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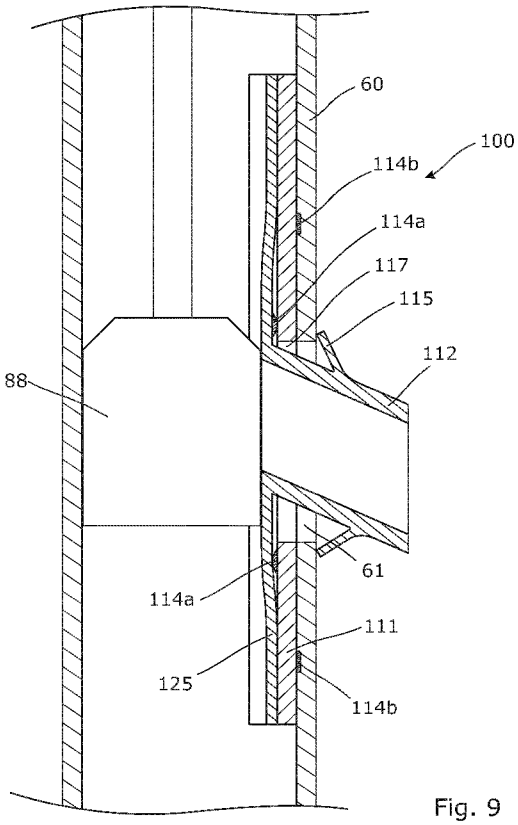


Fig. 9

(57) Abstract: The present invention relates to a lateral junction assembly (1) for providing a lateral junction in a wellbore by being inserted into a casing (60) having an opening (61) and defining a longitudinal axis (52), the lateral junction assembly (1) having a longitudinal direction (50) which is substantially parallel to the longitudinal axis (52) and comprising a pipe module (10) comprising a pipe section (12) for being inserted through the opening (61) in the casing and a flange (11), wherein the lateral junction assembly further comprises a fixation element (25) adapted for being connected with the flange (11) to fixate the pipe module (10) in a predetermined location with the pipe section extending through the opening (61) in the casing (60).

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LATERAL JUNCTION ASSEMBLY

Field of the invention

The present invention relates to a lateral junction assembly for providing a lateral junction in a wellbore by being inserted into a casing having an opening and defining a longitudinal axis. Furthermore, the invention relates to a lateral junction system for providing a lateral junction in a wellbore. Moreover, the invention relates to a wireline tool for transporting, positioning and assembling a lateral junction assembly in a casing. Finally, the present invention relates to a method of installing a lateral junction assembly in a wellbore.

Background art

A lateral wellbore is a branch of a primary wellbore and is often referred to as a lateral or side track. If a well has a plurality of laterals, it is referred to as a multi-lateral.

Designing wells with laterals is a way of increasing the yield of an oil or gas field and may contribute to reducing the costs associated with drilling operations. Laterals may be created before the well is completed or at a later stage after the well has been cased. When making a lateral after the well has been cased, the junction between the primary casing and the lateral has to be installed at the location downhole. It is very difficult to perform a welding operation downhole, and the sealing between the lateral junction and the casing often fails.

U.S. Patent 5,388,648 discloses different solutions wherein deformable devices are utilised for sealing the junction between vertical and lateral wells. Different types of deformable devices are lowered into a well prior to or after the well has been cased. Subsequently, the devices are deformed to obtain the intended shape of the lateral junction and cemented in place. A disadvantage in this respect is the use of cement or other curable liquid in the design of a lateral junction between a primary well and a lateral well. Furthermore, to deform the device subsequently induces the risk of leaks.

Laterals are created downhole, and the precision of such operation may therefore be difficult to control, constituting a limiting feature. At the same time, it is important that the lateral junction is properly sealed to avoid outflow from the casing back into the formation.

Summary of the invention

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 assembly which is easy to implement in an existing casing and still provides the necessary sealing effect.

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 lateral junction assembly for providing a lateral junction in a wellbore by being inserted into a casing having an opening (61) and defining a longitudinal axis, the lateral junction assembly having a longitudinal direction which is substantially parallel to the longitudinal axis and comprising:

- a pipe module comprising a pipe section for being inserted through the opening in the casing and a flange,

wherein the lateral junction assembly further comprises a fixation element adapted for being connected with the flange to fixate the pipe module in a predetermined location with the pipe section extending through the opening in the casing.

An advantage in this respect is that a lateral junction can be provided by simply assembling standard modules downhole. By connecting the fixation element to the flange, the pipe module is pushed against the inner surface of the casing and thereby secured in the predetermined position. The lateral junction provided does not require precision welding, cementing or other types of casting or custom operations to ensure a liquid-tight lateral junction.

In one embodiment, the pipe section may extend from a first surface of the flange, and the fixation element, when connected to the flange, may extend from a second surface of the flange opposite the first surface of the flange.

The lateral junction assembly may further comprise a sealing element arranged at the first surface of the flange.

Moreover, the assembly may comprise two or more fixation elements.

The side edges of the fixation elements and the side edges of the flange may be provided with indentations or grooves or serrations to improve the bonding properties between the side edges of the fixation elements and between the side edges of the flange and the side edges of the fixation elements.

Further, the one or more fixation elements may be sections of a hollow cylinder.

Moreover, the one or more fixation elements may be sections of a circular ring.

Also, a cross-section of the flange may constitute a first part of a circular ring and the one or more fixation elements may constitute a second and remaining part of the circular ring.

In another embodiment, the lateral junction assembly may comprise one or more fixation elements distributed in the longitudinal direction of the lateral junction assembly.

The lateral junction assembly may comprise one or more fixation elements positioned adjacent to a first edge of the flange and one or more fixation elements positioned adjacent to a second edge of the flange.

Further, the lateral junction assembly may comprise one or more fixation elements positioned substantially in a middle part of the flange in the longitudinal direction.

Additionally, the lateral junction assembly may comprise two or more pipe modules.

Also, the pipe module may comprise two or more pipe sections extending from the flange.

An advantage in this respect is that the distance between two laterals may be controlled by the distance between the pipe sections extending from the flange. Thus, the distance between two laterals does not have to be measured out.

The present invention furthermore relates to a lateral junction system for providing a lateral junction in a wellbore, the lateral junction system comprising:
- a primary casing having an inner surface and at least one opening, the primary casing defining a longitudinal axis, and
- a lateral junction assembly as described above,
wherein the pipe module is positioned such that the pipe section extends through the opening of the casing and the one or more fixation elements pushes the first surface of the flange towards the inner surface of the casing, whereby the pipe module is secured in a predetermined location.

Hereby, a modular system is provided having modules that can be transported to a desired location downhole and assembled to create a lateral junction. The modular system can be retrofitted to old wells or used in the completion of new wells. The modular system does not require precision welding to provide a liquid-tight lateral junction. The modules can be welded together to increase the strength of the system, but the welding does not affect the quality of the seals.

Furthermore, the lateral junction may comprise a lateral casing adapted to be connected to the pipe section of the pipe module.

In addition, the pipe module may have an extension in a transverse plane perpendicular to the longitudinal axis, the extension being smaller than an inner diameter of the casing.

Moreover, each of the fixation elements may have an extension in a transverse plane which is perpendicular to the longitudinal axis, the extension being smaller than an inner diameter of the casing.

Also, a cross-section of the flange may constitute a first part of a circular ring, and the one or more fixation elements may constitute a second and remaining part of the circular ring, an outer periphery of the ring being substantially equal to or slightly larger than an inner periphery of the casing.

The present invention further relates a wireline tool for transporting, positioning and assembling a lateral junction assembly as described above, the wireline tool comprising:

- an electronic unit for powering to the wireline tool,
- a motor unit,
- a pump unit,
- a driving unit moving the wireline tool downhole,
- a logging unit for determining the position in a casing downhole,
- a transportation unit for transporting and positioning the pipe module and the one or more fixation elements, and
- an assembly unit for assembling the lateral junction assembly downhole.

Moreover, the present invention relates to a method of installing a lateral junction assembly in a wellbore having a casing with at least one opening, the method comprising the steps of:

- lowering a pipe module comprising a pipe section and a flange into a wellbore,
- lowering one or more fixation elements adapted for being connected with the flange into a wellbore,
- positioning the pipe module in the casing with the pipe section extending through the opening of the casing,
- joining the flange of the pipe module with the one or more fixation elements, thereby fixating the lateral junction assembly in a predetermined location.

In said method, the side edges of the flange of the pipe module and side edges of the one or more fixation elements may be joined by cold welding caused by the side edges being pressed against each other.

In the lateral junction assembly as described above, the fixation element may be a flexible member for pushing the pipe section through an opening in the flange.

Also, the flexible member may be a sheet of spring steel.

In an embodiment, the flexible member may be formed as strands and made of spring steel.

Moreover, the fixation element may comprise multiple spring members for pushing the pipe section through an opening in the flange.

The lateral junction assembly as described above may further comprise one or more locking devices extending from the pipe section and being adapted to fixate the pipe section in an activated position wherein the pipe section extends through the opening in the flange.

Said one or more locking devices may be springs, such as leaf springs, extending from the pipe section towards the flexible member.

Further, the lateral junction assembly as described above may further comprise one or more activation members adapted to prevent the pipe section from being pushed through the opening in the casing by the fixation element.

The present invention also relates to a lateral junction system for providing a lateral junction in a wellbore, comprising:

- a primary casing having an inner surface and at least one opening, the primary casing defining a longitudinal axis, and
- a lateral junction assembly as described above,

wherein the pipe module is positioned such that the pipe section extends through the opening in the flange and the opening of the casing, whereby the lateral junction assembly is secured in a predetermined location.

