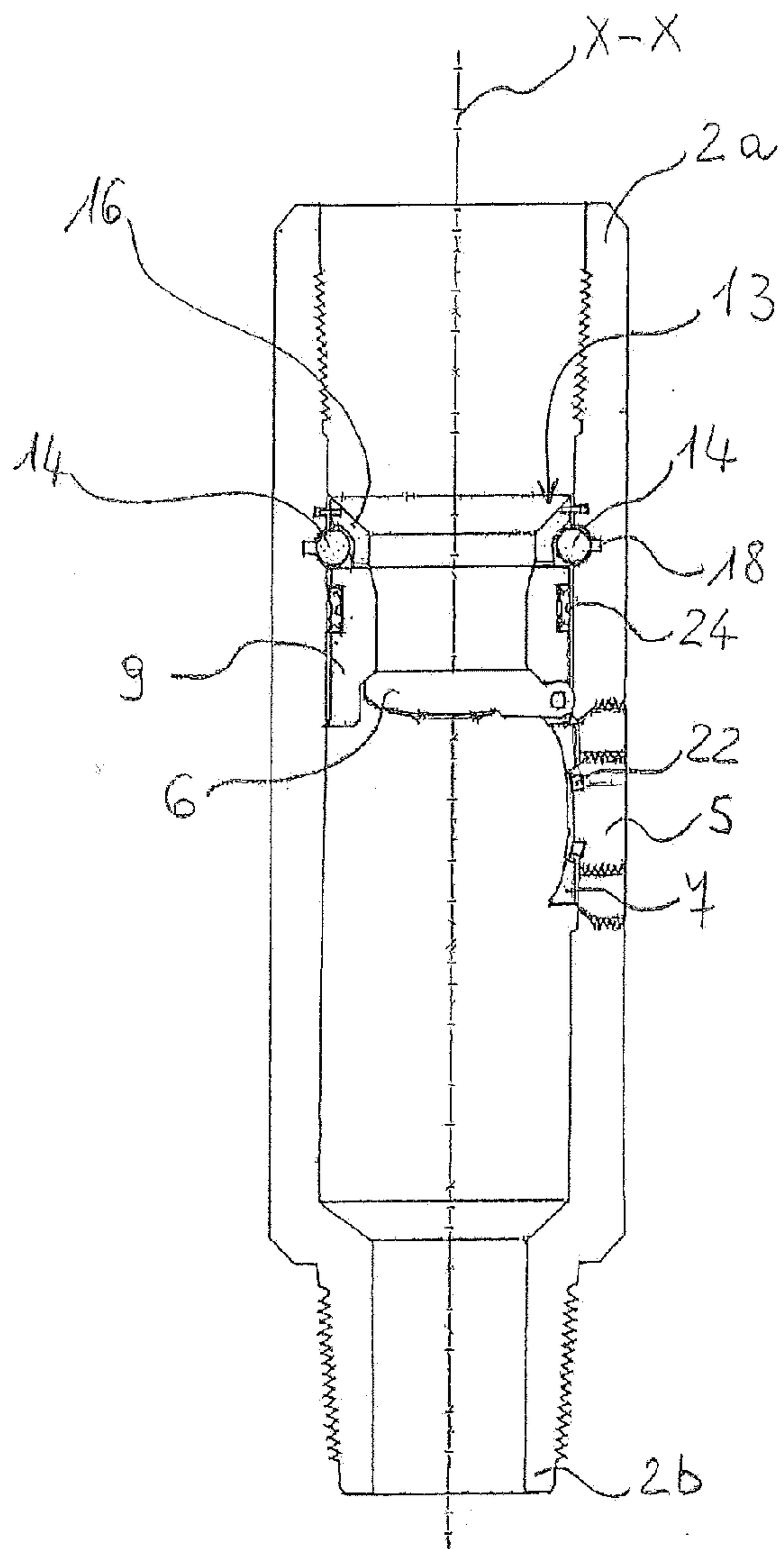


Fig. 2

