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(54) **Downhole driving unit having a spring member for assembling a hydraulic motor housing**

Bohrlochantriebseinheit mit Federelement zum Anordnen eines Hydraulikmotorgehäuses

Unité de commande de fond de trou dotée d'un élément de ressort pour l'assemblage de carter d'un moteur hydraulique

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Description

Field of the invention

[0001] The present invention relates to a downhole driving unit for insertion into a well, comprising a driving unit housing, and a wheel assembly comprising a stationary part and a rotational part, the stationary part being connected with the driving unit housing and being rotatably connected with the rotational part. The present invention also relates to a downhole system comprising the driving unit and an operational tool.

Background art

[0002] When operating in a downhole well, tools used for the operation may not be submergible themselves. Some tools are positioned at the front of coiled tubing and are driven forward by pushing the tubing further down the well. Other tools are lowered into the well by means of a wireline, and gravity will thus ensure that the tool submerges. Hence, not all tools are capable of moving in the well and thus need to be moved forward in the well by an additional tool. In particular, this is the case in the horizontal part of the well, as gravity cannot aid in the movement.

[0003] Several tools have been developed for this purpose, *inter alia* one running on a caterpillar track. However, this tool has the disadvantage that it cannot always hold its footing in the more uneven parts of the well, and in some cases, it is impossible for such a tool to pass a place where two well pipes meet but do not abut, hence leaving a gap. Another tool has wheels driven by means of a roller chain, such as the downhole tractor disclosed in WO 0046481, and all driven by one motor. However, if the motor is unable to drive all wheels, the tool is unable to drive itself any further. This may be the case if the well has an obstacle and one wheel is unable to be driven across the obstacle.

[0004] Well tools often utilise hydraulics for performing operations or providing propulsion in transportation tools, also denoted as well tractors. Supplying pressurised hydraulic fluid to various parts of a downhole tool requires a reliable and robust hydraulic system, as tools in the well cannot be accessed easily.

[0005] Especially the supply of hydraulic fluid into moving parts of a downhole tool is challenging. Furthermore, preventing dirty well fluid from entering hydraulic movable parts can be challenging.

Summary of the invention

[0006] It is an object of the present invention to wholly or partly overcome the above disadvantages and drawbacks of the prior art. More specifically, it is an object to provide an improved downhole tool for moving an operational tool forward in all parts of a well and also in wells having a small inner diameter, such as 54 mm (2 1/8 inches) while preventing well fluid from entering hydraulic movable parts.

[0007] The above objects, together with numerous other objects, advantages, and features, which will become evident from the below description, are accomplished by a solution in accordance with the present invention by a downhole driving unit for insertion into a well, comprising:

- a driving unit housing,
- a hydraulic motor comprising a hydraulic motor housing, and
- a wheel assembly comprising a stationary part and a rotational part, the stationary part being connected with the driving unit housing and being rotatably connected with the rotational part, the stationary part and the rotational part constituting the hydraulic motor housing, the rotational part comprising a wheel ring closed from one end,

wherein the wheel assembly comprises a spring member connecting the stationary part with the rotational part or connecting a first part of the rotational part with a second part of the rotational part.

[0008] In one embodiment, the first part may be the wheel ring and the second part may be a closing member closing the wheel ring from the one end.

[0009] Moreover, the stationary part may be a cam ring of the hydraulic motor.

[0010] The wheel assembly may further comprise a sealing member arranged between the stationary part and the rotational part or between a first part of the rotational part and a second part of the rotational part.

[0011] In addition, the sealing member may be a sealing ring, such as an O-ring, a sealing layer, or a sealing disc.

[0012] Said sealing layer or sealing disc may cover most of the closing member.

[0013] In another embodiment, the wheel assembly may be suspended in the driving unit housing.

[0014] Furthermore, the spring member may be a circlip or a snap ring.

[0015] Additionally, the spring member may be ring-shaped and may have a gap so that when the ring is inserted, the ring can be squeezed together to obtain a smaller diameter and then spring back to its original diameter when released again.

[0016] Moreover, the rotational part may comprise a wheel ring, and a bearing may be arranged between the cam ring and the wheel ring.

[0017] In one embodiment, the hydraulic motor may be a radial piston motor.

[0018] The downhole driving unit according to the invention may further comprise an arm assembly movable between a projected position and a projected position in relation to the driving unit housing, and the arm assembly may be connected with or form part of the stationary part of the wheel assembly.

[0019] Furthermore, the downhole driving unit accord-

ing to the invention may comprise an arm activation assembly arranged in the driving unit housing for moving the arm assembly between the retracted position and the projected position.

[0020] Also, the wheel assembly may further comprise a planetary gearing system.

[0021] In addition, the planetary gearing system may comprise planet gears engaging the sun gear and the ring gear, the planet gears being interconnected by means of a carrier member.

[0022] Moreover, the hydraulic motor may have a rotatable section which is connected with a sun gear of the planetary gearing system.

[0023] Said planetary gearing system may be comprised in the hydraulic motor housing.

[0024] Further, the planetary gearing system may comprise a ring gear constituted by the wheel ring or the closing member.

[0025] Also, the arm assembly may comprise a wheel arm, and the wheel arm may comprise fluid channels for providing fluid to and from the hydraulic motor through the stationary part.

[0026] In one embodiment, the rotatable section may be a hydraulic cylinder block.

[0027] Said hydraulic motor may comprise pistons movable within cylinders in the hydraulic cylinder block.

[0028] Also, the hydraulic cylinder block may comprise cylinders in which a piston moves in each of the cylinders, the piston comprising a piston body and a ball bearing suspended in a piston body so that the ball bearing abuts the cam ring.

[0029] Additionally, the hydraulic cylinder block may comprise fluid channels arranged in alignment with the fluid channels in the wheel arm so that fluid is led from the wheel arm to cylinders in the hydraulic cylinder block.

[0030] The downhole driving unit according to the invention may further comprise a pump for providing fluid to the hydraulic motor.

[0031] The present invention further relates to a downhole system comprising the driving unit according to the invention and an operational tool connected with the driving unit for being moved forward in a well or borehole.

[0032] In one embodiment, the operational tool may be a stroker tool, a key tool, a milling tool, a drilling tool, a logging tool, etc.

[0033] The present invention also relates to a use of the driving unit according to the invention in a well or borehole for moving itself and/or an operational tool forward in a well or borehole.

Brief description of the drawings

[0034] The invention and its many advantages will be described in more detail below with reference to the accompanying schematic drawings, which for the purpose of illustration show some non-limiting embodiments and in which

Fig. 1 shows a downhole tool, such as a driving unit, in a well,

Fig. 2 shows the wheel shown in Fig. 1 in another view,

Fig. 3 shows another downhole tool, such as a driving unit, in a well,

Fig. 4 shows the wheel shown in Fig. 3 in another view,

Fig. 5A shows a cross-sectional view of the wheel shown in Fig. 1,

Fig. 5B shows another cross-sectional view of the wheel of Fig. 5A,

Fig. 6 shows an arm activation assembly,

Fig. 7A shows a cross-sectional view of another embodiment of the wheel shown in Fig. 3,

Fig. 7B shows another cross-sectional view of the wheel of Fig. 7A,

Fig. 8A shows a cross-sectional view of another embodiment of the wheel,

Fig. 8B shows another cross-sectional view of the wheel of Fig. 8A,

Fig. 9 shows a cross-sectional view of another embodiment of the wheel, and

Fig. 10 shows a downhole system.

[0035] All the figures are highly schematic and not necessarily to scale, and they show only those parts which are necessary in order to elucidate the invention, other parts being omitted or merely suggested.

Detailed description of the invention

[0036] Fig. 1 shows a downhole tool, such as driving unit 11, arranged in a casing in a well or borehole. The downhole tool is powered through a wireline 9 which is connected with the tool via a top connector 13. The downhole tool further comprises an electronic section having mode shift electronics 15 and control electronics 16 before the electricity is supplied to an electrical motor 17 driving a hydraulic pump 18. In Fig. 1, the downhole tool is a driving unit 11 having a driving unit housing 51 in which wheel assemblies 90 are suspendedly connected. The driving unit 11 is connected with a compensating device 20 for compensating the pressure within the driving unit so that a high pressure does not result in the driving unit housing bulging outwards or collapsing in-

wards.

[0037] As shown in Fig. 1, part of the wheel assembly 90 projects from the driving unit housing 51 and the other part remains in a slot 117 in the driving unit housing, as shown in Fig. 2. The wheel assembly 90 comprises a stationary part 91 and a rotational part 92. The stationary part 91 is connected with the driving unit housing 51 and is rotatably connected with the rotational part 92.

[0038] In Fig. 3, the downhole tool is also a driving unit 11 having a driving unit housing 51 in which arm assemblies 60 are moved between a retracted position and a projected position in relation to the driving unit housing 51 along a longitudinal axis of driving unit 11 by means of fluid from the hydraulic pump. In Fig. 3, an arm assembly 60 is shown in its projected position. As shown in Fig. 4, part of the arm assembly 60 projects from the driving unit housing 51, and the other part is connected with the wheel assembly 90. The wheel assembly 90 comprises a stationary part 91 and a rotational part 92. The stationary part 91 is connected with the arm assembly 60 or forms part of the arm assembly and is rotatably connected with the rotational part 92.

[0039] The driving unit 11 may be inserted into a well and propels itself forward and is capable of moving an operational tool forward in the well. In order to be able to propel itself, the driving unit comprises several wheel assemblies 90, either suspended directly in the driving unit housing 51 or arranged in a first end 88 of the arm assembly 60 furthest away from the end 89 closest to the driving unit housing 51 when the arm is in its projected position, as shown in Figs. 3 and 4.

[0040] The rotational part 92 is fixedly connected with or forms part of a wheel ring 99 which is the outermost part of the wheel assembly 90 contacting an inner surface of the casing 6 or borehole 4. On its outside, the wheel ring 99 has indentations 110 to obtain a better grip in the casing wall or the borehole wall, as shown in Figs. 2 and 4.