In addition, the present invention relates to a wireline tool for transporting, positioning and activating a lateral junction assembly as described above in a casing, the wireline tool comprising:

- an electronic unit for powering to the wireline tool,
- a motor unit,
- a pump unit,
- a driving unit moving the wireline tool downhole,
- a logging unit for determining the position in a casing downhole,
- a transportation unit for transporting and positioning the lateral junction assembly, and
- an activation unit for activating the lateral junction assembly downhole by removing one or more activation members of the lateral junction assembly.

Also, the wireline tool as described above may further comprise an expander cone for pushing the pipe section of the lateral junction assembly through the opening in the flange and the opening in the casing.

Finally, the present invention relates to a method of installing a lateral junction assembly in a wellbore having a casing with at least one opening, the method comprising the steps of:

- lowering a lateral junction assembly as described above into a wellbore,
- positioning the lateral junction assembly in the casing with the pipe section aligned with the opening of the casing,
- activating the lateral junction assembly downhole by removing one or more activation members, so that the pipe section extends through the opening in the casing, and
- fixating the lateral junction assembly in a predetermined location by means of the one or more locking devices.

This method may further comprise the step of pulling or pushing an expander cone past the lateral junction assembly downhole, whereby the pipe section is pushed through the opening in the flange and the opening in the casing.

Brief description of the drawings

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. 1a shows a perspective view of a lateral junction assembly having a pipe module and one fixation element.

Fig. 1b shows a side view of the lateral junction assembly of Fig. 1a,

Fig. 1c shows a cross-section of the lateral junction of Figs. 1a and 1b taken along line 1c,

Fig. 2a shows a perspective view of a lateral junction assembly having a pipe module and two fixation elements,

Fig. 2b shows a top view of the lateral junction assembly of Fig. 2a,

Fig. 2c shows a cross-section of the lateral junction of Figs. 2a and 2b taken along line 2c,

Fig. 3 shows a lateral junction comprising alternative fixation elements to the fixation elements of Fig. 1,

Fig. 6a shows a cased primary wellbore, a lateral wellbore and a lateral junction assembly positioned in the junction between the primary wellbore and the lateral,

Fig. 6b is an enlarged view of the lateral junction assembly of Fig. 6a,

Fig. 7 shows a wireline tool for transporting, positioning and assembling a lateral junction assembly,

Fig. 8a shows a cross-section of another lateral junction assembly in a longitudinal direction,

Fig. 8b shows a cross-section of yet another lateral junction assembly in a transversal direction,

Fig. 9 shows a lateral junction assembly positioned downhole and an expander cone, and

Fig. 10 shows another wireline tool for transporting, positioning and assembling a lateral junction assembly.

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

Fig. 1a shows show a lateral junction assembly 1 comprising a pipe module 10 and one fixation element 25 for fixating the pipe module 10 in a predetermined position inside a casing 60 in order to make a lateral extending from the casing 60 into the formation as shown in Fig. 6a. The lateral junction assembly 1 extends in a longitudinal direction 50 and has a top end 16a and a bottom end 15a.

The pipe module 10 comprises a flange 11 extending in the longitudinal direction 50 from a bottom edge 15a to a top edge 16a. The flange is curved in a direction transverse to the longitudinal direction 50. A pipe section 12 extends from an outer surface 13 of the flange 11 and a sealing material 14 is positioned on the outer surface 13 extending around the pipe section 12. The sealing material 14 has the shape of a strip but may be shaped and positioned in various manners that will be evident for a person skilled in the art. The pipe module further comprises a passage 18 extending from an inner surface 19 of the flange, through the flange 11 and through the pipe section 12.

Referring to Fig. 1c, recesses or grooves 20 are provided in the inner surface of the flange 11. The recesses 20 are adapted for receiving a fixation element 25. The fixation element 25 is positioned adjacent to the centre of the flange 13 in the longitudinal direction 50. The fixation element 25 is shaped as a circular ring with a cut out portion corresponding to the recesses in the flange 11 of the pipe module 10. End pieces 26 of the fixation element 25 are adapted for being inserted into the recesses 20 as shown in Fig. 1c.

The lateral junction assembly 1 may comprise more than one fixation element 25 to fixate the pipe module 10. One fixation element 25 may be positioned adjacent to the top end 16a of the lateral junction assembly 1, and another fixation element 25 may be positioned adjacent to the bottom end 15a.

The pipe section 10 and the fixation element 25 are assembled by positioning the end pieces 26 of fixation element 25 in the recesses 20 in the flange 11. Hereby, the fixation element 25, in combination with the flange 11, creates a cylindrical ring having an outer periphery when seen in a cross-sectional view of Fig. 1c. This periphery is designed to be equal to or slightly larger than an inner periphery of the casing in which the assembly is installed.

In use the lateral junction assembly 1 according to Figs. 1a, 1b, and 1c is lowered into a wellbore and positioned as shown in Figs. 6a and 6b. Prior to introduction of the lateral junction assembly 1, the wellbore has been provided with a casing 60 defining a longitudinal axis 52 extending along a longitudinal extension of the well. The lateral junction assembly 1 is positioned with the pipe section 12 extending through an opening 61 in the casing 60 and into the formation. The outer surface 13 of the flange 11 is pushed towards an inner

surface 62 of the casing 60 by assembling the fixation element 25 and the pipe module 10 substantially as shown in Fig. 1a. Hereby, a fluid-tight seal is created between the outer surface 13 of the flange 11 and the inner surface 62 of the casing 60. Positioning and assembling of the lateral junction assembly 1 will be described in further detail below.

The fixation element 25 has a diameter equal to or slightly larger than the inner diameter of the casing 60. To be able to lower the fixation element 25 down into the casing 60, the fixation element 25 has to be slightly compressed compared to its original size. When the pipe module 10 has been positioned with the pipe section 12 extending through the opening 61 in the casing 60 and the end pieces 26 of a fixation element have been inserted in the recesses 20, the fixation element 25 is returned to its original size. Hereby, a radial pressure is provided on the flange 11 towards the casing 60.

Figs. 2a, 2b and 2c show another lateral junction assembly 1 comprising a pipe module 10 and a fixation element 25 comprising two fixation parts 21, 22 for fixating the pipe module 10 in a predetermined position inside the casing 60. The lateral junction assembly 1 extends in a longitudinal direction 50 and has a top end 16a and a bottom end 15a.

The pipe module 10 comprises a flange 11 extending in the longitudinal direction 50 from a bottom edge 15a to a top edge 16a and being curved in a direction transverse to the longitudinal direction 50. A pipe section 12 extends from an outer surface 13 of the flange 11. On an outer surface 13 of the flange a sealing material 14 is positioned around the extending pipe section 12. The sealing material 14 has the shape of a strip but may be shaped and positioned in various manners that will be evident for a person skilled in the art. The pipe module further comprises a passage 18 extending in a direction parallel to a lateral axis 51 from an inner surface 19 of the flange, through the flange 11 and through the pipe section 12.

The first fixation part 21 and the second fixation part 22 each has two side edges 23, a top edge 16b and a bottom edge 15b. The fixation parts 21, 22 are curved having a radius of curvature which is substantially equal to the radius of curvature of the flange 11.

In use the lateral junction assembly 1 according to Figs. 2a, 2b, and 2c is lowered into a cased wellbore and positioned as shown in Figs. 6a and 6b. The lateral junction assembly 1 is positioned with the pipe section 12 extending though the opening 61. The outer surface 13 of the flange 11 is pushed towards an inner surface 62 of the casing 60 by assembling the fixation parts 21, 22 and the pipe module 10 substantially as shown in Fig. 2a. Hereby, a fluid-tight seal is created between the outer surface 13 of the flange 11 and the inner surface 62 of the casing 60.

To secure the lateral junction assembly 1 in the casing and create the necessary pressure on the flange, a certain amount of tension is needed in the lateral junction assembly 1. Hereby a sealing effect is provided between the flange and the inner surface 62 of the casing.

The lateral junction assembly 1 is assembled by positioning the fixation parts 21, 22 and the pipe module 10 substantially as shown in Fig. 2a and with the sides 23 of the fixation parts 21, 22 abutting each other and abutting the sides 17 of the flange 11 of the pipe module 10. When assembled, the flange 11 and the fixation parts 21, 22 constitute a hollow cylinder having an outer periphery.

Now referring to Figs. 2a and 6b, by providing a lateral junction assembly having an outer periphery that is equal to or slightly larger than an inner periphery of the casing 60, tension is created in the lateral junction assembly 1 when installed inside the casing 60.

On the side edges 17, 23 small indentations or grooves forming peaks (not shown) may be provided for improving the mutual bonding properties between the fixation parts 21, 22 and the bonding properties between the fixation parts 21, 22 and the flange 11. When the fixation parts 21, 22 and the flange 11 are assembled inside the casing 60 as shown in Figs. 6a and 6b, they are press-fitted into engagement with each other to create a closed cylinder. This press fitting may contribute to plastic deformation of at least the peaks provided on the side edges of the fixation parts 21, 22 and the flange 11. The pushing together of the fixation parts 21, 22 and the flange 11 may also result in the side edges being cold welded together.

Fig. 3 shows a lateral junction assembly 1 having a pipe module 10 almost identical to the pipe module described above and shown in Figs. 2a, 2b and 2c. The pipe module shown in Fig. 3 comprises a sealing material 14 positioned on the outer surface 13 covering the majority of the surface 13 and providing a large sealing surface.