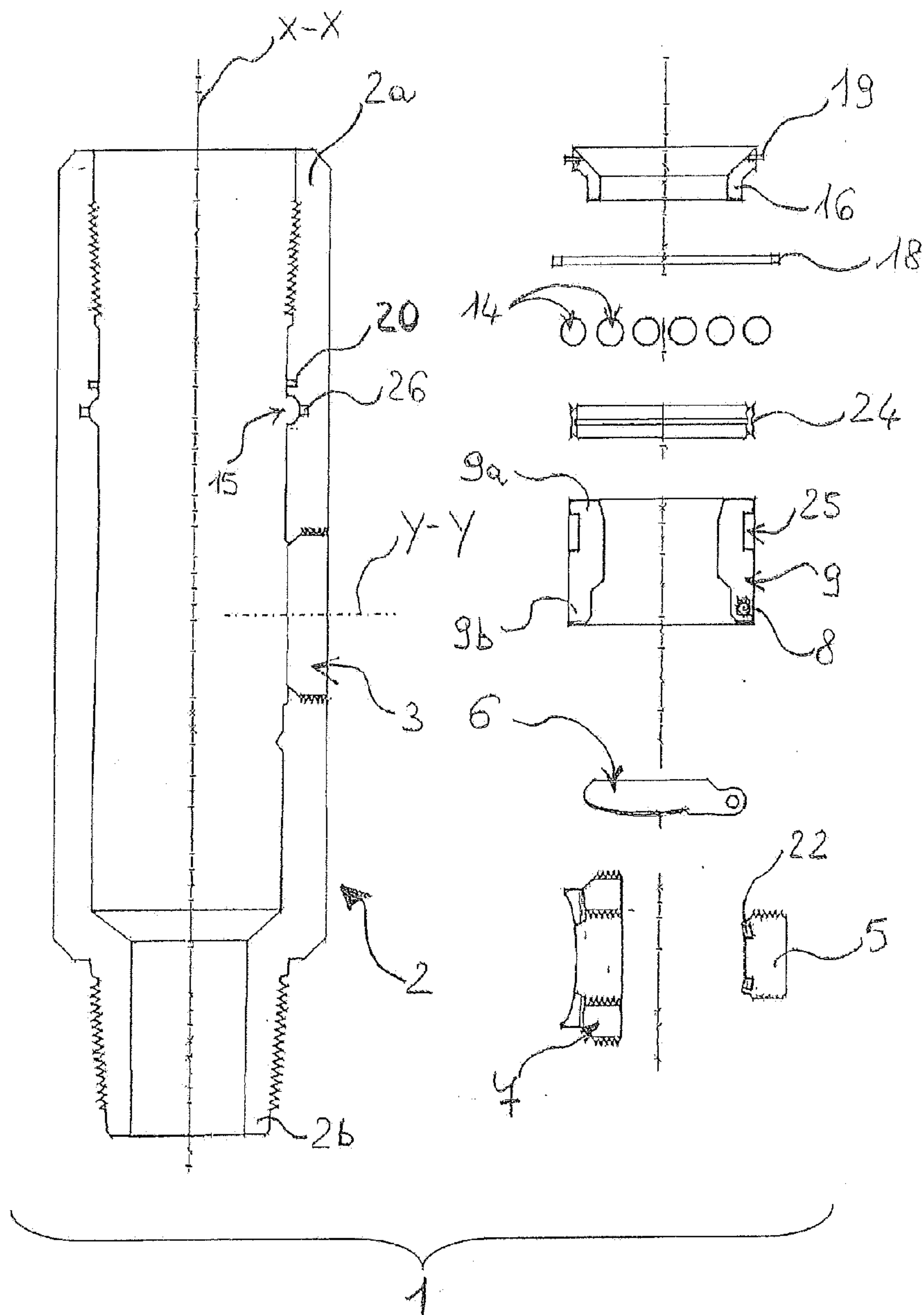


Fig. 3

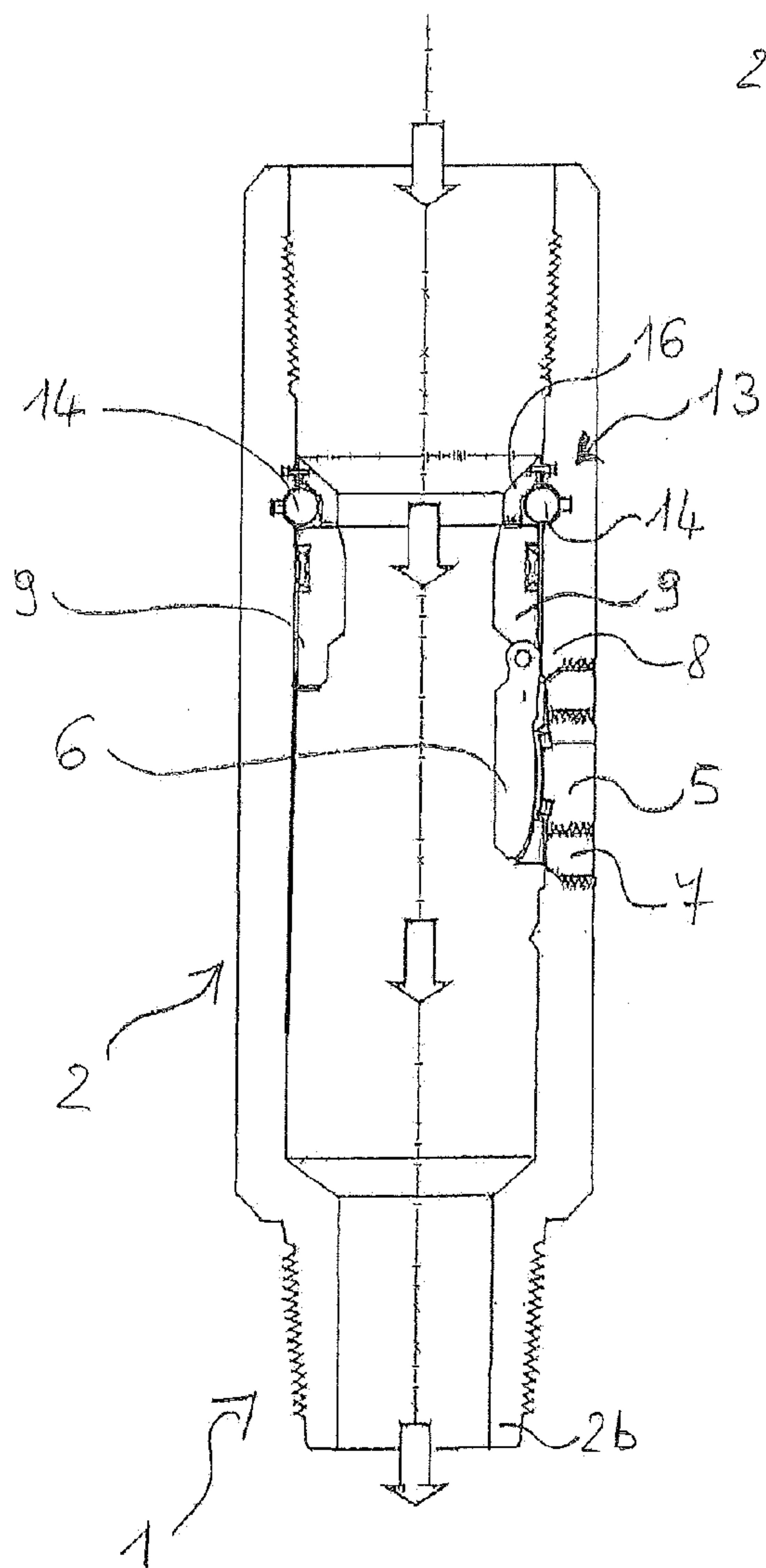