[0041] In Figs. 5A and 5B, the wheel assemblies 90 are directly suspended in the driving unit housing 51, as shown in Figs. 1 and 2. Thus, the stationary part 91 is suspended in the driving unit housing 51 and comprises fluid channels for supplying fluid to and from the hydraulic motor 23. The wheel assembly 90 rotates around a wheel rotation axis 33. In order to be able to propel itself forward in the well, each wheel assembly 90 comprises a hydraulic motor 23. The hydraulic motor 23 has a hydraulic motor housing 93 and a rotatable section 84 connected with the rotational part 92 for rotating part of the wheel assembly 90 and thus drive the wheel ring 99 and the driving unit 11 forward in the well. As shown, the stationary part 91 and the rotational part 92 constitute the hydraulic motor housing 93, and the wheel assembly 90 comprises a spring member 113 connecting the stationary part 91 with the rotational part 92 in order to assemble the hydraulic motor housing 93 and thus the wheel assembly 90. The spring member 113 is a snap ring or a circlip being a ring-shaped member having a gap so that when the ring is inserted, the ring can be squeezed together to obtain a smaller outer diameter and then spring back to its original diameter when released again in a groove with which it is to engage.

[0042] In Figs. 5A and 5B, the stationary part 91 is a cam ring 24 of the hydraulic motor 23, and the wheel ring 99 is closed from one end and open at the other end to engage the outer circumference of the cam ring 24. The wheel ring 99 has a groove 114 in which the snap ring 113 is inserted to engage and fasten a projecting flange 120 of the cam ring 24 to the wheel ring 99. In a second groove 121 in the wheel ring 99, a sealing member 27 is arranged so as to seal between the cam ring 24 and the wheel ring 99 when squeezed together by the snap ring 113.

[0043] By having a snap ring 113 for connecting the wheel ring 99 and the cam ring 24, the hydraulic motor housing 93 is assembled in a simple manner without using e.g. a screw connection which may become leaky when the wheel is used, and dirty well fluid can thus enter the motor housing, and small fragments in the well fluid may ruin the function of the motor and thus the rotation of the wheel. Furthermore, the seal between the wheel ring 99 and the cam ring 24 can be a face seal, and the sealing member can be a conventional O-ring which is easily replaced.

[0044] The stationary part 91 and the rotational part 92 constitute the hydraulic motor housing 93 in which the rotatable section 84 of the hydraulic motor 23 rotates in relation to the cam ring 24 driving the rotational part 92 of the wheel assembly 90. Thus, the cam ring 24 is stationary, and a ball bearing 36 is arranged on an outside of the cam ring 24 between the cam ring 24 and the wheel ring 99 in order to provide a simple and substantially friction-free transition between the rotatable wheel ring and the stationary cam ring. By arranging the transition between the rotational part 92 and the stationary part 91 of the wheel assembly 90 between the cam ring 24 and the wheel ring 99, a more friction-free transition is provided in that a ball bearing 36 can be arranged therebetween. Furthermore, a more fluid-tight hydraulic motor housing is provided. In Figs. 5A-7, the bearing between the wheel ring 99 and the cam ring 24 is a ball bearing, but in another embodiment, the bearing may be another bearing providing a substantially friction-free transition between the cam ring 24 and the wheel ring 99.

[0045] In Fig. 6, the arm activation assembly 41 is shown which is arranged in the driving unit housing 51, as indicated in Fig. 1, for moving the arm assemblies 60 between a retracted position and a projected position. The arm assembly 60 is fastened to one end of a crank member 71 which is rotated around a rotation axis 32, as indicated by arrows. This end is rotatably connected in relation to the housing, and the other end of the crank member 71 is moved along the longitudinal axis of the driving unit 11 by means of a piston 47 moving in a piston housing 45. The piston is moved in a first direction by means of hydraulic fluid supplied by means of a pump and in an opposite and second direction by means of a

spring member 44.

[0046] The arm assemblies 60 are moved in and out of the driving unit housing 51 between the projected and retracted positions by means of an arm activation assembly 41 arranged in the driving unit housing 51, as indicated by the dotted lines. The arm activation assemblies 41 are driven by the hydraulic pump for moving the arm assemblies 60. The driving unit 11 is most often used for moving an operational tool into a specific position in the well or just forward in the well while an operation is performed, such as moving a logging tool forward while logging fluid and formation data in order to optimise the production of oil fluid from the well. Another operational tool could also be a stroker tool providing an axial force in one or more strokes, a key tool opening or closing valves in the well, positioning tools such as a casing collar locator (CCL), a milling tool or drilling tool, etc. The operational tool is connected through a connector 14.

[0047] Figs. 7A and 7B show a cross-sectional view of the wheel assembly in Figs. 3 and 4. The wheel assembly 90 is connected with the driving unit housing 51 via a wheel arm 81 of the arm assembly 60, as shown in Figs. 3 and 4. As shown, the wheel assembly 90 comprises a hydraulic motor 23 comprising a hydraulic motor housing 93 constituted by the stationary part 91 and the rotational part 92. The hydraulic motor 23 comprises a rotatable section 84 connected with the rotational part 92 for rotating part of the wheel assembly 90.

[0048] The wheel assembly 90 comprises a closing member 26 closing the wheel ring 99 from an end 111, and the hydraulic motor 23 is thus enclosed by the wheel arm 81, the wheel ring 99, the closing member 26 and sealing members 27B therebetween to provide a sealed connection and a substantially tight hydraulic motor housing. The closing member is fastened to the wheel ring by means of a snap ring 113 arranged in a groove in the wheel ring and holding a flange 115 of the closing member to abut against a sealing member 27B. In this way, well fluid surrounding the driving unit is kept out of the hydraulic motor housing 93. The hydraulic motor 23 is thus comprised in the same housing as the wheel assembly 90 so that the motor housing and the wheel housing are the same housing and thus the same fluid chamber. The solution of the present invention is thus very compact in that the arm assembly 60 with the wheel assembly 90, when retracted in the driving unit housing 51, only takes up little space, so that the diameter of the driving unit 11 and thus of the downhole tool is not substantially increased when there are wheels at the end of the arms 60 of the driving unit 11. The closing member 26 is directly connected with the hydraulic cylinder block for transmitting the rotational force of the hydraulic motor 23 to the wheel ring 99 in order to move the driving unit 11 forward in the well. In Figs. 7A and 7B, the hydraulic motor 23 is a radial piston motor in which the rotatable section 84 is a hydraulic cylinder block. The hydraulic cylinder block has cylinders 83 in which at least four pistons 82 move radially in relation to a wheel rotational axis of the wheel assembly 90 to provide the rotational force. The wheel arm 81 comprises fluid channels 85 for providing fluid to and from the hydraulic motor 23 through the stationary part 91 of the wheel assembly 90.

[0049] The wheel assembly 90 of Figs. 8A-9 further comprises a planetary gearing system 95 comprised in the hydraulic motor housing 93, and the rotatable section 84 of the hydraulic motor 23 is connected with a sun gear 96 of the planetary gearing system 95.

[0050] Figs. 8A and 8B show a cross-sectional view of the wheel assembly 90 arranged in one end of the arm assembly, as shown in Figs. 3 and 4, in which the wheel assembly 90 also comprises a hydraulic motor 23 where the stationary part 91 and the rotational part 92 constitute the hydraulic motor housing 93 of the hydraulic motor 23. The arm assembly 60 comprises the wheel arm 81, and the stationary part 91 constitutes part of the wheel arm 81 as the cam ring 24 is formed as part of the wheel arm 81.

[0051] Also, in Figs. 7A-9, the hydraulic motor 23 is a radial piston motor in which the rotatable section 84 is a hydraulic cylinder block having cylinders 83 in which at least six pistons 82 move radially in relation to a wheel rotational axis of the wheel assembly 90. The wheel arm comprises fluid channels 85 for providing fluid to and from the hydraulic motor 23 through the stationary part 91 of the wheel assembly 90 in order to rotate the wheel of the driving unit and thus the driving unit.

[0052] In Figs. 5A, 7A and 8A, the pistons move in the cylinders forced outwards by the hydraulic fluid from the fluid channel 86 in the hydraulic cylinder block 84. This is due to the fact that the fluid channels 85 in the stationary part 91 are arranged opposite fluid channels 86 in the hydraulic cylinder block 84 so that fluid flows into the back of the cylinder and forces the piston outwards. Other pistons in the hydraulic cylinder block 84 are moved in the opposite direction by lobes in the cam ring forcing the pistons back into the cylinder, as shown in Figs. 5B, 7B and 8B. In Figs. 5B, 7B and 8B, other fluid channels 85 in the stationary part 91 are arranged opposite the front of the cylinder so that fluid in the cylinder can be emptied and the piston moved towards the centre of the hydraulic cylinder block 84. In this way, the hydraulic cylinder block 84 rotates.

[0053] As shown in Figs. 8A and 8B, a ball bearing 36B is arranged between a projecting shaft 112 of the stationary part 91 of the wheel assembly 90 and the rotatable section 84 of the hydraulic motor 23. The shaft is stationarily arranged inside the hydraulic cylinder block and forms part of the wheel arm 81 or is connected with the wheel arm 81. The ball bearing is arranged around the shaft and in a recess in the hydraulic motor block.

[0054] The closing member 26 has indentations matching recesses in the hydraulic cylinder block for transmitting the rotational force from the hydraulic cylinder block to the wheel ring 99. In Fig. 9, the hydraulic cylinder block drives the wheel ring via the closing member 26. In Fig. 9, the closing member 26 is fastened to

the wheel ring 99 by means of the snap ring 113 arranged in a groove 114 of the wheel ring 99 to keep a projecting flange 115 of the closing member firmly fastened to the wheel ring 99. In between the flange of the closing member 26 and the wheel ring 99, a sealing member 116 is arranged. In order to transmit the rotational force of the hydraulic motor block 84, the closing member 26 comprises projections which are flanges increasing the diameter of the closing member 26, the projections corresponding to indentations in the wheel ring 99.

[0055] In Figs. 5A-5B and 8A-8B, the planetary gearing system 95 comprises a sun gear 96 fastened to the rotatable hydraulic cylinder block by means of screws. The sun gear 96 drives the planet gears 97 which are connected through a carrier member 37, such as a carrier plate. The carrier member 37 is screwed into the hydraulic motor block. The planet gears rotate around a planet gear rotational axis 34 and are rotatably connected with the carrier member 37 through a ball bearing 36B arranged between a projecting part of the carrier plate 37 and a hole in the planet gear. The planet gears mesh with the wheel ring 99 which, accordingly, functions as the ring gear 98 of the planetary gearing system 95.

[0056] The planetary gearing system 95 is comprised in the hydraulic motor housing 93 and is connected directly to the hydraulic motor block. Thus, the hydraulic fluid inside the hydraulic cylinder block also surrounds the gears of the planetary gearing system 95 as they are comprised in the same motor housing. By arranging the planetary gearing system 95 directly in the hydraulic motor housing 93, the width of the wheel along the rotational axis 33 of the wheel assembly 90 is substantially reduced in relation to a planetary gearing system arranged outside the hydraulic motor housing 93. A small wheel width provides a smaller diameter of the driving unit, enabling the driving unit to enter also small diameter wells.