Referring to Fig. 3, the lateral junction assembly 1 comprises two fixation elements 25, a top fixation element positioned adjacent to the top of the flange 11 and constituted by fixation parts 24a, 24b and a bottom fixation element positioned adjacent to the bottom of the flange 11 and constituted by fixation parts 24c, 24d. Each of the fixation elements 25 are assembled by positioning the side edges 23 of the fixation parts abutting each other and abutting the side edges 17 of the pipe module 10. Hereby, a circular ring having an outer periphery is formed. The fixation elements 25 serve to provide a radial pressure on the pipe module 10 towards the casing when installed inside the casing. This pressure is created by rigidity of the fixation elements and the pipe module due to the fact that the outer periphery of the assembly of the fixation elements and the pipe module is at least somewhat larger than the inner periphery of the casing in which they are assembled.

The side edges 23 of the fixation parts 24a, 24b, 24c, 24d are provided with indentations or grooves forming peaks (not shown) for improving the bonding properties as described earlier.

Figs. 4 and 5 show different configurations of a pipe module 10. Solutions incorporating the invention may use any of the above-mentioned technical features and functionalities in combination with the configurations shown in Figs. 4 and 5.

In Fig. 4, the flange 11 has a circular outer edge 17 and a pipe section 12 extending from substantially a centre of an outer surface 13 of the flange 11. In the shown configuration, the flange 11 further comprises recesses 20 for accommodating fixation elements, such as the fixation element 25 shown in Fig. 1a.

Fig. 5 shows an elongated pipe section 10 comprising an elongated flange 11. The elongated flange 11 has two separate pipe sections 12a, 12b located a

distance apart and extending from an outer surface 13 of the flange 11. When positioned in a casing, the pipe sections 12a, 12b extend either through a common opening in the casing or through separate openings. This configuration can be used to control the distance between two lateral wellbores. Sealing material may be positioned on the outer surface 13 e.g. as a common seal covering all the outer surface 13 of the flange 11 or as separate seals arranged on the flange each extending around a pipe section as described earlier. The elongated pipe section is secured inside the casing using fastening elements e.g. as shown in Fig. 2a, 3 or 1a.

The flange 11 may be configured in a number of different ways such as, but not limited to, as a circle, an oval, a rectangle, a square, a trapezium, etc. The fixation elements may also de shaped differently from what is shown in the drawing. The flange 11 of the pipe module 10 and the fixation elements 21, 22 may be shaped like wedges or trapeziums and together constitute a hollow cylinder. The fixation elements and flange 11 may then be joined by sliding the fixation elements in a longitudinal direction 50 relative to the flange from a position either above or below. As the top edge 16b of the fixation elements reaches the top edge 16a of the flange 11, side edges 17, 23 come into abutment against each other. When the top edges 16a, 16b are aligned, a hollow cylinder is created, and the pipe module 10 has been wedged into the casing.

Referring to Figs. 6a and 6b, positioning of the lateral junction assembly will be described in the following. To utilise the lateral junction assembly 1, a cased vertical, horizontal or otherwise inclining primary wellbore, as shown in Fig. 6a, is provided. Before installing the lateral junction assembly 1, the installation site has to be prepared by drilling an opening in the casing and drilling a lateral wellbore deviating from the direction of the primary wellbore. This is done using conventional directional drilling techniques, e.g. by using a radial drill string and whipstocks. When the opening through the casing and the lateral wellbore has been drilled, the drill string and whipstocks are retrieved.

Next, a pipe module 10 and a set of the fixation elements 21, 22, 24a, 24b, 24c, 24d, 25 are lowered into a cased wellbore, e.g. transported by a downhole tractor or well tool suspended from a wireline as described later. Arriving at a predetermined location inside the casing wherein an opening 61 has been provided, the pipe module 10 is positioned with the pipe section 12 extending

through the opening 61 as shown in Fig. 6b. Next, the fixation elements are connected with the flange 11 of the pipe module 10. The method of establishing this connection is determined by the configuration of the fixation elements. During connection of the flange 11 and fixation elements, the well tool keeps the different parts in place. The well tool applies the necessary pressure/force to push the side edges of the fixation elements and the flange into abutment against each other. When the side edges are pushed together, the peaks (not shown) created by the grooves or indentations collide and deform due to the high pressure. The deformation may result in a type of cold welding process and cold welds being provided between the side edges, thereby enhancing the strength of the bond. Spot welding can be applied as an additional feature to strengthen the connections between the fixation elements and/or the flange 11. When the lateral junction assembly 1 has been installed, the sealing material 14 forms a liquid-tight barrier between the outer surface 13 of the flange 11 and the inner surface 61 of the casing 60. Next, the lateral casing 65 already positioned in the lateral wellbore is connected to the pipe section 12 of the lateral junction assembly 1. Alternatively, the casing is introduced through the hole extending through the pipe section 12 of the lateral junction assembly 1 and into the lateral wellbore.

When the lateral junction assembly 1 has been installed, the inner diameter of the primary casing comprising the lateral junction is smaller than the inner diameter of other sections of the casing.

Figs. 8a and 8b show another lateral junction assembly 100 comprising a flange 111 extending in a longitudinal direction and being curved in a transverse direction and a pipe section 112 for being inserted through an opening 117 in the flange 111. On an outer surface 131 of the flange 111, a sealing material 114b may be arranged around the opening 117 for providing a sealing effect between the flange 111 and an inner surface of the casing. The lateral junction assembly 100 further comprises a fixation element 125 extending from the pipe section 112 and acting to force the pipe section 112 through the opening 117 in the flange 111. The fixation element 125 may be a sheet of spring steal, one or more spring members, such as in the form of strands, or other flexible means capable of exerting a pushing force on an end of the pipe section when in a deactivated position as shown in Fig. 8a. Before being installed in a casing downhole, the pipe section 112 is kept in the position as shown in Fig. 8a, by one or more activation members 116, preventing the pipe section 112 from being pushed through the

opening 117. The activation members 116 are distance rods maintaining a certain distance between the pipe section and the opening through which it is to enter when fastening to the casing forming a lateral. The activation members may also be a second pipe section surrounding the lateral assembly, hindering the pipe section from entering the opening.

On an outer surface of the pipe section 112, one or more locking devices 115 are provided for fixating the pipe section 112 when it has been pushed through the opening 117 as shown in Fig. 9. The locking device 115 is fastened to the pipe section and extend from the pipe section towards the flexible member and thus away from the flange in the inactivated position and towards the flange in the activated and installed position. The locking device is a spring, such as leaf spring. Further, sealing material 114a may be provided around the pipe section 112 on a surface of the fixation element 125 facing towards the flange 111. When the pipe section 112 has been pushed through the opening 117, the sealing material 114a and/or 114b are/is pushed towards the flange and the casing, respectively, and the one or more locking devices 115 extend(s) from the pipe section 112 to prevent further displacements of the pipe section 112.

In use the lateral junction assembly 100 is lowered into a cased wellbore and positioned in the same way as the embodiments shown in Figs. 6a and 6b, in which the pipe section projects from the casing forming a first part of a lateral. The lateral junction assembly 100 is positioned with the opening 117 opposite the opening 61 in the casing. The lateral junction assembly 100 is activated by removing the activation members 116 by an activation unit of a wireline tool 80 known to the skilled person, such as a wireline tool. When the activation members 116 have been removed, the pipe section 112 is forced through the opening 117 in the flange 111 and the opening 61 in the casing. The sealing material 114a being pushed towards the flange and the locking devices 115 preventing displacement of the pipe section 112 fixate the lateral junction assembly 100 inside the casing. The pipe section 112 may alternatively, or in addition to the force generated by the fixation element, be forced through the opening 117 in the flange 111 and the opening 61 in the casing by the wireline tool applying a pushing force to the pipe section. This may be done by pulling or pushing an expander cone 88 or other suitable tool past the lateral junction assembly, whereby the pipe section is pushed through the openings 117, 61 by the cone 88, as shown in Fig. 9.

Fig. 7 shows a wireline tool 80 for transporting, positioning and assembling/installing different embodiments of the lateral junction assembly 1, 100 inside a casing downhole. During operation, the wireline tool is connected to and suspended from a wireline 90. The wireline tool 80 comprises an electronic unit 81 providing power and controlling the functionality of the wireline tool 80, a driving unit 84 such as a downhole tractor for moving the wireline tool 80 inside the casing, a motor unit 82, and a pump unit 83 e.g. for providing hydraulic pressure. Furthermore, the wireline tool comprises a logging unit 85 for controlling and determining the position of the wireline tool in downhole, a transportation unit 86 for transporting and positioning the pipe module and the one or more fixation elements, and an assembly unit 87 for connecting/assembling the pipe module and the one or more fixation elements of the lateral junction assembly. As shown in Fig. 10, the wireline tool may alternatively or in addition to the above described comprise an expander cone 88 or other suitable tool for applying a force to the pipe section to push it through the openings 117, 61.

By fluid or 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.

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

In the event that the tools are not submergible all the way into the casing, a downhole tractor can be used to push the tools all the way into position in the well. A downhole tractor is any kind of driving tool capable of pushing or pulling tools in a well downhole, such as a Well Tractor®.

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 lateral junction assembly (1) for providing a lateral junction in a wellbore by being inserted into a casing having an opening (61) and defining a longitudinal axis (52), the lateral junction assembly having a longitudinal direction (50) which is substantially parallel to the longitudinal axis and comprising:
- a pipe module (10) comprising a pipe section (12) for being inserted through the opening in the casing and a flange (11, 111),
wherein the lateral junction assembly further comprises a fixation element (25, 125) adapted for being connected with the flange to fixate the pipe module in a predetermined location with the pipe section extending through the opening in the casing.