Fig. 4a

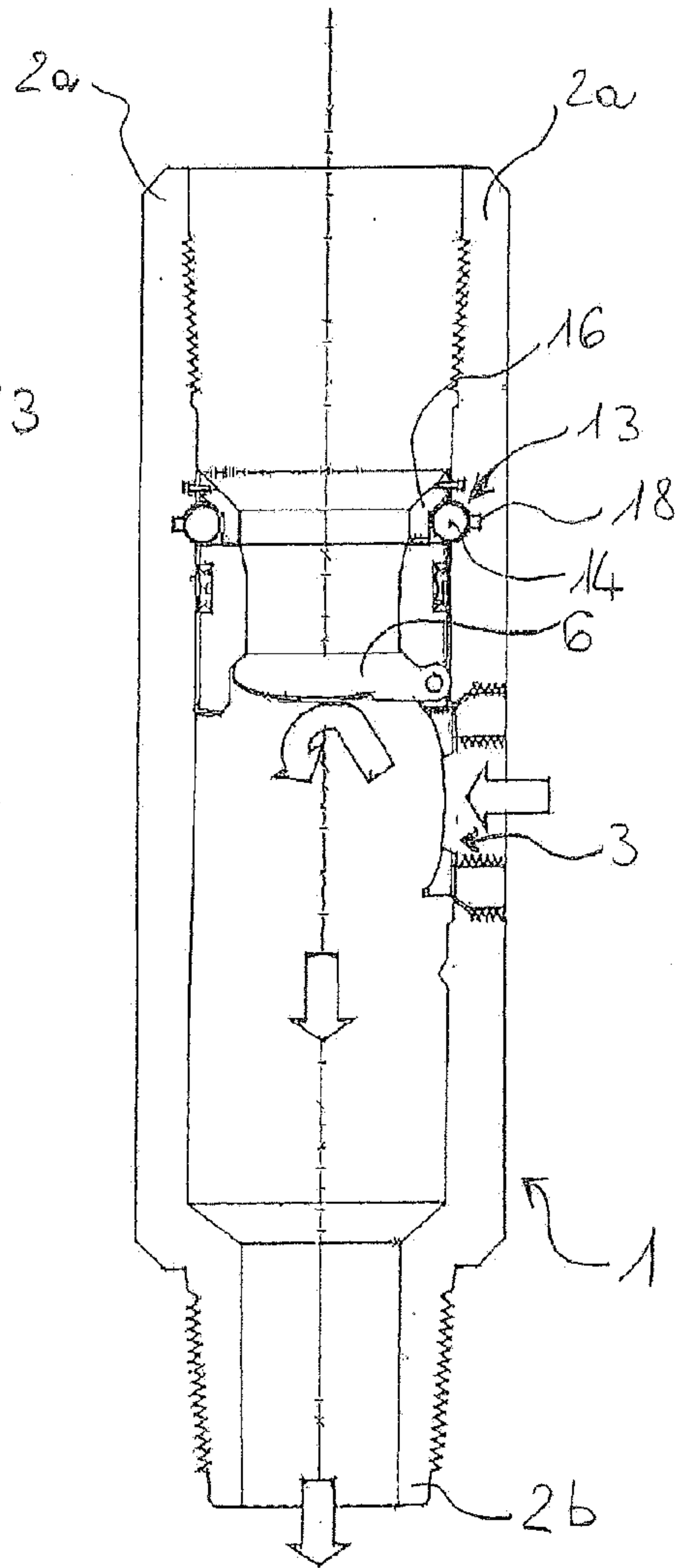


Fig. 4b