[0057] In Fig. 9, the sun gear 96 is provided as part of the hydraulic cylinder block. The planet gears mesh with the closing member 26 which, accordingly, functions as the ring gear 98 in the planetary gearing system 95. Thus, the wheel ring 99 is driven by the hydraulic cylinder block by driving the planet gears which drive the closing member 26 driving the wheel ring 99.

[0058] Furthermore, the fluid channels 86 in the hydraulic cylinder block supplying fluid to the motor are substantially parallel with the rotational axis of the wheel. The wheel arm 81 comprises fluid channels 85 aligned with the fluid channels 86 in the hydraulic cylinder block so that the fluid can flow freely from the arm to the motor. Only the channels supplying fluid to the motor are shown. By having the fluid channels of the hydraulic cylinder block substantially parallel to the rotational axis of the wheel, the fluid channels are much easier to manufacture.

[0059] In order to be able to roll along the cam ring 24, the pistons moving in the cylinders of the hydraulic cylinder block are provided with a ball bearing 117. The central part of the ball bearing is suspended in a piston body of the piston, and an outermost part of the ball bearing abuts the cam ring, the ball bearing thus being capable of rotating in relation to the piston.

[0060] The invention further relates to a downhole system as shown in Fig. 10, in which the driving unit 11 is connected to an operational tool which, in this case, is a logging tool logging fluid and formation data. The operational tool could also be a stroker tool providing an axial force in one or more strokes, a key tool opening or closing valves in the well, positioning tools such as a casing collar locator (CCL), a milling tool or drilling tool, etc.

[0061] By well fluid is meant any kind of fluid that may be present in oil or gas wells downhole, such as natural gas, oil, oil mud, crude oil, water, etc. By gas is meant any kind of gas composition present in a well, completion, or open hole, and by oil is meant any kind of oil composition, such as crude oil, an oil-containing fluid, etc. Gas, oil, and water fluids may thus all comprise other elements or substances than gas, oil, and/or water, respectively.

[0062] By a casing is meant any kind of pipe, tubing, tubular, liner, string etc. used downhole in relation to oil or natural gas production.

[0063] Although the invention has been described in the above in connection with preferred embodiments of the invention, it will be evident for a person skilled in the art that several modifications are conceivable without departing from the invention as defined by the following claims.

Claims

1. A downhole driving unit (11) for insertion into a well, comprising:

   - a driving unit housing (51), and
   - a wheel assembly (90) comprising a stationary part (91) and a rotational part (92), the stationary part being connected with the driving unit housing and being rotatably connected with the rotational part,

   characterised in that the wheel assembly further comprises a hydraulic motor (23) comprising a hydraulic motor housing (93), the stationary part and the rotational part constituting the hydraulic motor housing, the rotational part comprising a wheel ring (99) closed from one end,
   wherein the wheel assembly comprises a spring member (113) connecting the stationary part with the rotational part or connecting a first part (122) of the rotational part with a second part (123) of the rotational part.

2. A downhole driving unit according to claim 1, wherein the first part is the wheel ring and the second part is a closing member (26) closing the wheel ring from the one end.

3. A downhole driving unit according to claim 1 or 2, wherein the stationary part is a cam ring (24) of the hydraulic motor.

4. A downhole driving unit according to claim 2, wherein the wheel assembly further comprises a sealing member (27, 27B, 116) arranged between the stationary part and the rotational part or between a first part of the rotational part and a second part of the rotational part.

5. A downhole driving unit according to any of the preceding claims, wherein the spring member is a circlip or a snap ring.

6. A downhole driving unit according to any of the preceding claims, wherein the hydraulic motor is a radial piston motor.

7. A downhole driving unit according to any of the preceding claims, further comprising an arm assembly (60) movable between a retracted position and a projected position in relation to the driving unit housing, and wherein the arm assembly is connected with or forms part of the stationary part of the wheel assembly.

8. A downhole driving unit according to claim 7, further comprising an arm activation assembly (41) arranged in the driving unit housing for moving the arm assembly between the retracted position and the projected position.

9. A downhole driving unit according to any of the preceding claims, wherein the wheel assembly further comprises a planetary gearing system (95).

10. A downhole driving unit according to claim 9, wherein the hydraulic motor has a rotatable section (84) which is connected with a sun gear (96) of the planetary gearing system.

11. A downhole driving unit according to claim 9 or 10, wherein the planetary gearing system is comprised in the hydraulic motor housing.

12. A downhole driving unit according to any of claims 9-11, wherein the planetary gearing system comprises a ring gear (98) constituted by the wheel ring or the closing member.

13. A downhole system comprising the driving unit according to any of claims 1-12 and an operational tool (12) connected with the driving unit for being moved forward in a well or borehole.

14. A downhole system according to claim 13, wherein the operational tool is a stroker tool, a key tool, a milling tool, a drilling tool, a logging tool, etc.

15. Use of the driving unit according to any of claims 1-12 in a well or borehole for moving itself and/or an operational tool forward in a well or borehole.

Patentansprüche

1. Bohrlochantriebseinheit (11) zum Einbringen in ein Bohrloch, Folgendes umfassend:

   - ein Antriebseinheitsgehäuse (51), und
   - eine Radgruppe (90), die einen feststehenden Teil (91) und einen sich drehenden Teil (92) umfasst, wobei der feststehende Teil mit dem Antriebseinheitsgehäuse verbunden ist und drehend mit dem sich drehenden Teil verbunden ist,

   dadurch gekennzeichnet, dass die Radgruppe außerdem einen Hydraulikmotor (23) umfasst, der ein Hydraulikmotorgehäuse (93) umfasst, wobei der feststehende Teil und der sich drehende Teil das Hydraulikmotorgehäuse bilden, wobei der sich drehende Teil einen Radring (99) umfasst, der an einem Ende verschlossen ist,
   wobei die Radgruppe ein Federelement (113) umfasst, das den feststehenden Teil mit dem sich drehenden Teil verbindet oder das einen ersten Teil (122) des sich drehenden Teils mit einem zweiten Teil (123) des sich drehenden Teils verbindet.

2. Bohrlochantriebseinheit nach Anspruch 1, wobei der erste Teil der Radring ist und der zweite Teil ein Verschlusselement (26) ist, das den Radring an dem einen Ende verschließt.

3. Bohrlochantriebseinheit nach Anspruch 1 oder 2, wobei der feststehende Teil ein Nockenring (24) des Hydraulikmotors ist.

4. Bohrlochantriebseinheit nach Anspruch 2, wobei die Radgruppe außerdem ein Abdichtungselement (27, 27B, 116) umfasst, das zwischen dem feststehenden Teil und dem sich drehenden Teil oder zwischen einem ersten Teil des sich drehenden Teils und einem zweiten Teil des sich drehenden Teils angeordnet ist.

5. Bohrlochantriebseinheit nach einem der vorhergehenden Ansprüche, wobei das Federelement ein Sprengring oder ein Sicherungsring ist.

6. Bohrlochantriebseinheit nach einem der vorhergehenden Ansprüche, wobei der Hydraulikmotor ein Radialkolbenmotor ist.

7. Bohrlochantriebseinheit nach einem der vorherge-

henden Ansprüche, die außerdem eine Armgruppe (60) umfasst, die zwischen einer eingezogenen Position und einer relativ zum Antriebseinheitsgehäuse hervorstehenden Position bewegt werden kann, wobei die Armgruppe mit dem feststehenden Teil der Radgruppe verbunden ist oder einen Teil von diesem bildet.

8. Bohrlochantriebseinheit nach Anspruch 7, die außerdem eine im Antriebseinheitsgehäuse angeordnete Armaktivierungsgruppe (41) umfasst, um die Armgruppe zwischen der eingezogenen Position und der hervorstehenden Position zu bewegen.

9. Bohrlochantriebseinheit nach einem der vorhergehenden Ansprüche, wobei die Radgruppe außerdem ein Planetengetriebesystem (95) umfasst.

10. Bohrlochantriebseinheit nach Anspruch 9, wobei der Hydraulikmotor einen drehbaren Abschnitt (84) hat, der mit einem Sonnenrad (96) des Planetengetriebesystem verbunden ist.

11. Bohrlochantriebseinheit nach Anspruch 9 oder 10, wobei das Planetengetriebesystem im Hydraulikmotorgehäuse enthalten ist.

12. Bohrlochantriebseinheit nach einem der Ansprüche 9 bis 11, wobei das Planetengetriebesystem ein Hohlrad (98) umfasst, das vom Radring oder dem Verschlusselement gebildet wird.

13. Bohrlochsystem, das die Antriebseinheit nach einem der Ansprüche 1 bis 12 umfasst, sowie ein Arbeitsgerät (12), das mit der Antriebseinheit verbunden ist, um in einem Schacht oder Bohrloch vorwärts bewegt zu werden.

14. Bohrlochsystem nach Anspruch 13, wobei das Arbeitsgerät ein Schlagwerkzeug, Keilwerkzeug, Mahlwerkzeug, Bohrwerkzeug, Registrierungswerkzeug etc. ist.

15. Verwendung der Antriebseinheit nach einem der Ansprüche 1 bis 12 in einem Schacht oder Bohrloch, um sich selbst und/oder ein Arbeitsgerät in einem Schacht oder Bohrloch vorwärtszubewegen.

Revendications

1. Unité de commande de fond de trou (11) pour l'insertion dans un puits, comprenant :

- un carter d'unité de commande (51), et
- un ensemble de roue (90) comprenant une partie fixe (91) et une partie rotative (92), la partie fixe étant raccordée avec le carter d'unité de commande et étant raccordée en rotation avec la partie rotative,

caractérisée en ce que l'ensemble de roue comprend en outre un moteur hydraulique (23) comprenant un carter de moteur hydraulique (93), la partie fixe et la partie rotative constituant le carter de moteur hydraulique, la partie rotative comprenant une bague de roue (99) fermée à partir d'une extrémité, dans laquelle l'ensemble de roue comprend un élément de ressort (113) raccordant la partie fixe avec la partie rotative ou raccordant une partie fixe (122) de la partie rotative avec une seconde partie (123) de la partie rotative.

2. Unité de commande de fond de trou selon la revendication 1, dans laquelle la première partie est la bague de roue et la seconde partie est un élément de fermeture (26) fermant la bague de roue à partir d'une extrémité.

3. Unité de commande de fond de trou selon la revendication 1 ou 2, dans laquelle la partie fixe est un anneau à came (24) du moteur hydraulique.