2. A lateral junction assembly according to claim 1, wherein the pipe section extends from a first surface (13) of the flange, and the fixation element, when connected to the flange, extends from a second surface (19) of the flange opposite the first surface of the flange.

3. A lateral junction assembly according to claim 1 or 2, further comprising a sealing element (14) arranged at the first surface of the flange.

4. A lateral junction assembly according to any of the preceding claims, wherein the assembly comprises two or more fixation elements (21, 22, 24a, 24b, 24c, 24d, 25).

5. A lateral junction assembly according to claim 4, wherein the one or more fixation elements are sections of a hollow cylinder.

6. A lateral junction assembly according to claim 4, wherein the one or more fixation elements are sections of a circular ring.

7. A lateral junction assembly according to any of the preceding claims, wherein a cross-section of the flange constitutes a first part of a circular ring and the one or more fixation elements constitute a second and remaining part of the circular ring.

8. A lateral junction assembly according to any of the preceding claims, comprising one or more fixation elements distributed in the longitudinal direction of the lateral junction assembly.

9. A lateral junction assembly according to any of the preceding claims, comprising two or more pipe modules.

10. A lateral junction assembly according to any of the preceding claims, wherein the pipe module comprises two or more pipe sections extending from the flange.

11. A lateral junction system for providing a lateral junction in a wellbore, the lateral junction system comprising:
- a primary casing (60) having an inner surface (62) and at least one opening (61), the primary casing defining a longitudinal axis (52), and
- a lateral junction assembly (1) according to any of the claims 1-10,
wherein the pipe module is positioned such that the pipe section extends through the opening of the casing and the one or more fixation elements pushes the first surface of the flange towards the inner surface of the casing, whereby the pipe module is secured in a predetermined location.

12. A lateral junction system according to claim 11, wherein the pipe module has an extension in a transverse plane perpendicular to the longitudinal axis, the extension being smaller than an inner diameter of the casing.

13. A lateral junction system according to claim 11 or 12, wherein a cross-section of the flange constitutes a first part of a circular ring, and the one or more fixation elements constitute a second and remaining part of the circular ring, an outer periphery of the ring being substantially equal to or slightly larger than an inner periphery of the casing.

14. A wireline tool for transporting, positioning and assembling a lateral junction assembly according to claims 1-10 in a casing, the wireline tool comprising:
- an electronic unit for powering to the wireline tool,
- a motor unit,
- a pump unit,

- a driving unit moving the wireline tool downhole,
- a logging unit for determining the position in a casing downhole,
- a transportation unit for transporting and positioning the pipe module and the one or more fixation elements, and
- an assembly unit for assembling the lateral junction assembly downhole.

15. A method of installing a lateral junction assembly in a wellbore having a casing with at least one opening, the method comprising the steps of:
- lowering a pipe module comprising a pipe section and a flange into a wellbore,
- lowering one or more fixation elements adapted for being connected with the flange into a wellbore,
- positioning the pipe module in the casing with the pipe section extending through the opening of the casing,
- joining the flange of the pipe module with the one or more fixation elements, thereby fixating the lateral junction assembly in a predetermined location.

16. A method according to claim 15, wherein side edges of the flange of the pipe module and side edges of the one or more fixation elements are joined by cold welding caused by the side edges being pressed against each other.

17. Lateral junction assembly according to claim 1, wherein the fixation element is a flexible member for pushing the pipe section through an opening (117) in the flange.

18. A lateral junction assembly according to claim 17, wherein the flexible member is a sheet of spring steel.

19. A lateral junction assembly according to claim 1, wherein the fixation element comprises multiple spring members for pushing the pipe section through an opening (117) in the flange.

20. A lateral junction assembly according to claim 1 or 17-19, further comprising one or more locking devices (115) extending from the pipe section and being adapted to fixate the pipe section in an activated position wherein the pipe section extends through the opening in the flange.

21. A lateral junction assembly according to claim 17-20, further comprising one or more activation members (116) adapted to prevent the pipe section from being pushed through the opening in the casing by the fixation element.

22. A lateral junction system for providing a lateral junction in a wellbore, comprising:
- a primary casing (60) having an inner surface (62) and at least one opening (61), the primary casing defining a longitudinal axis (52), and
- a lateral junction assembly (1) according to any of the claims 17-21,
wherein the pipe module is positioned such that the pipe section extends through the opening in the flange and the opening of the casing, whereby the lateral junction assembly is secured in a predetermined location.

23. A wireline tool for transporting, positioning and activating a lateral junction assembly according to claims 17-21 in a casing, the wireline tool comprising:
- an electronic unit for powering to the wireline tool,
- a motor unit,
- a pump unit,
- a driving unit moving the wireline tool downhole,
- a logging unit for determining the position in a casing downhole,
- a transportation unit for transporting and positioning the lateral junction assembly, and
- an activation unit for activating the lateral junction assembly downhole by removing one or more activation members (116) of the lateral junction assembly.

24. A wireline tool according to claim 23, further comprising an expander cone (88) for pushing the pipe section of the lateral junction assembly through the opening in the flange and the opening in the casing.

25. A method of installing a lateral junction assembly in a wellbore having a casing with at least one opening, the method comprising the steps of:
- lowering a lateral junction assembly according to claims 17-21 into a wellbore,
- positioning the lateral junction assembly in the casing with the pipe section aligned with the opening of the casing,
- activating the lateral junction assembly downhole by removing one or more activation members, so that the pipe section extends through the opening in the casing, and

- fixating the lateral junction assembly in a predetermined location by means of the one or more locking devices.

26. A method according to claim 25, further comprising the step of:

- pulling or pushing an expander cone (88) past the lateral junction assembly downhole, whereby the pipe section is pushed through the opening in the flange and the opening in the casing.