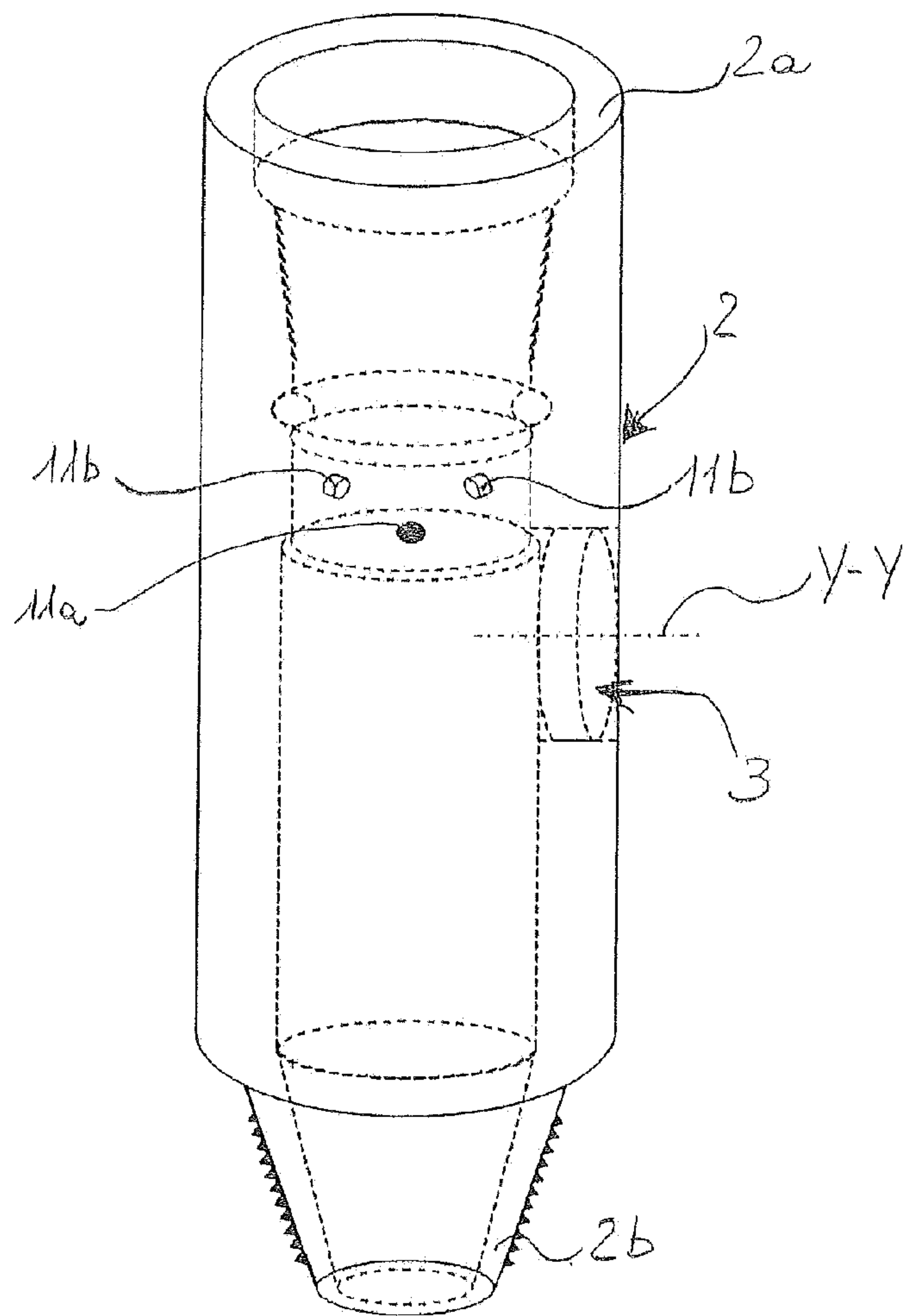


Fig. 6

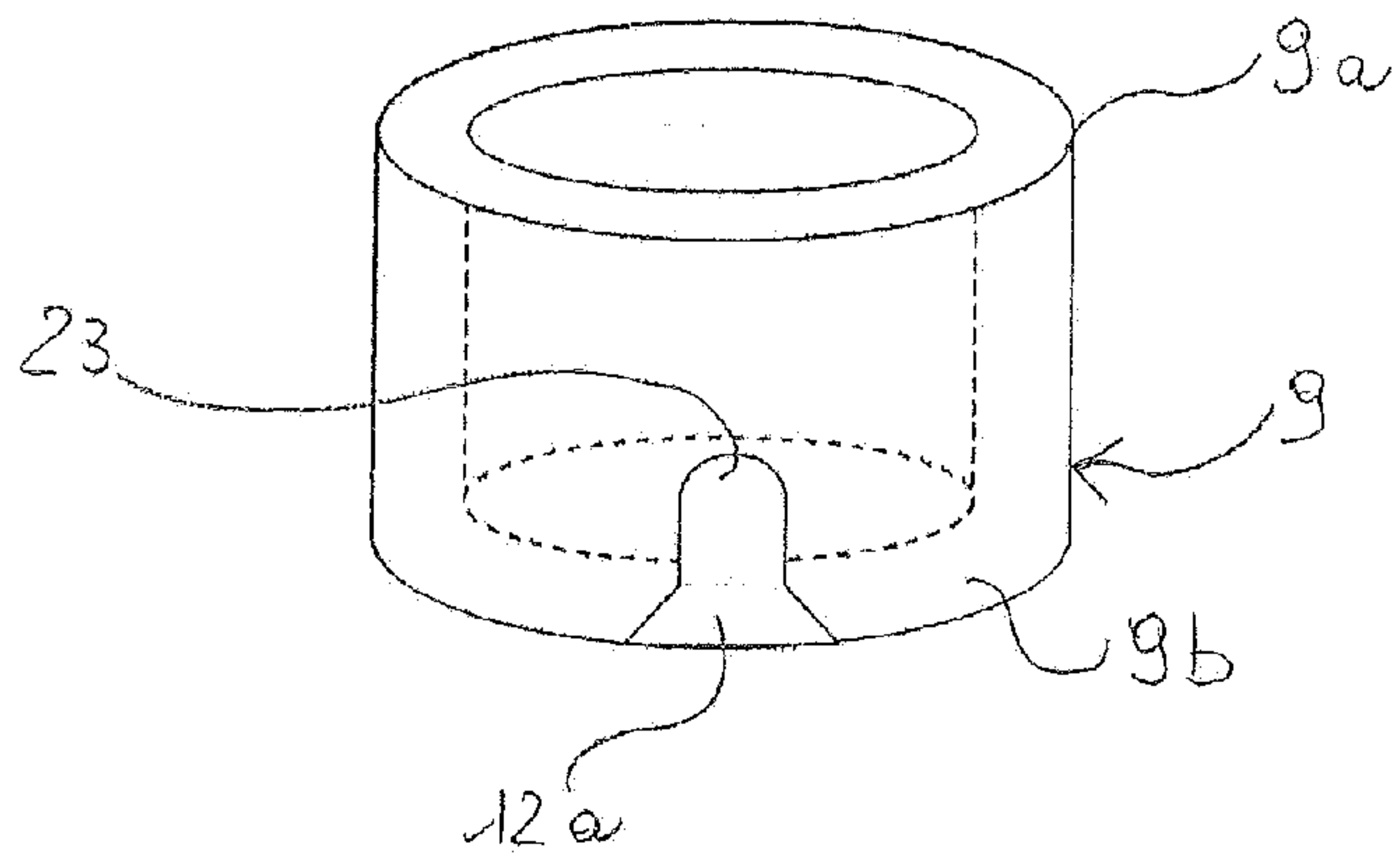