4. Unité de commande de fond de trou selon la revendication 2, dans laquelle l'ensemble de roue comprend en outre un élément d'étanchéité (27, 27B, 116) agencé entre la partie fixe et la partie rotative ou entre une première partie de la partie rotative et une seconde partie de la partie rotative.

5. Unité de commande de fond de trou selon l'une quelconque des revendications précédentes, dans laquelle l'élément de ressort est une bague de retenue ou un anneau élastique.

6. Unité de commande de fond de trou selon l'une quelconque des revendications précédentes, dans laquelle le moteur hydraulique est un moteur à pistons radiaux.

7. Unité de commande de fond de trou selon l'une quelconque des revendications précédentes, comprenant en outre un ensemble de bras (60) mobile entre une position rétractée et une position en saillie par rapport au carter d'unité de commande, et dans laquelle l'ensemble de bras est raccordé avec ou fait partie de la partie fixe de l'ensemble de roue.

8. Unité de commande de fond de trou selon la revendication 7, comprenant en outre un ensemble d'activation de bras (41) agencé dans le carter d'unité de commande pour déplacer l'ensemble de bras entre la position rétractée et la position en saillie.

9. Unité de commande de fond de trou selon l'une quelconque des revendications précédentes, dans la-

quelle l'ensemble de roue comprend en outre un système d'engrenage planétaire (95).

10. Unité de commande de fond de trou selon la revendication 9, dans laquelle le moteur hydraulique a une section rotative (84) qui est raccordée à un planétaire (96) du système d'engrenage planétaire.

11. Unité de commande de fond de trou selon la revendication 9 ou 10, dans laquelle le système d'engrenage planétaire est compris dans le carter de moteur hydraulique.

12. Unité de commande de fond de trou selon l'une quelconque des revendications 9 à 11, dans laquelle le système d'engrenage planétaire comprend une couronne (98) constituée par la bague de roue ou l'élément de fermeture.

13. Système de fond de trou comprenant l'unité de commande selon l'une quelconque des revendications 1 à 12 et un outil (12) opérationnel raccordé à l'unité de commande, destiné à être déplacé vers l'avant dans un puits ou un fond de trou.

14. Système de fond de trou selon la revendication 13, dans lequel l'outil opérationnel est un outil de frappe, un outil à clé, un outil de fraisage, un outil de forage, un outil de diagraphie, etc.

15. Utilisation de l'unité de commande selon l'une quelconque des revendications 1 à 12 dans un puits ou un forage pour se déplacer elle-même et/ou déplacer un outil opérationnel vers l'avant dans un puits ou un forage.

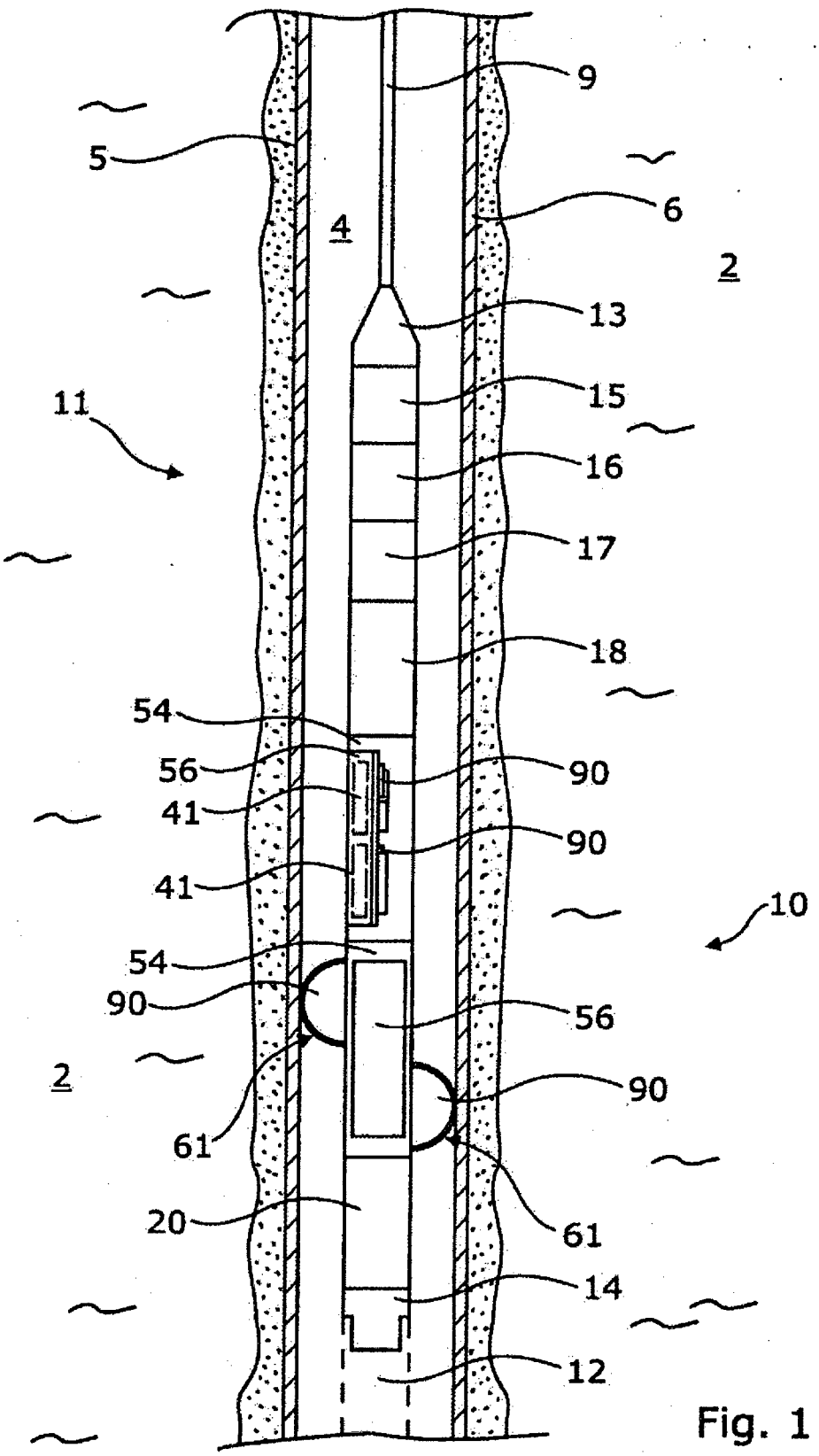
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Fig. 1