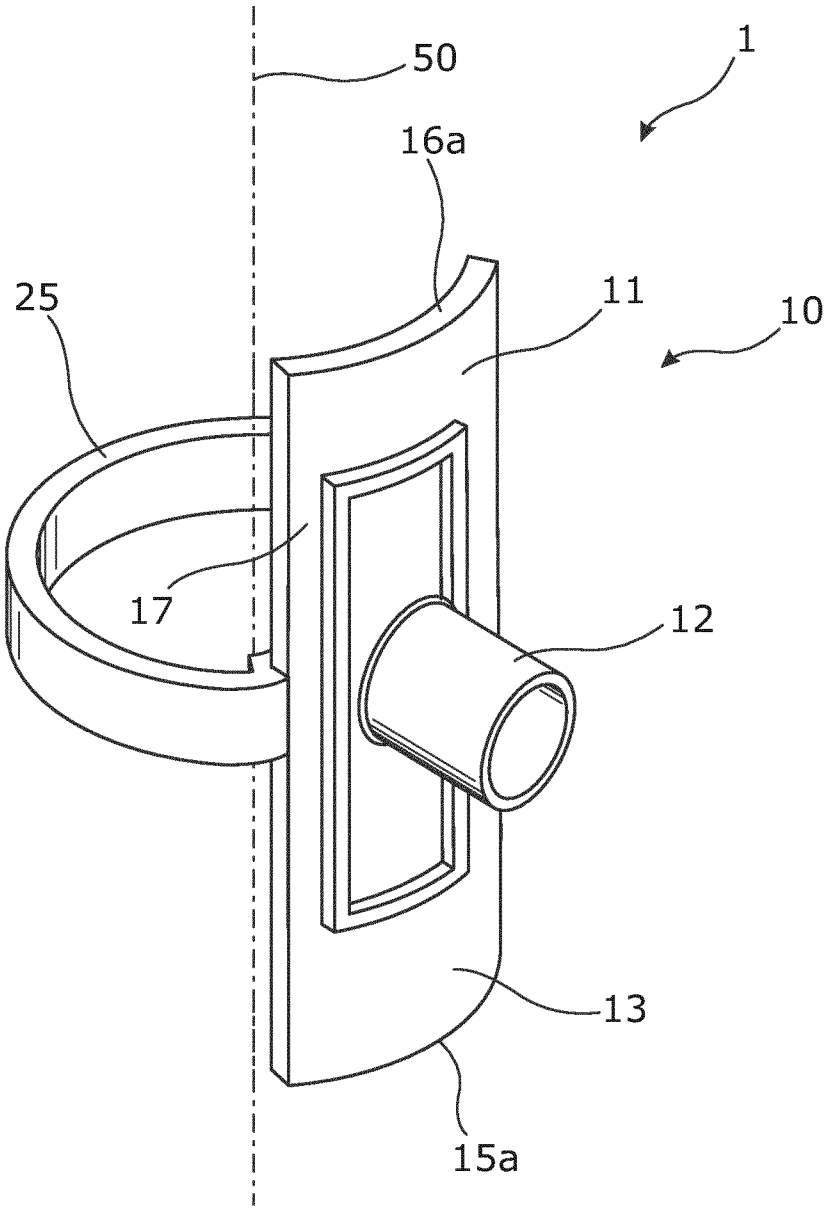


Fig. 1a

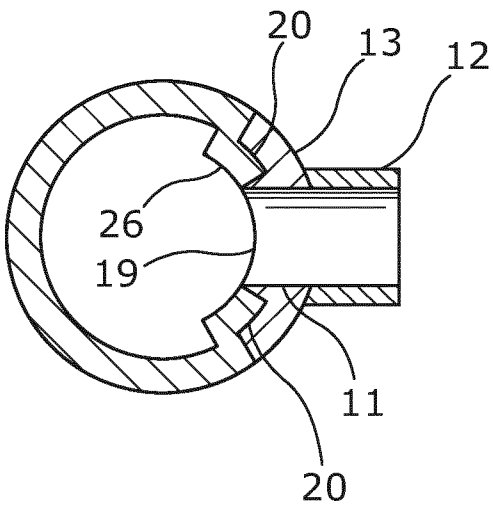


Fig. 1c

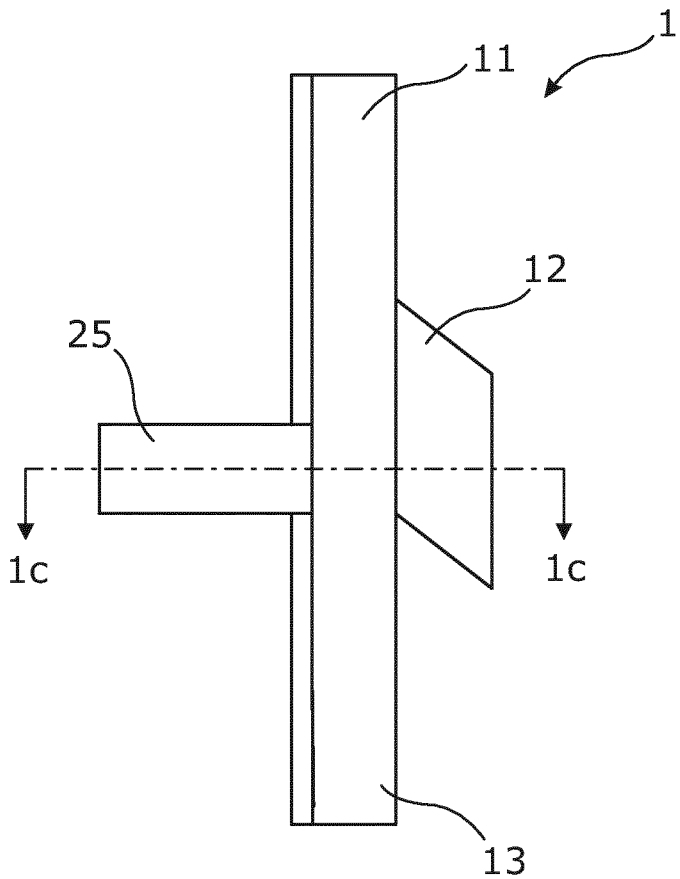


Fig. 1b

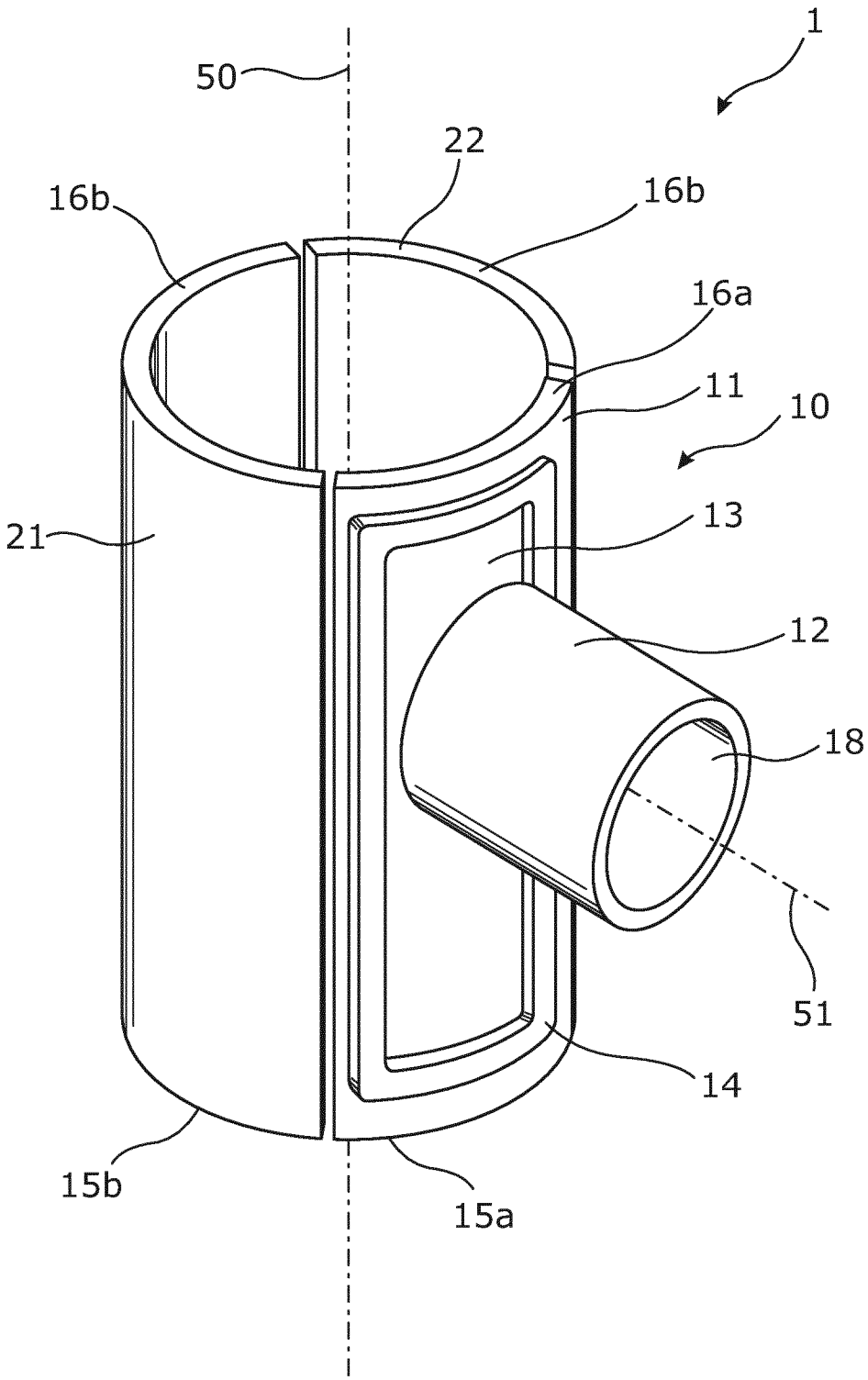


Fig. 2a