Fig. 7

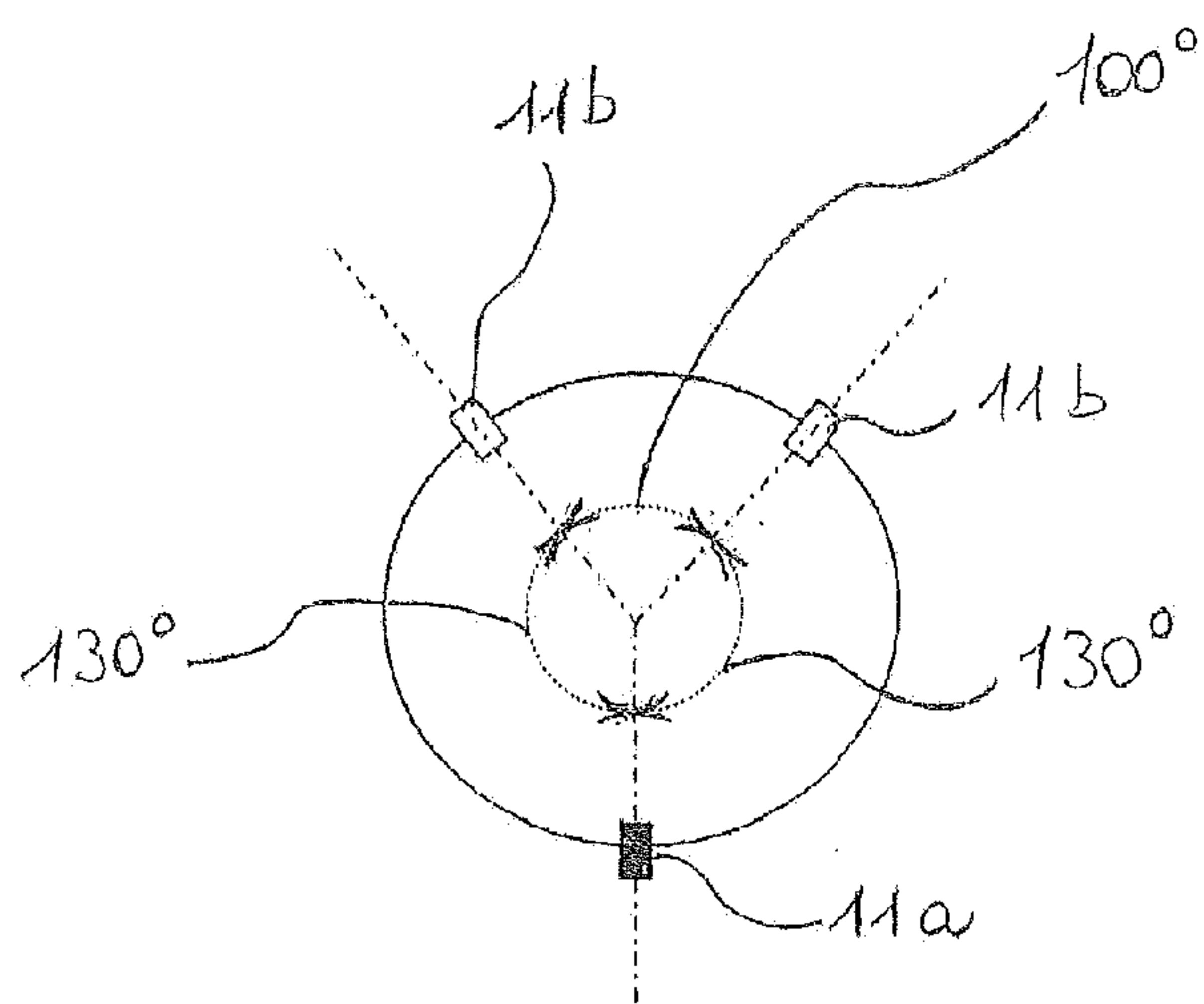