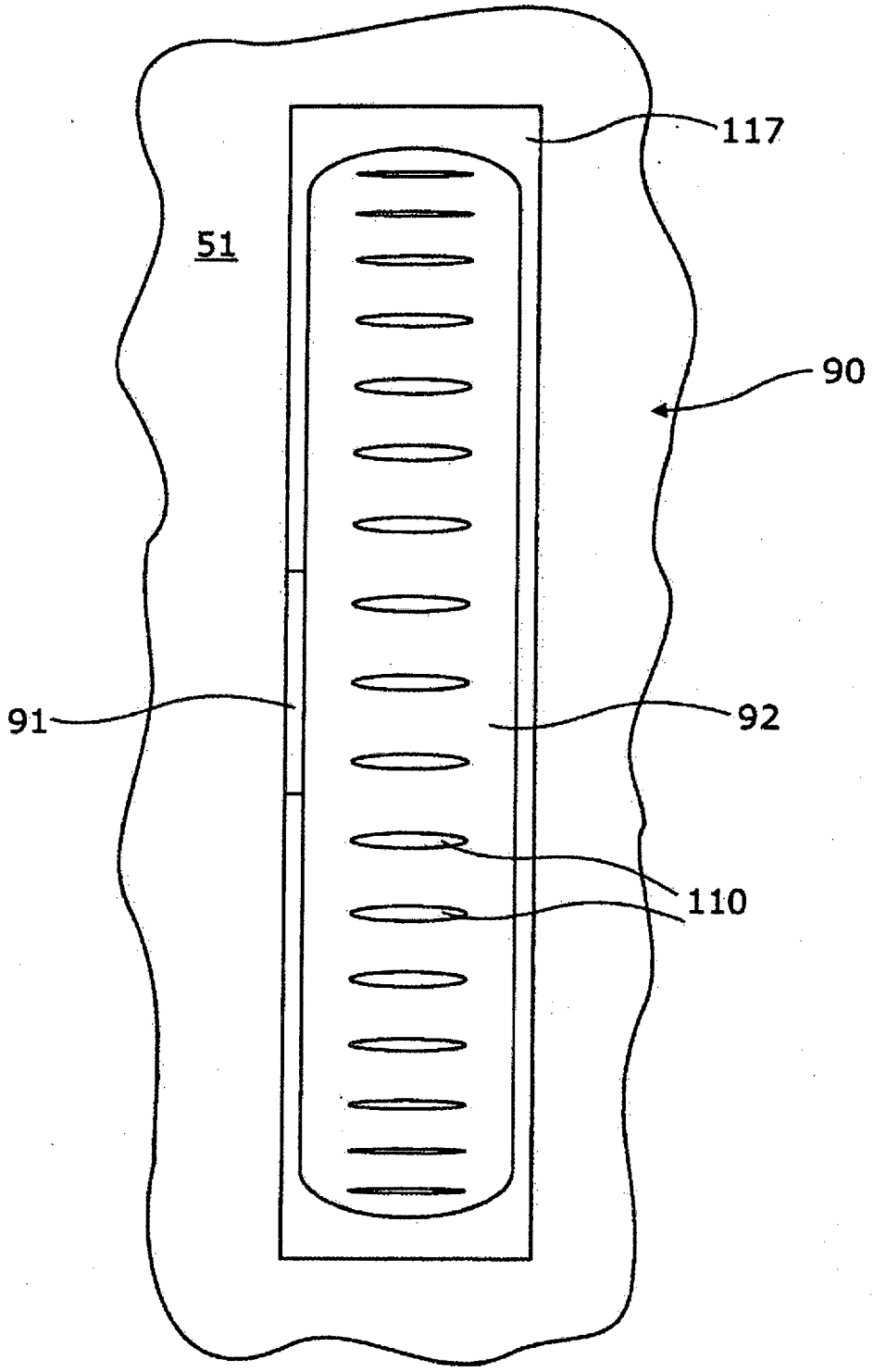

Fig. 2

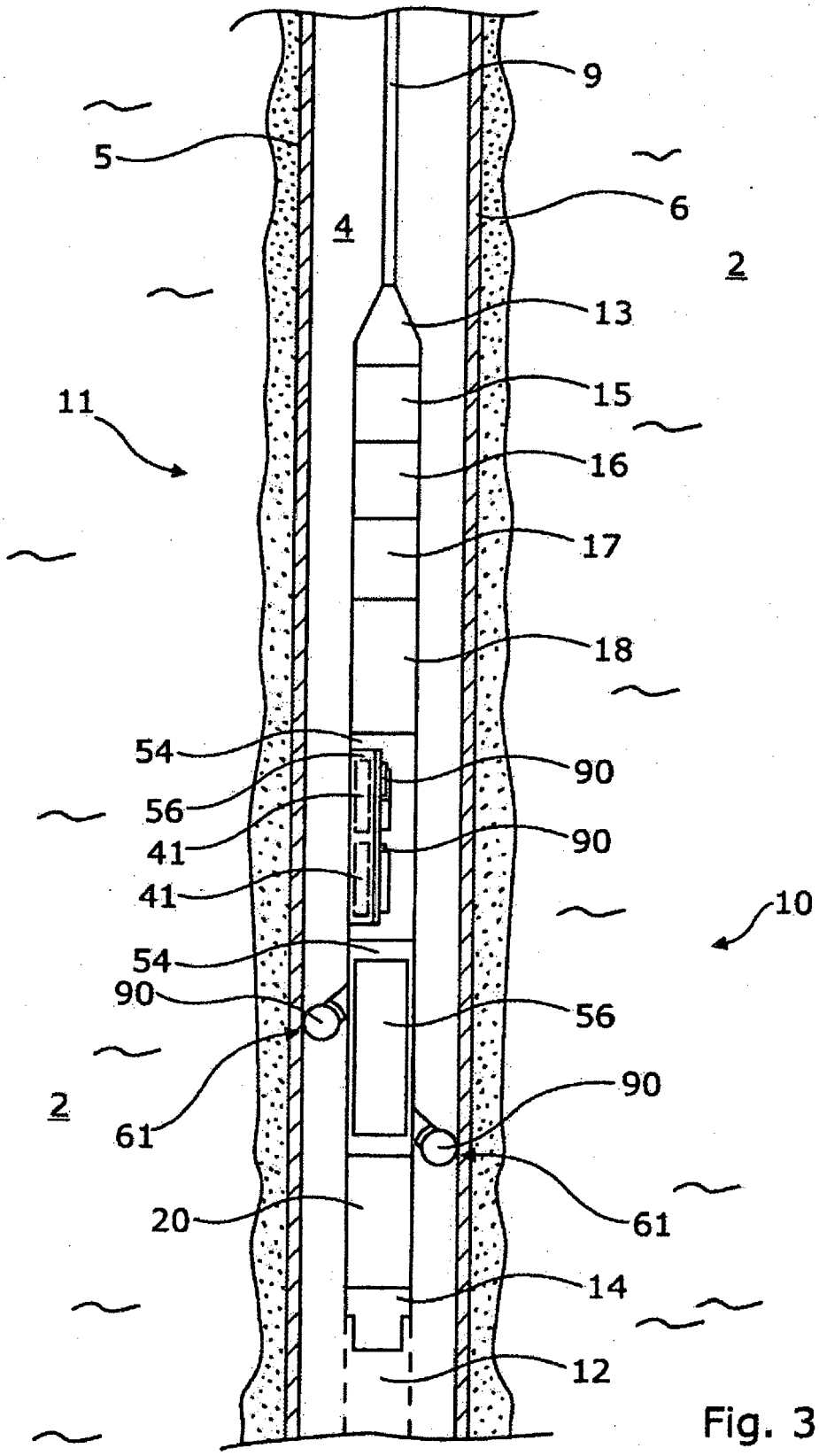
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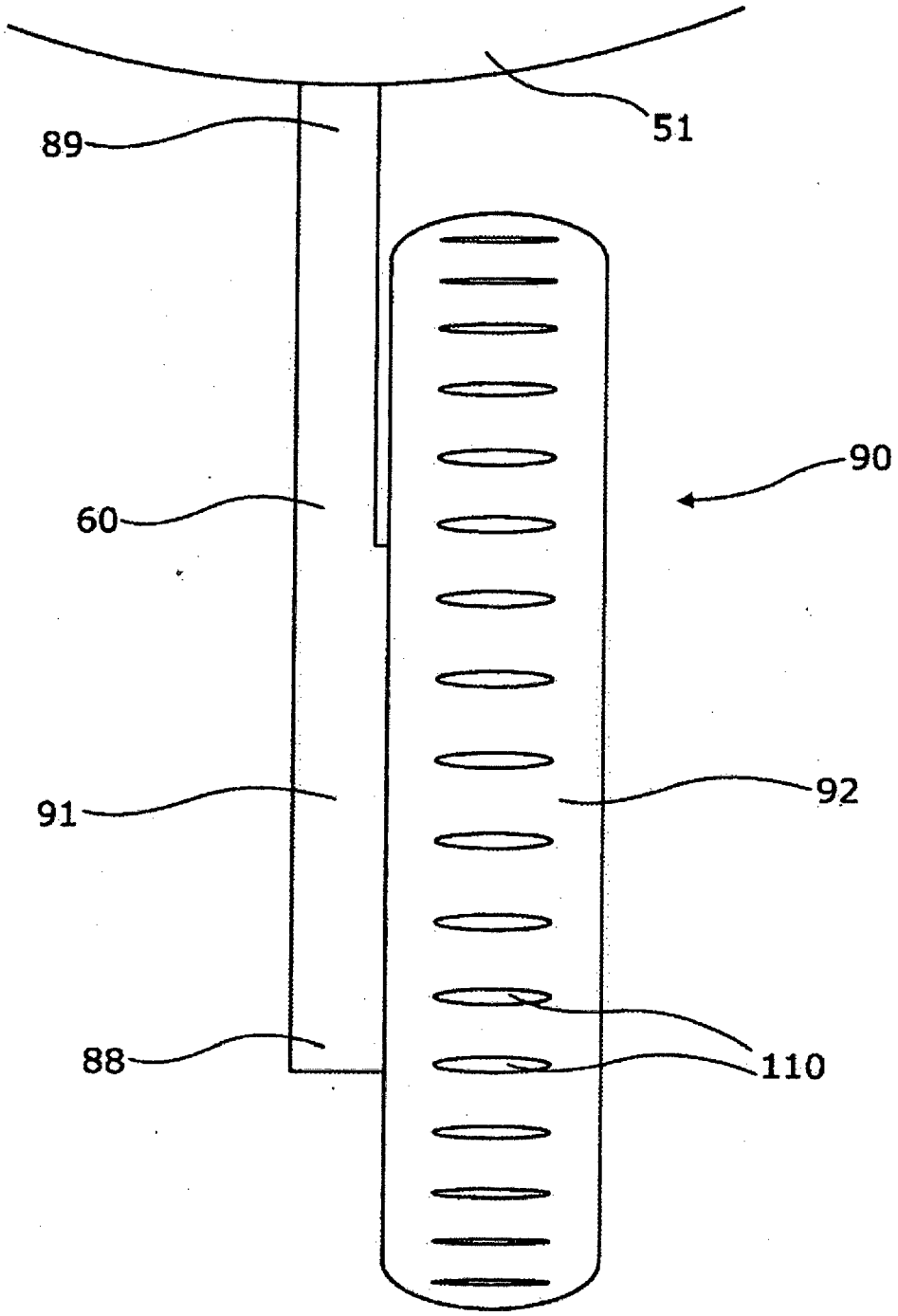
Fig. 3



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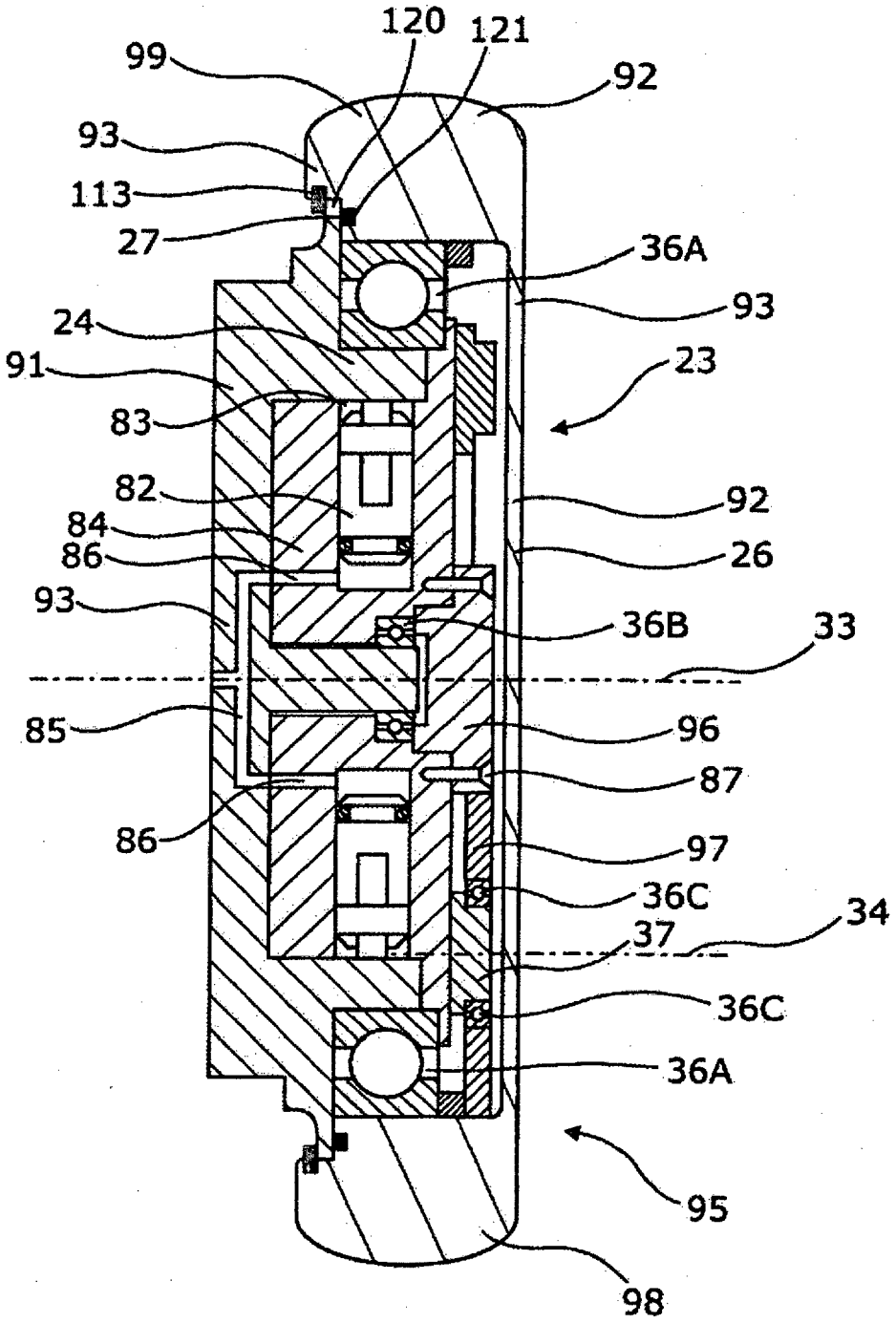
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36A
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Fig. 5A