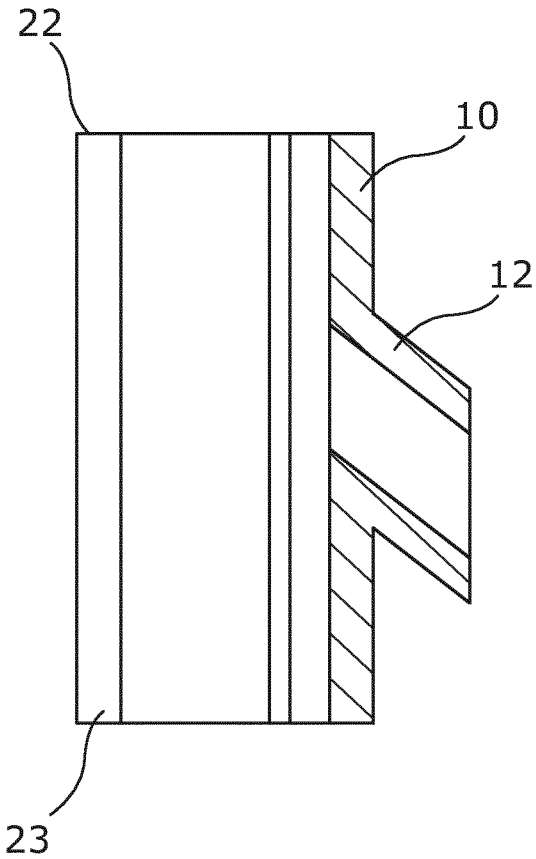


Fig. 2c

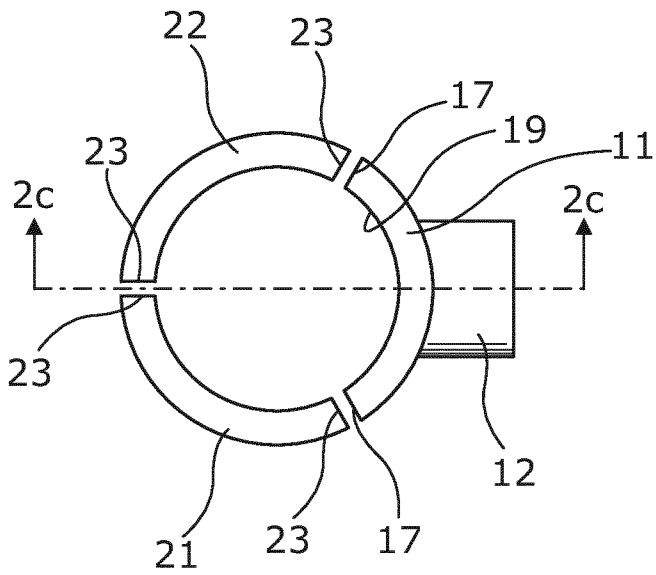


Fig. 2b

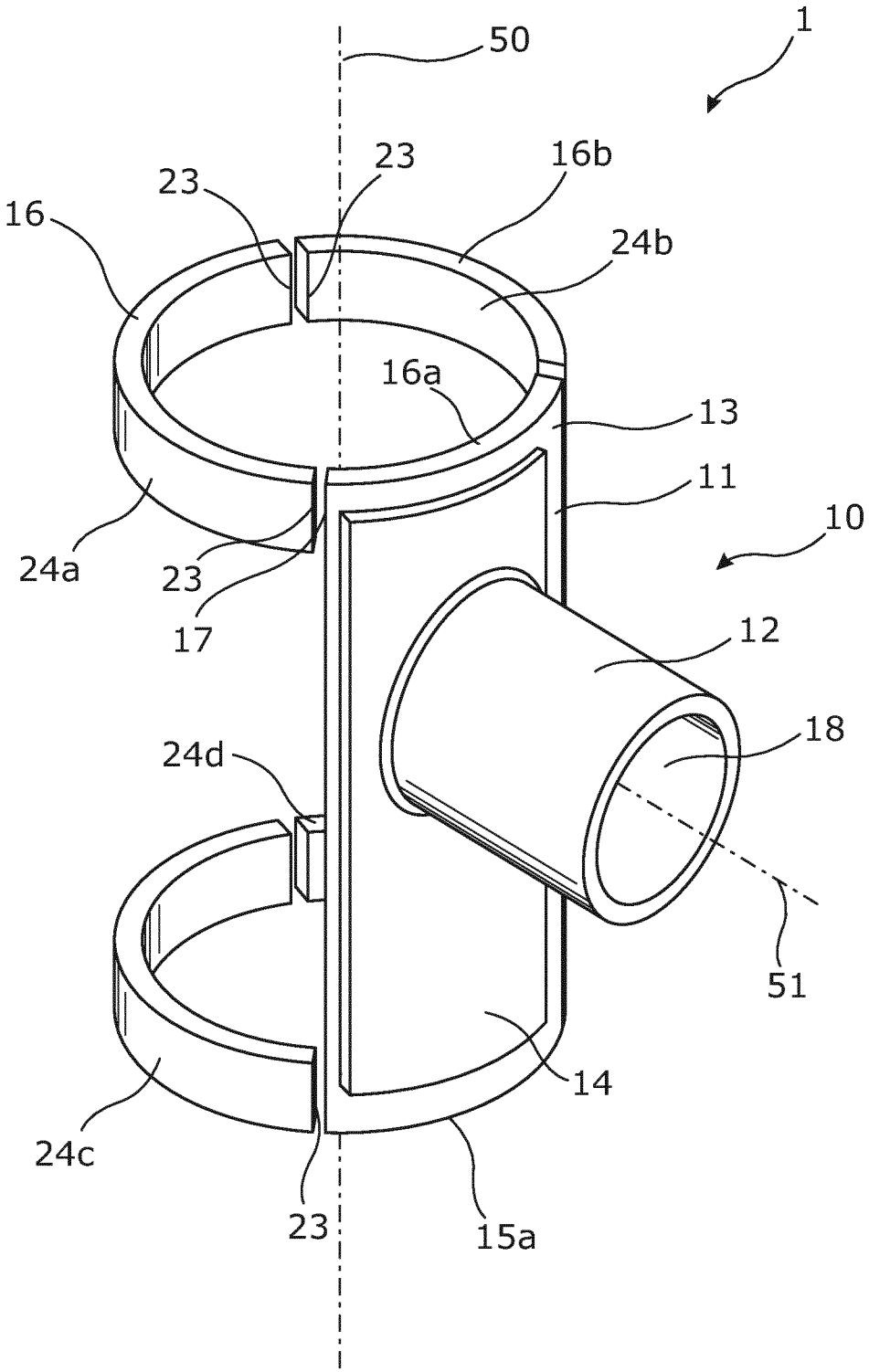

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Fig. 3