Fig. 8

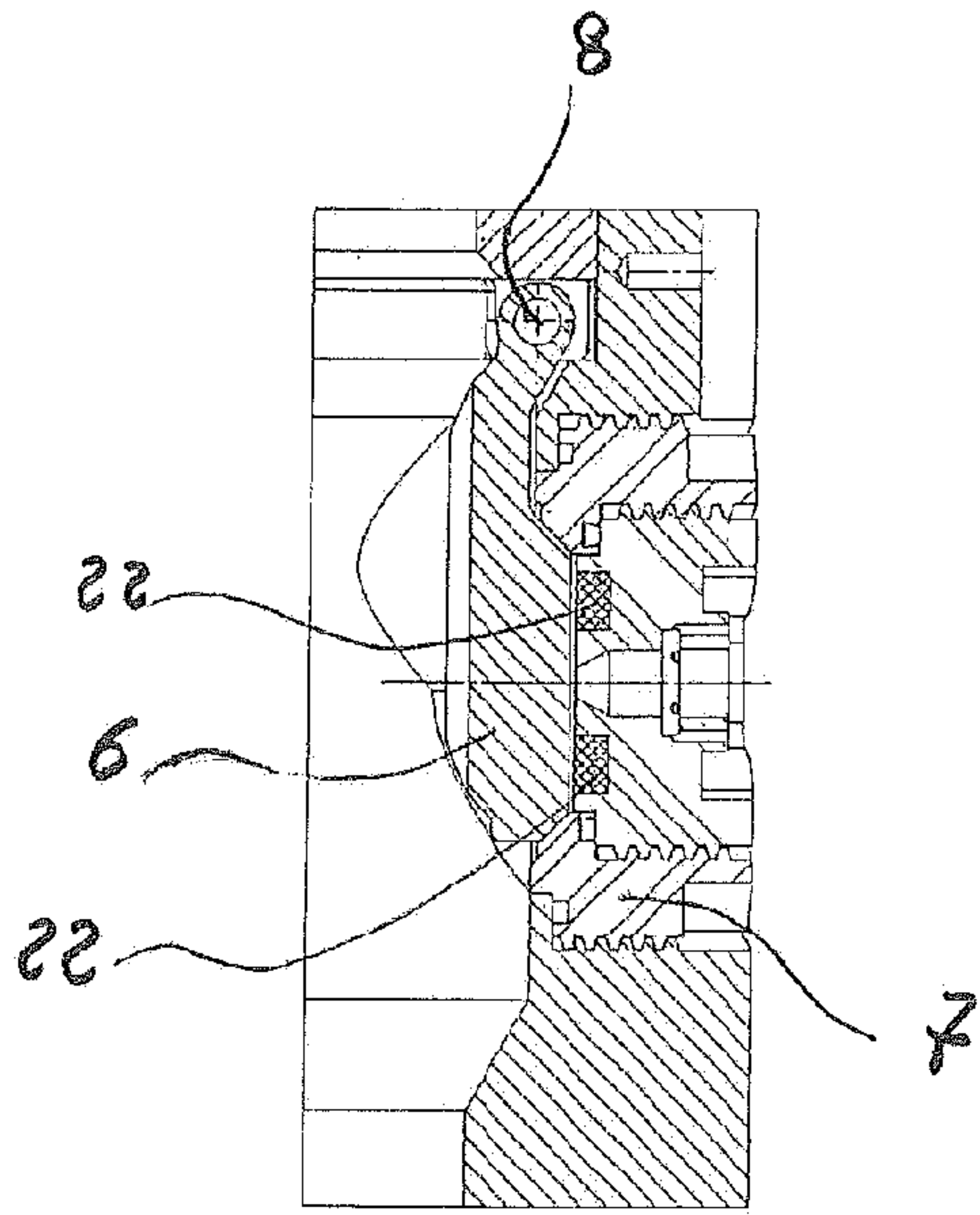


Fig. 9