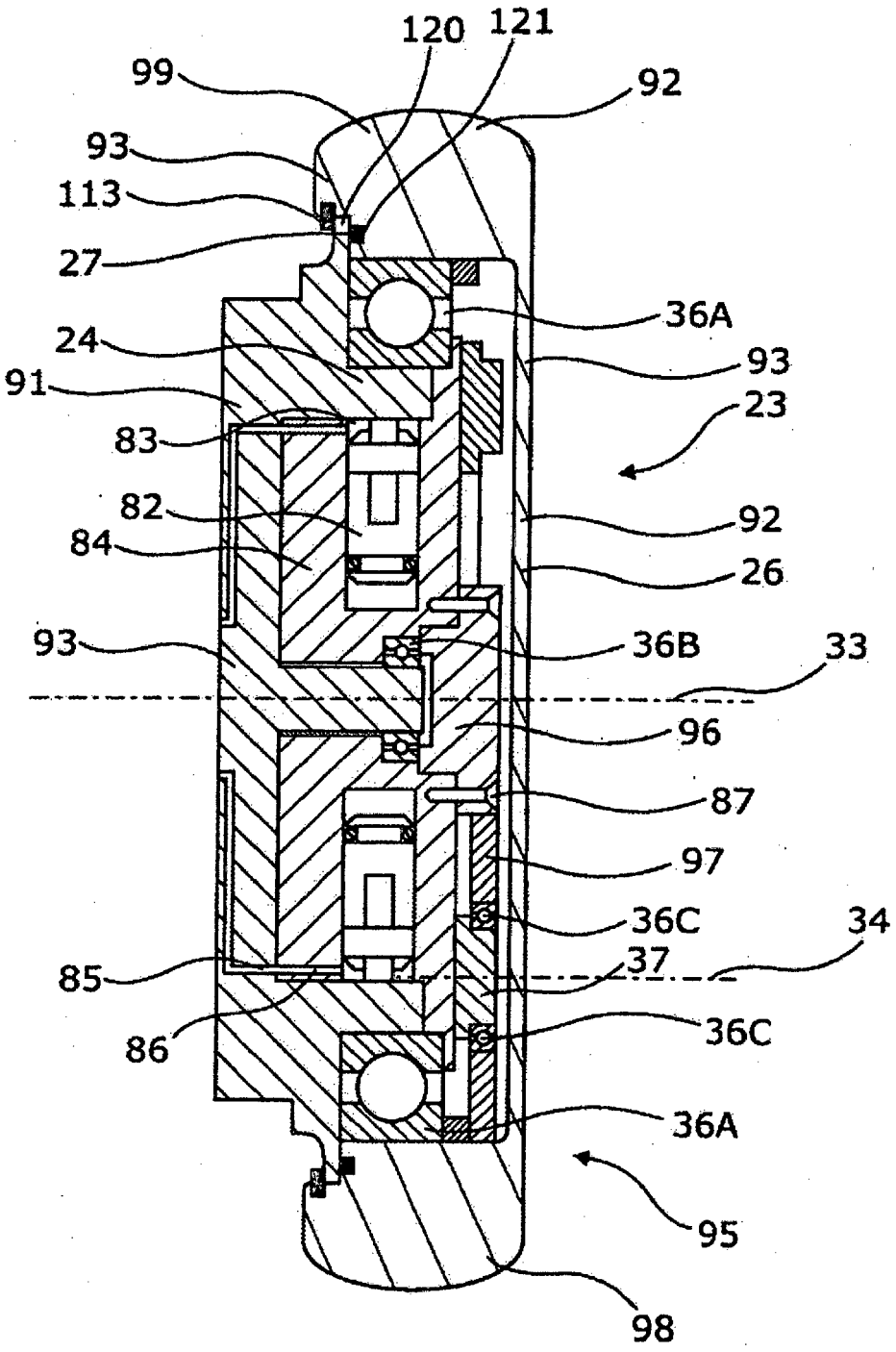
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Fig. 5B

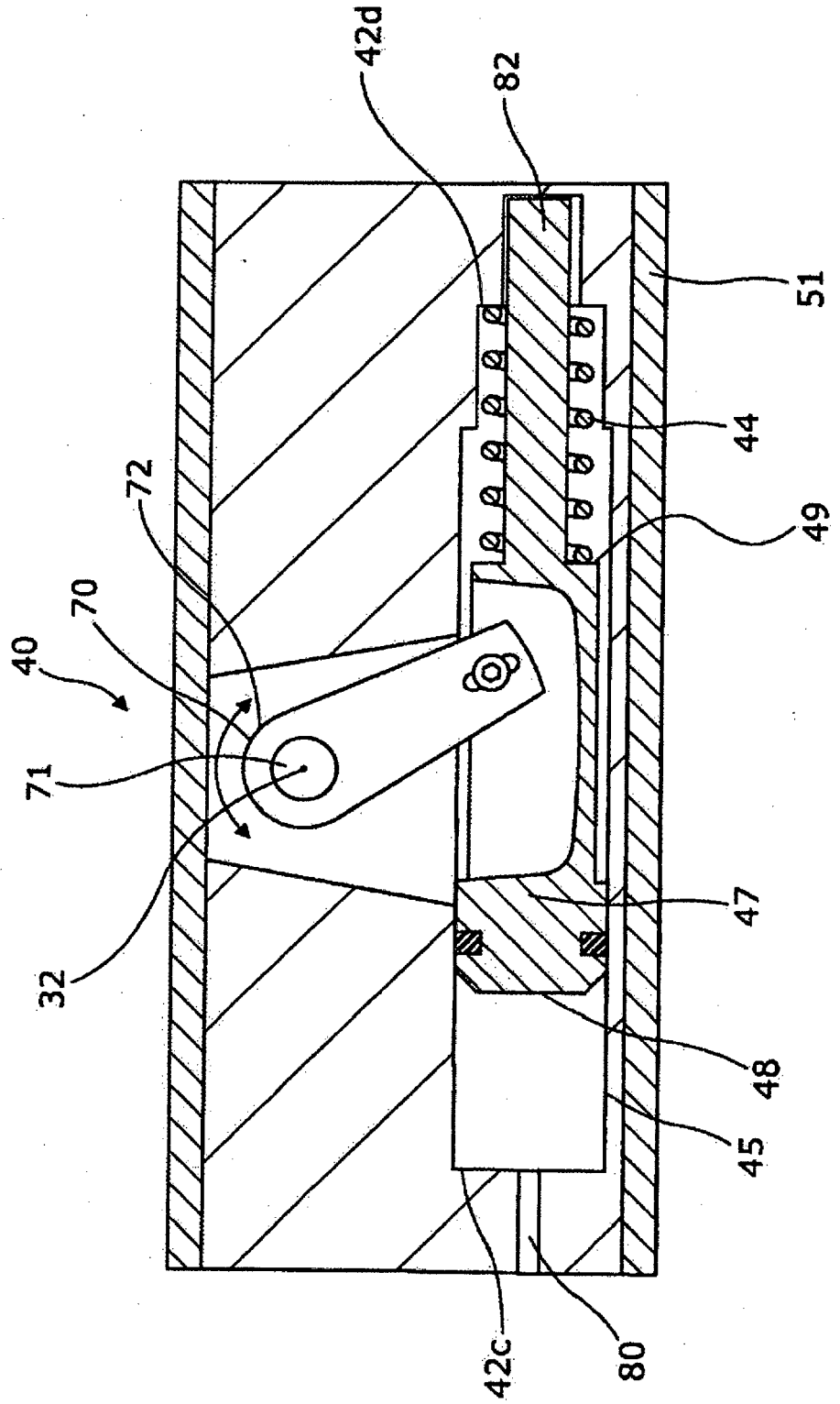

Fig. 6

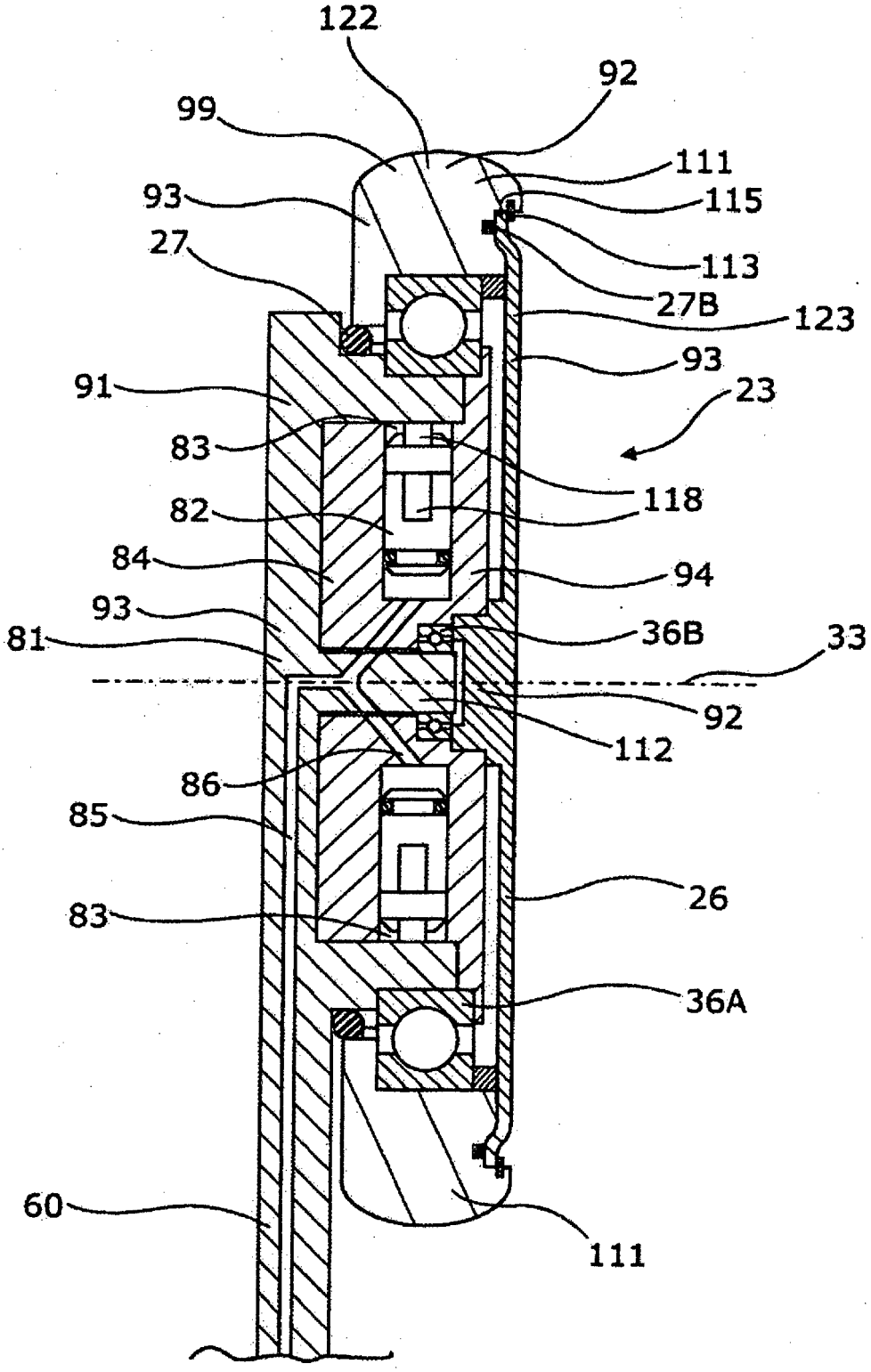
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Fig. 7A