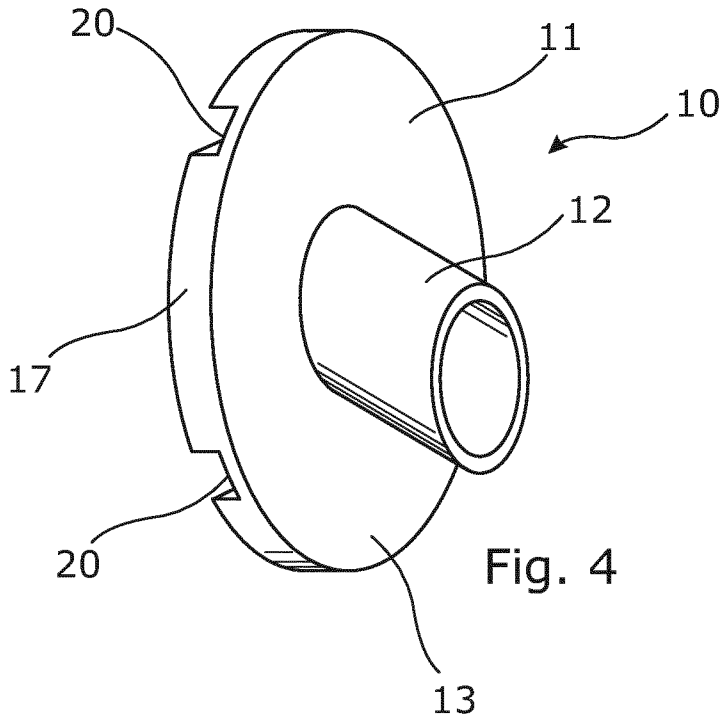


Fig. 4

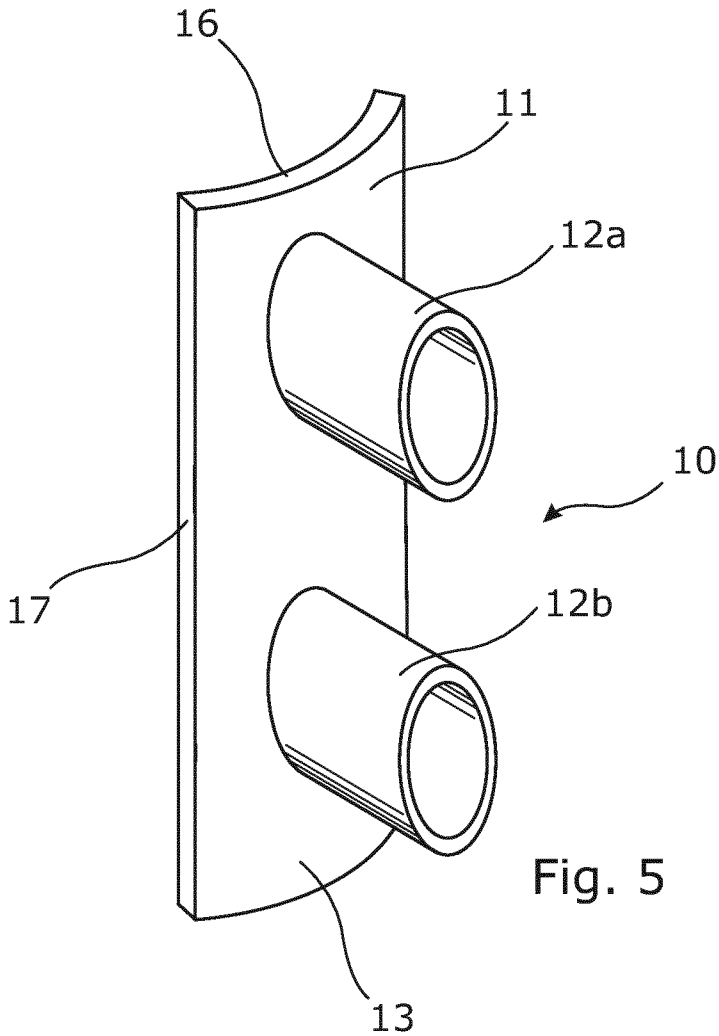


Fig. 5

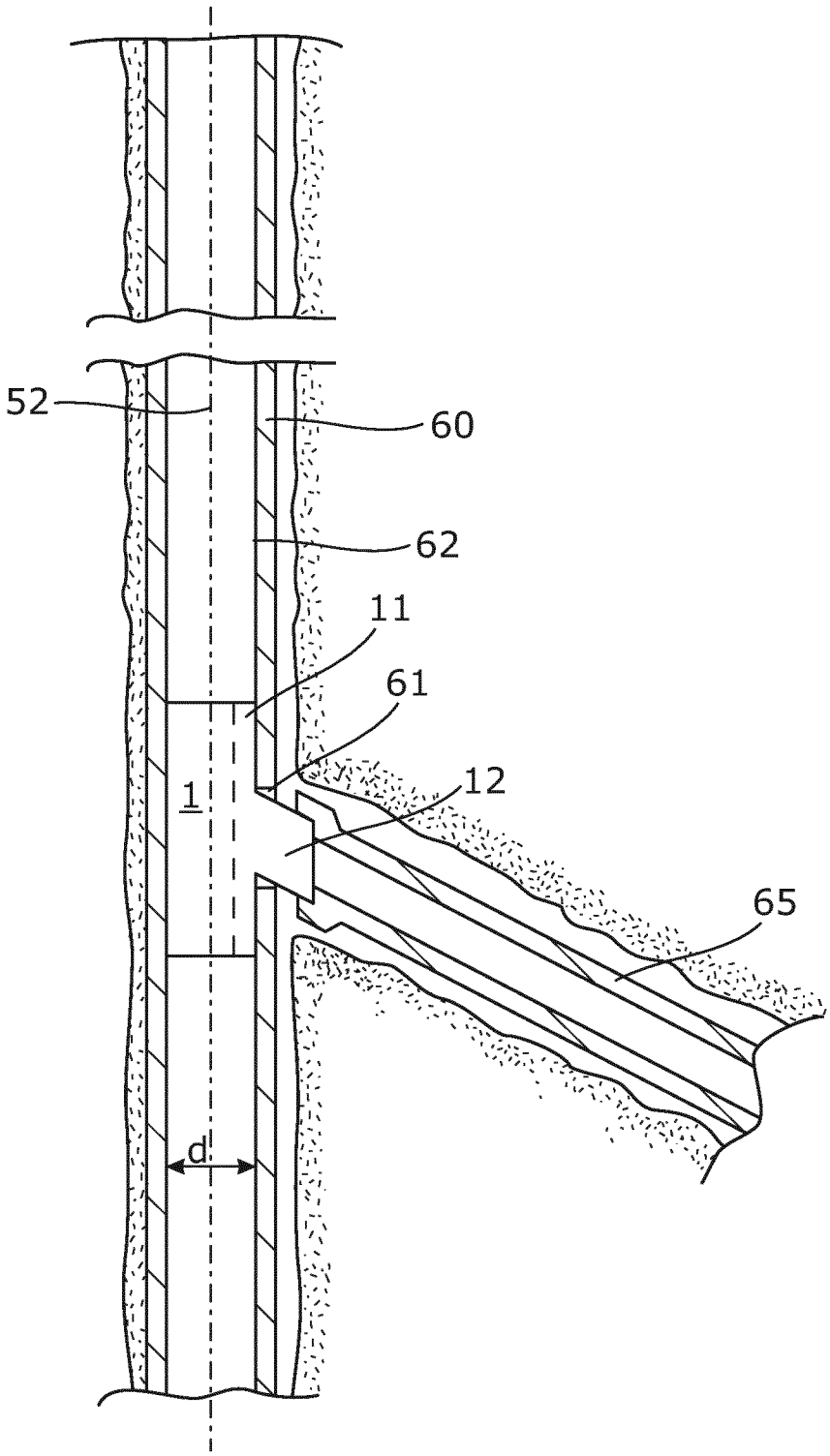


Fig. 6a

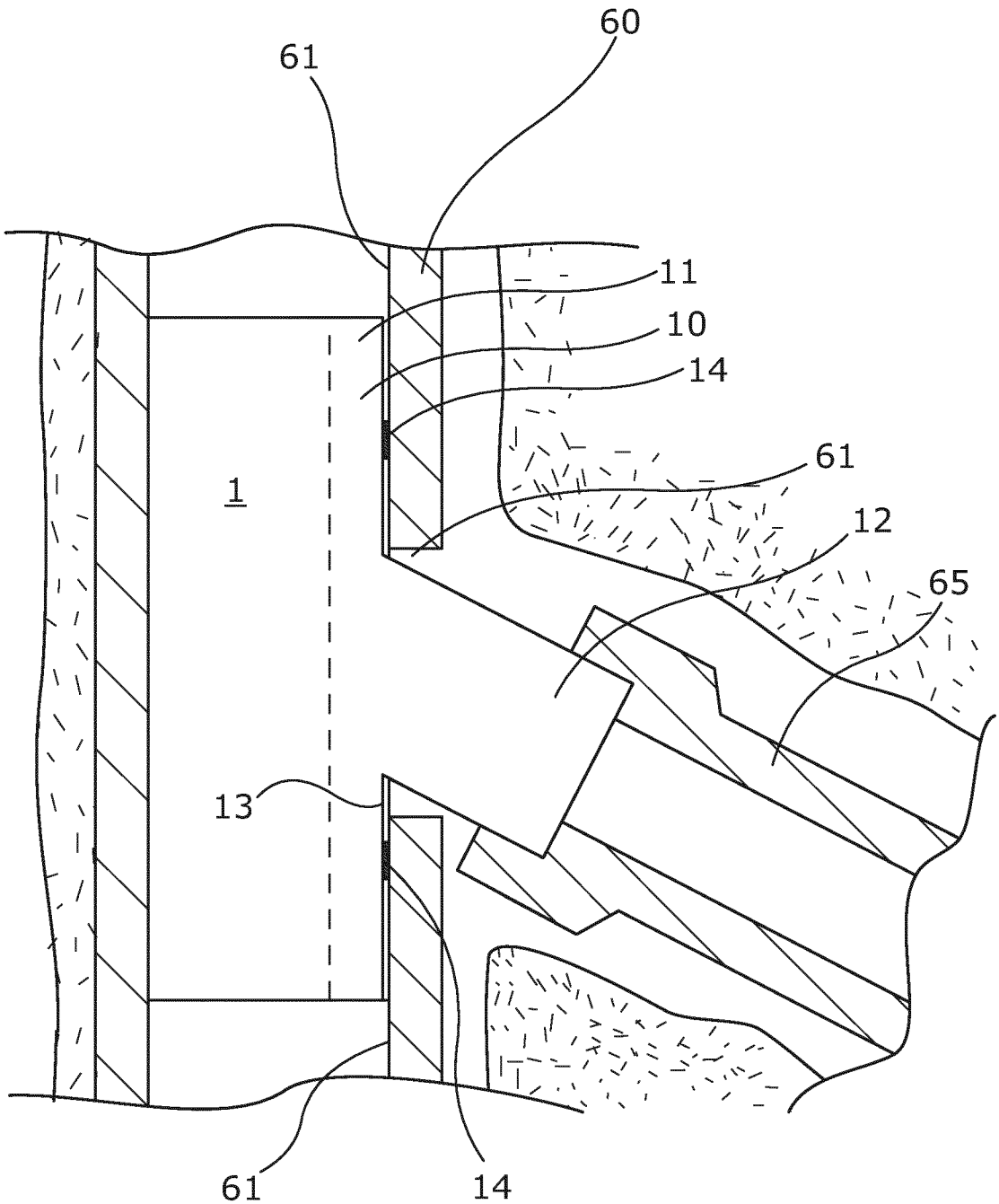


Fig. 6b