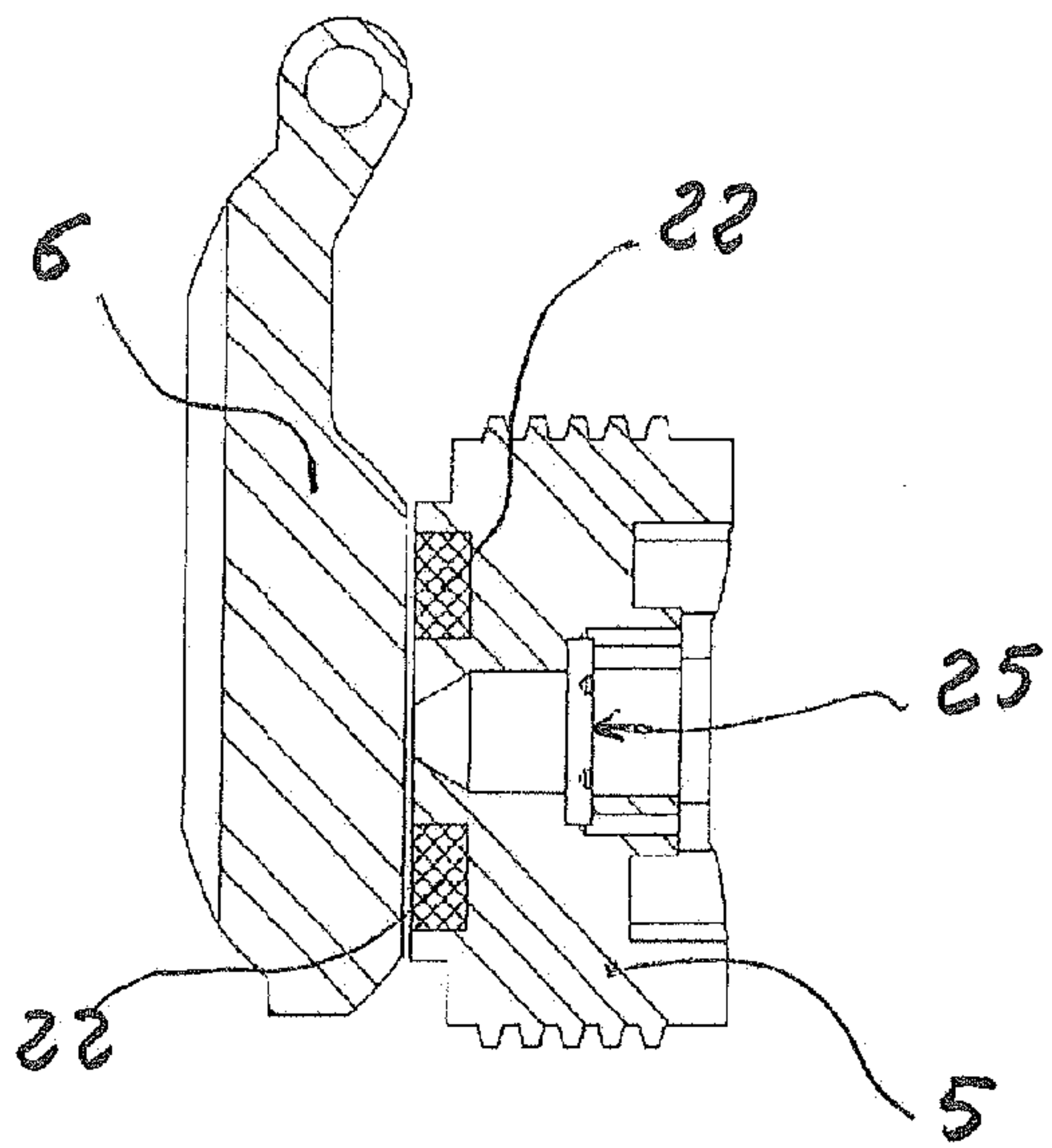


Fig. 10

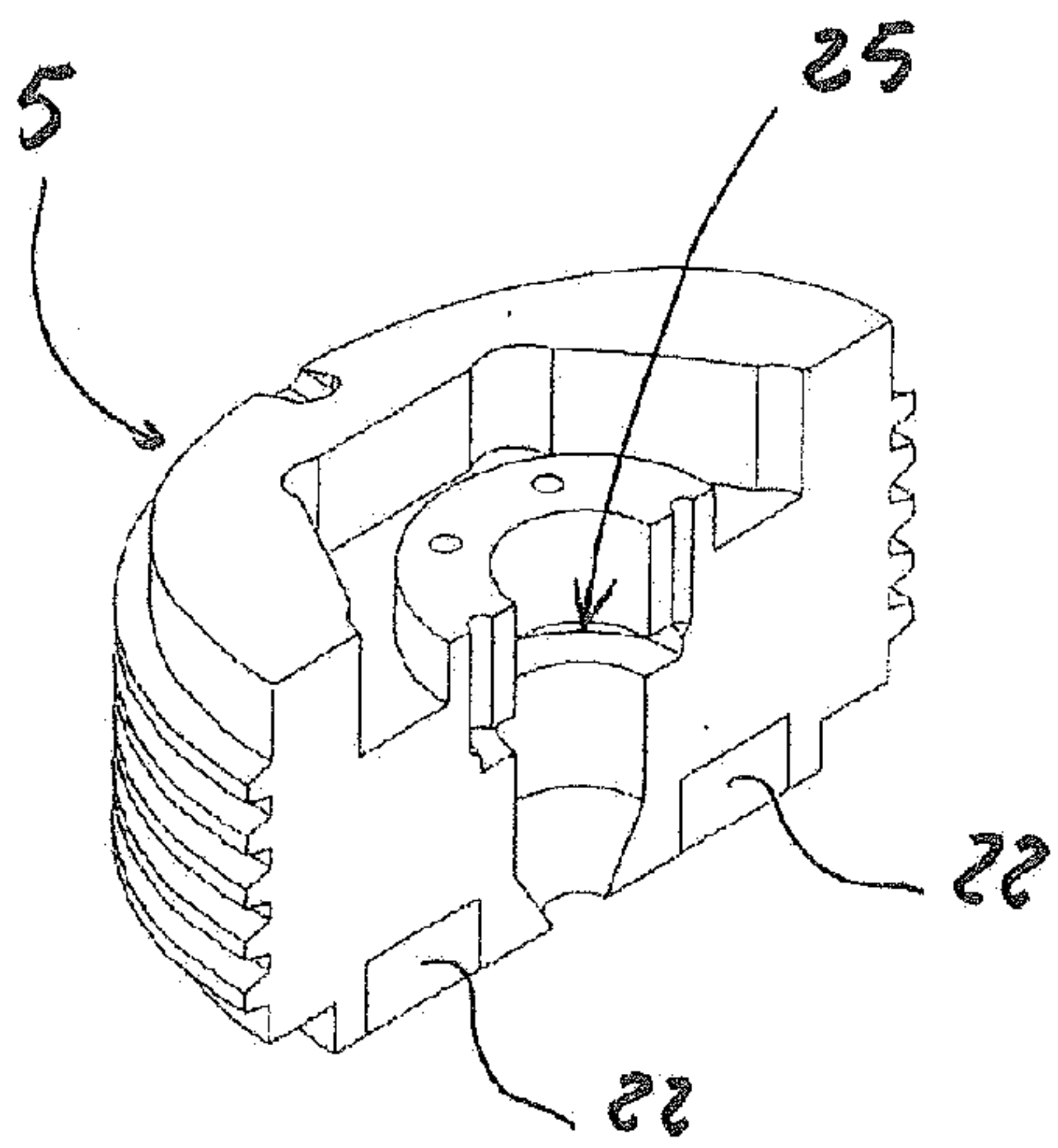