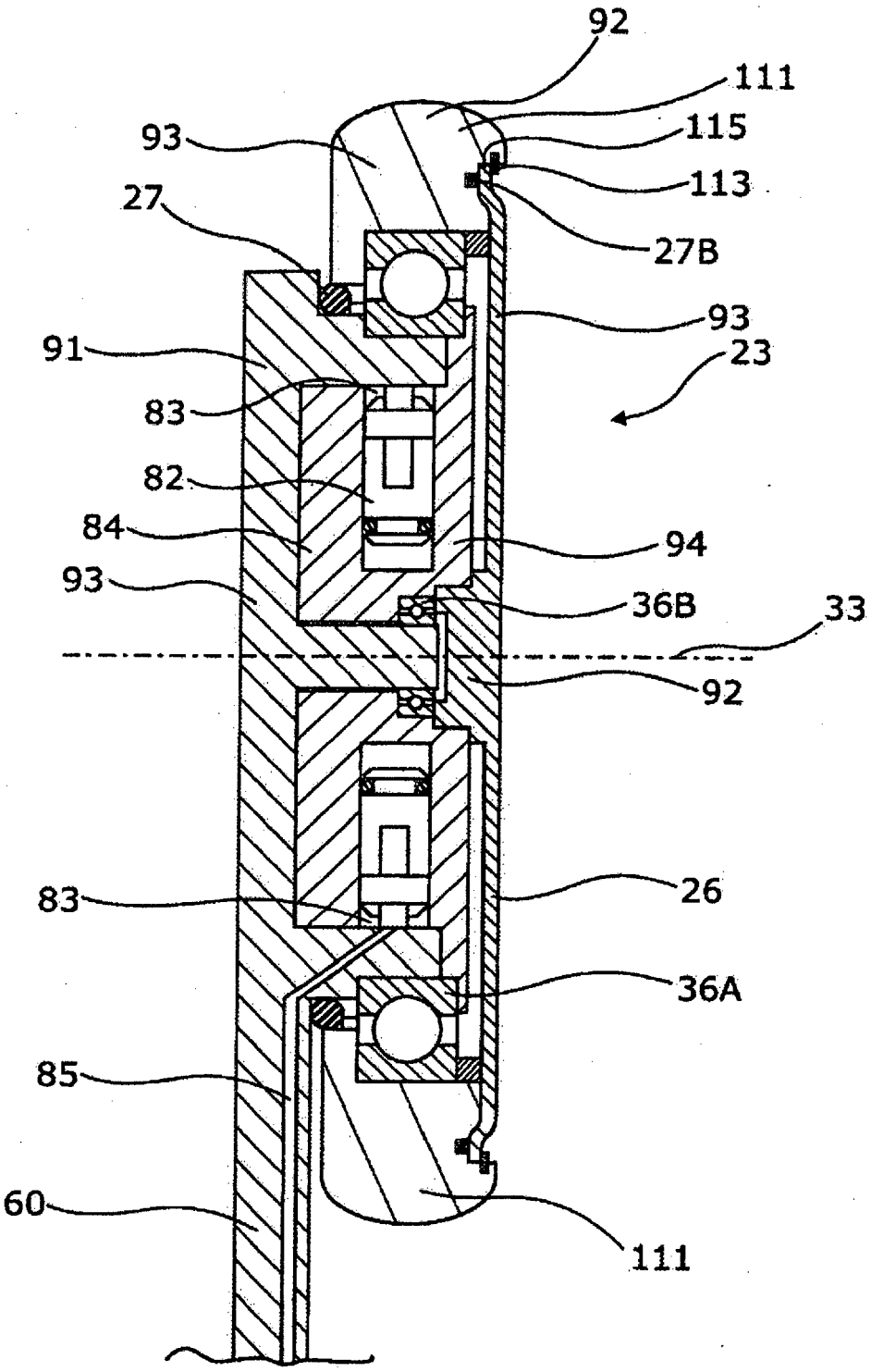
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Fig. 7B

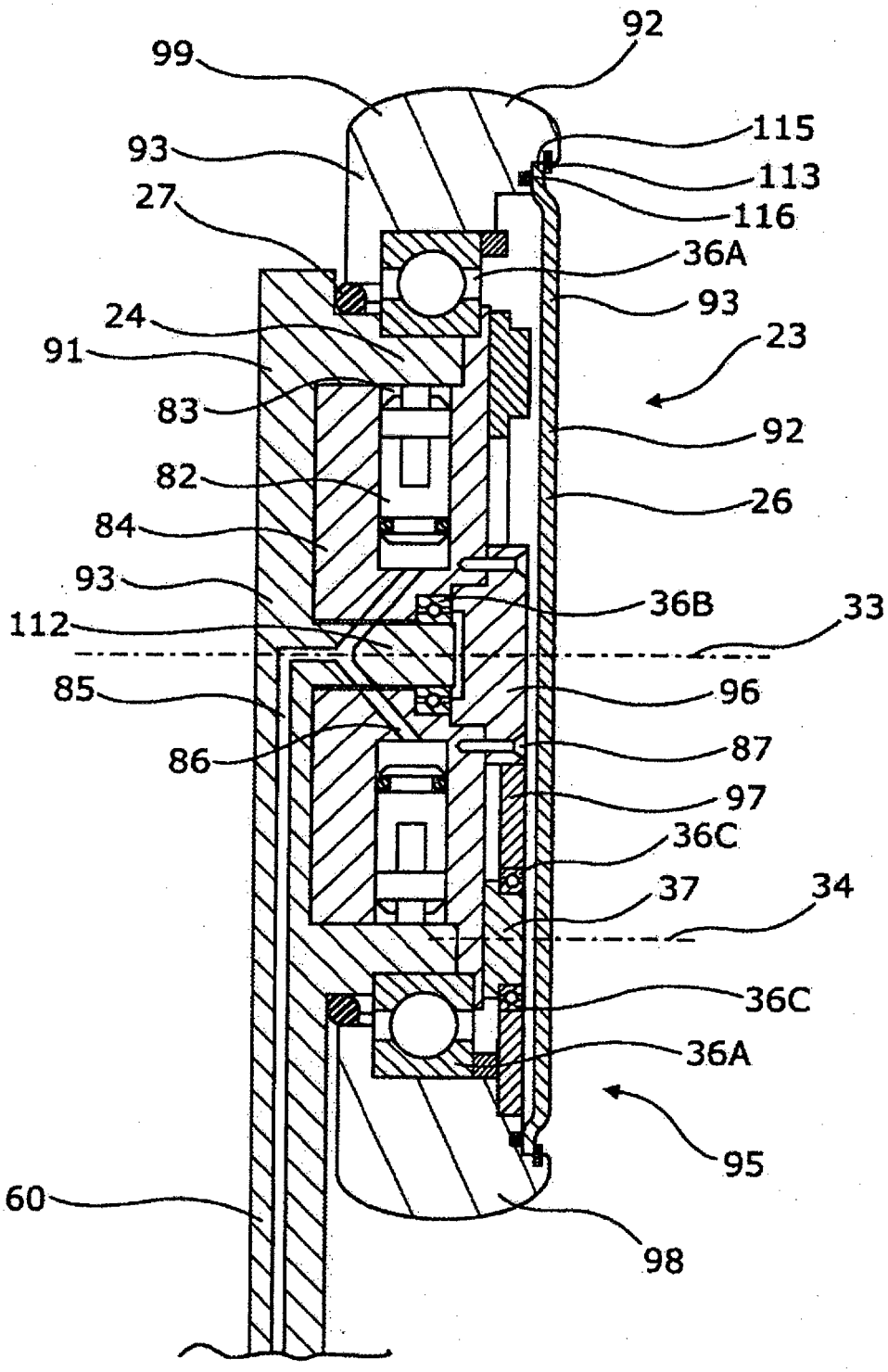
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Fig. 8A

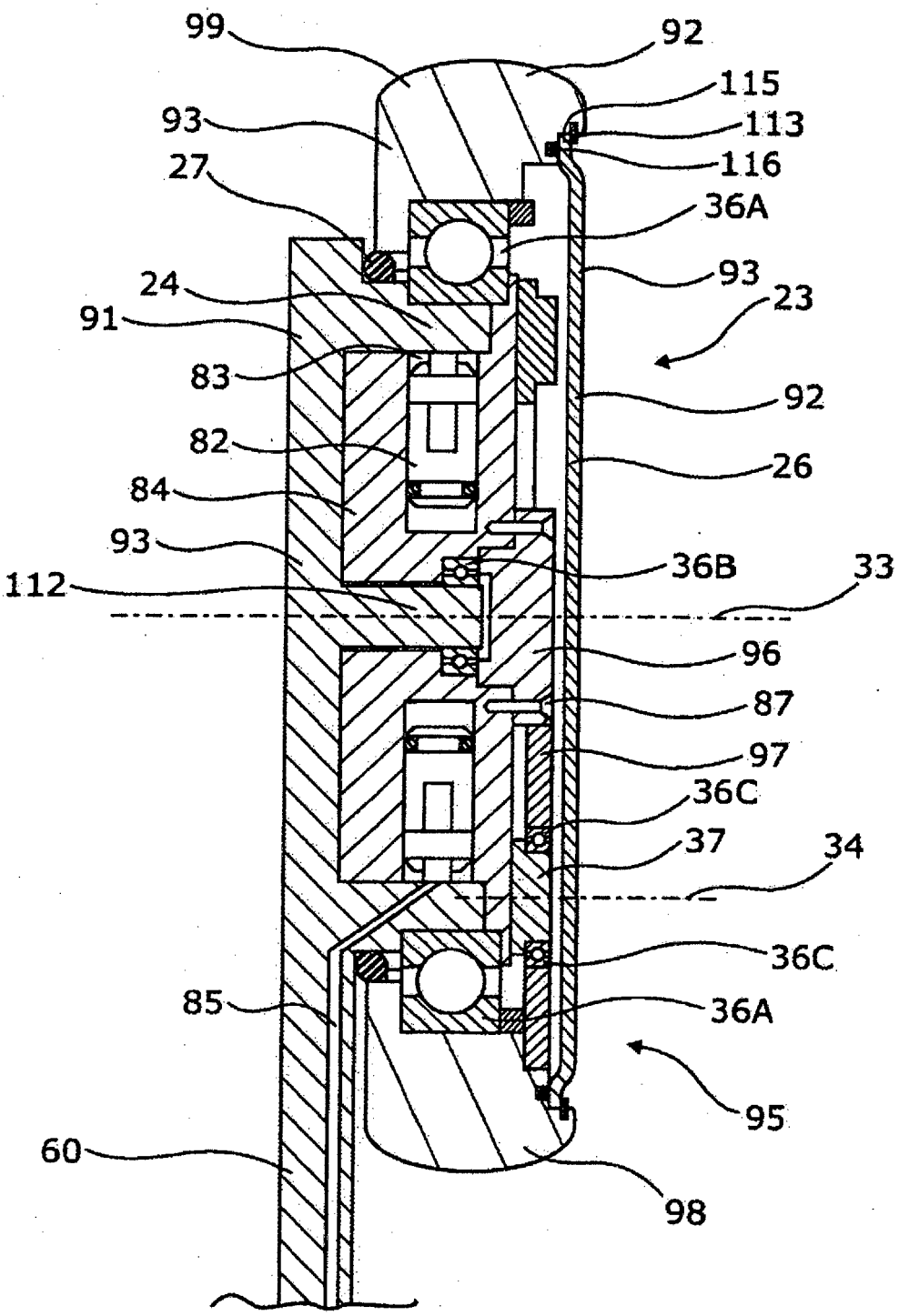
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Fig. 8B

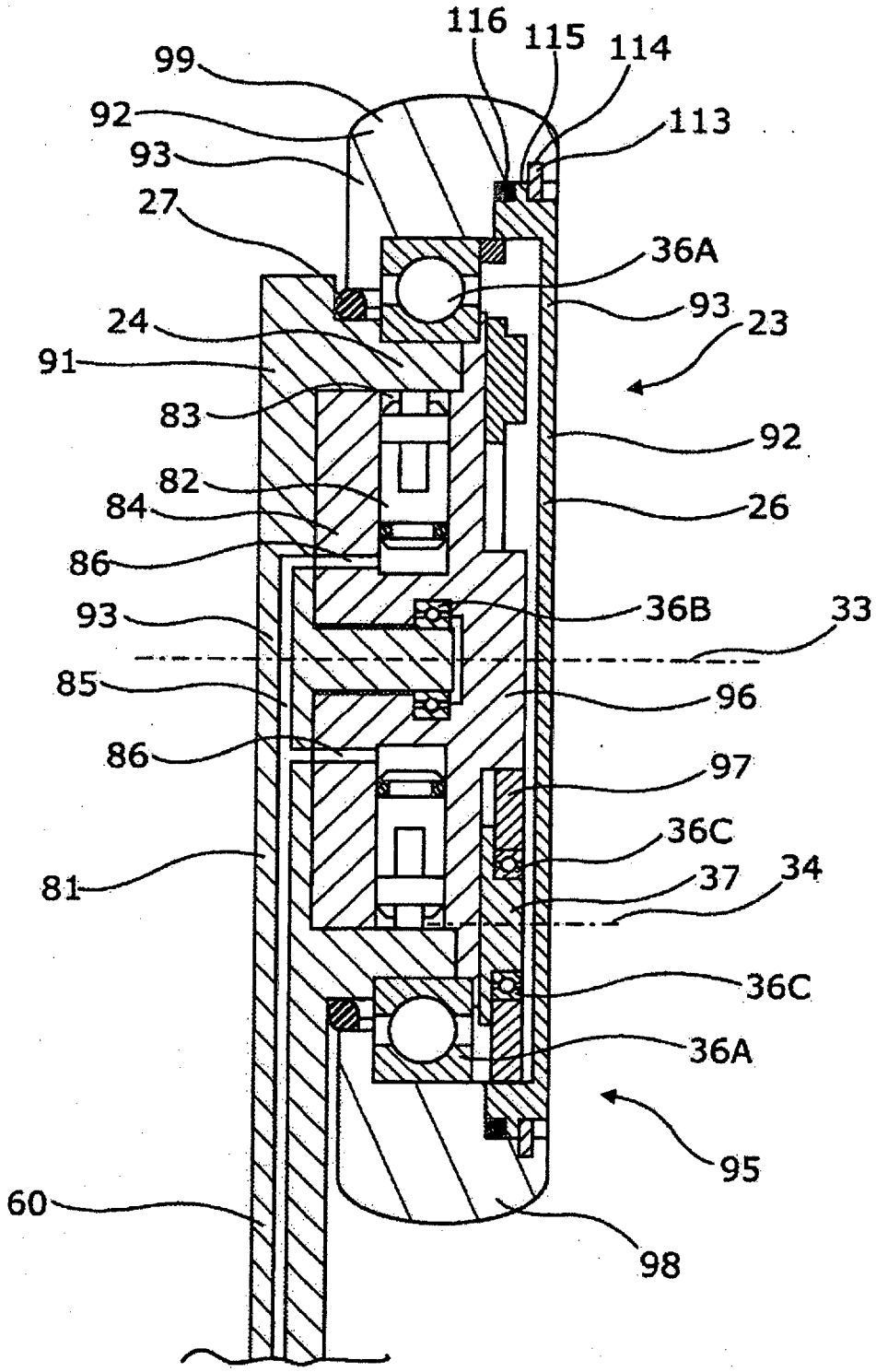
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Fig. 9

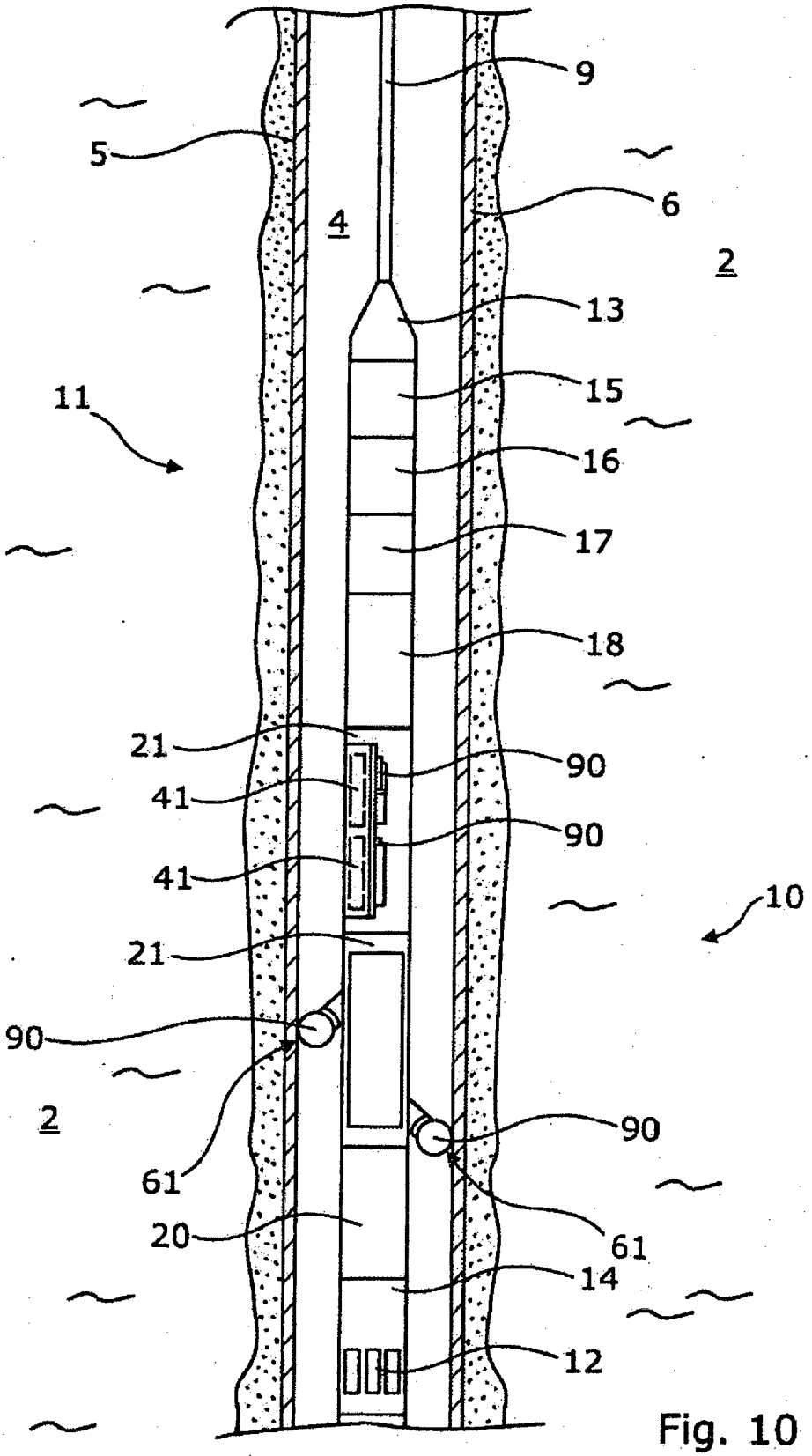

Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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