Fig. 11

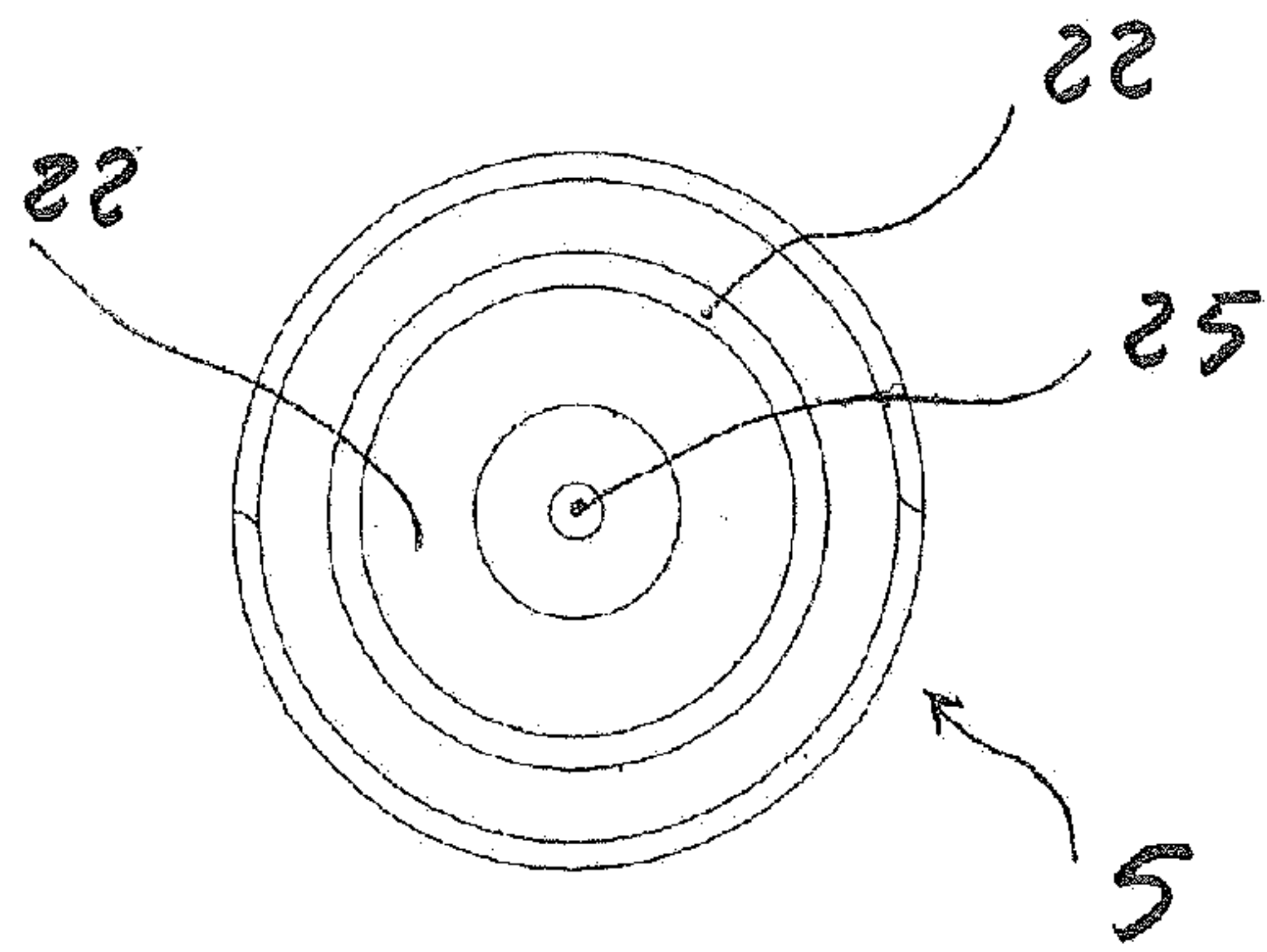


Fig. 12