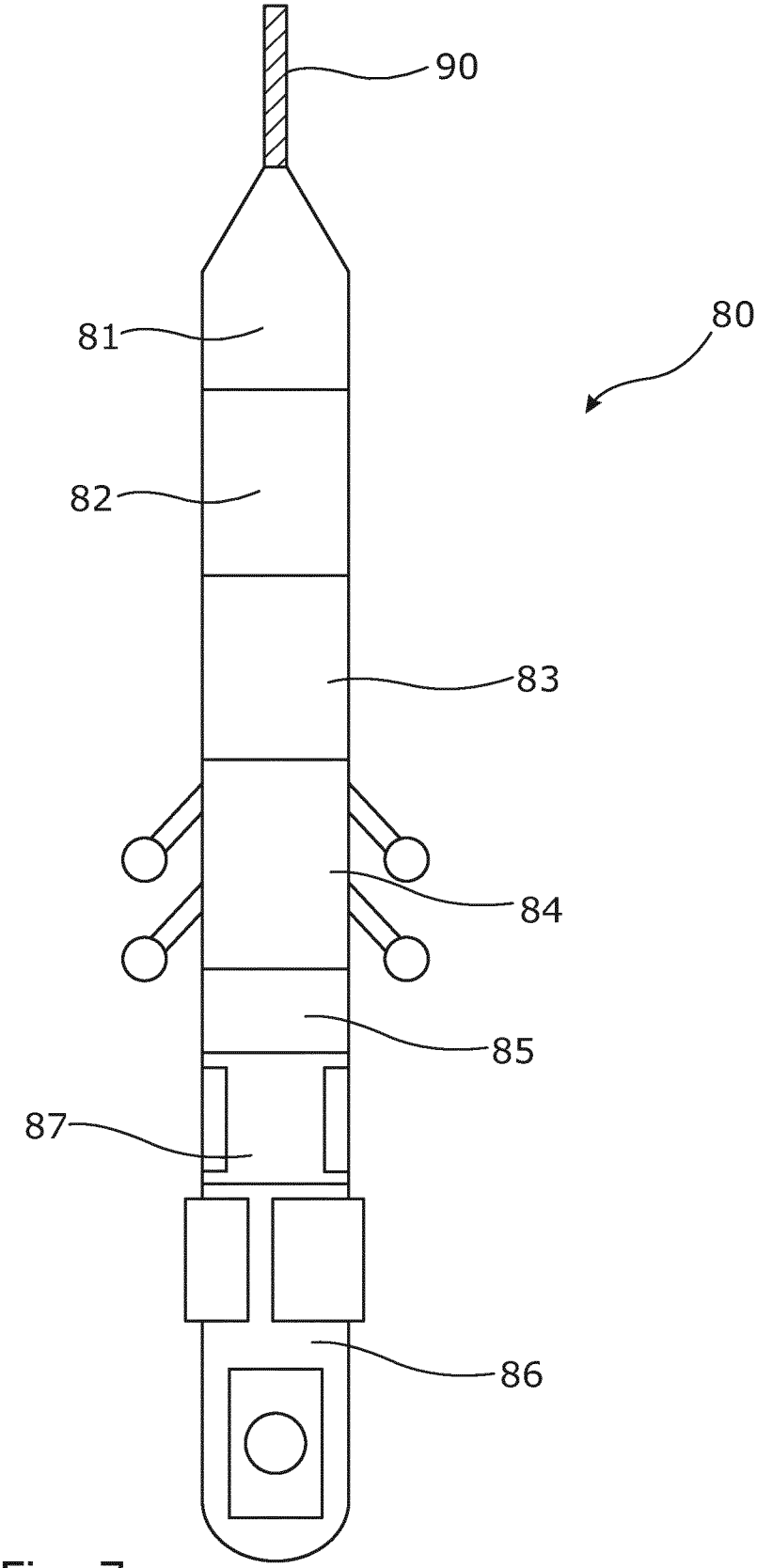


Fig. 7

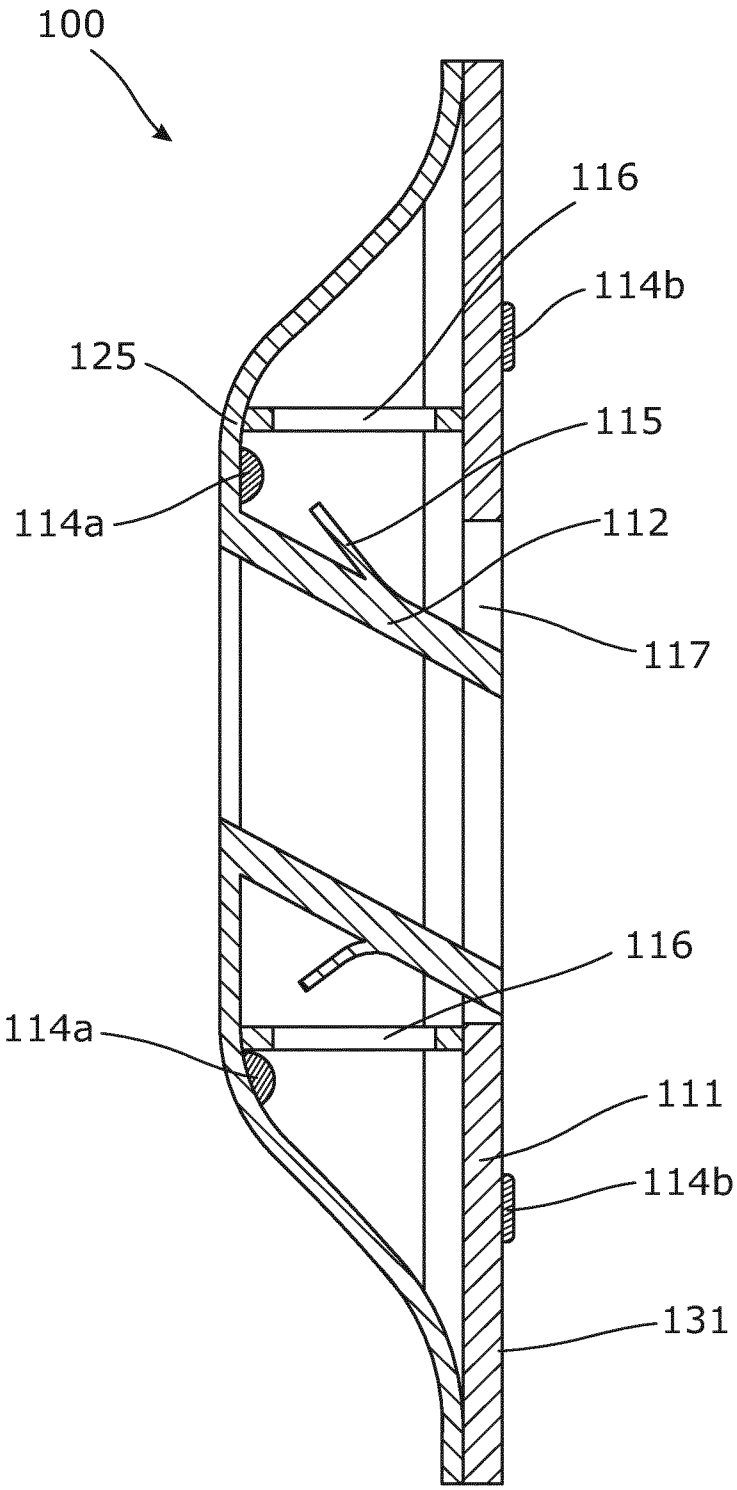


Fig. 8a

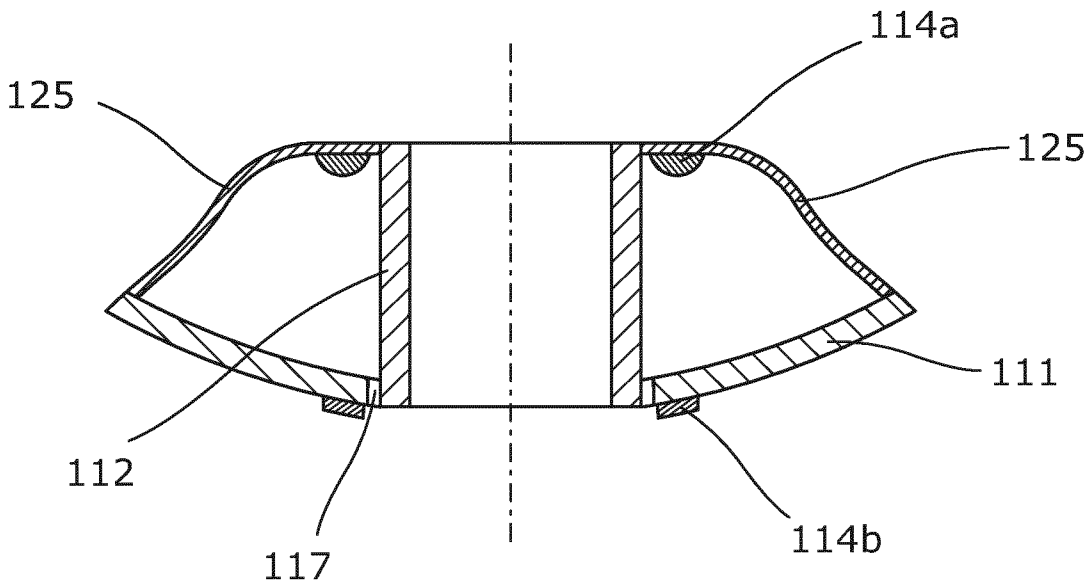


Fig. 8b

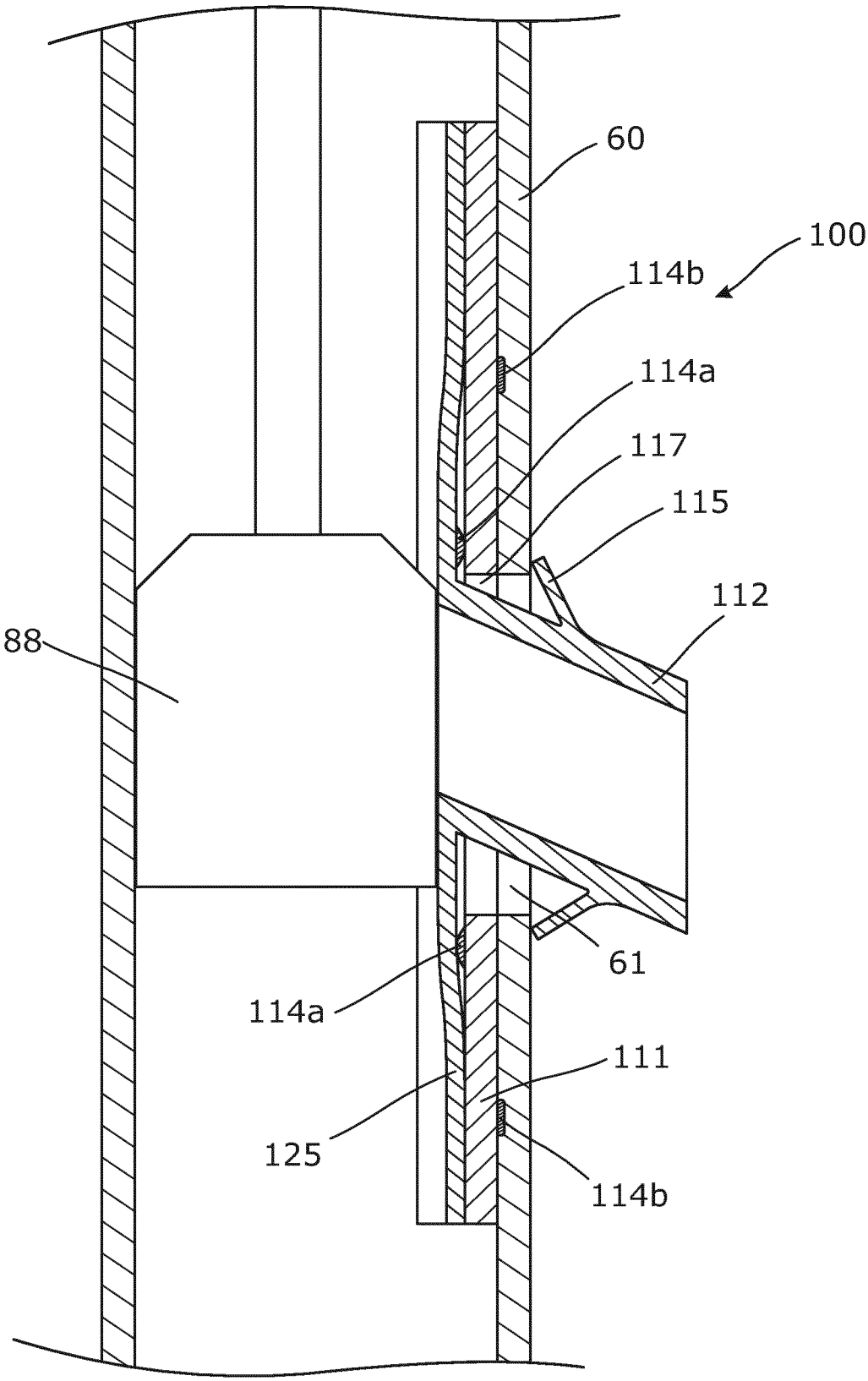


Fig. 9

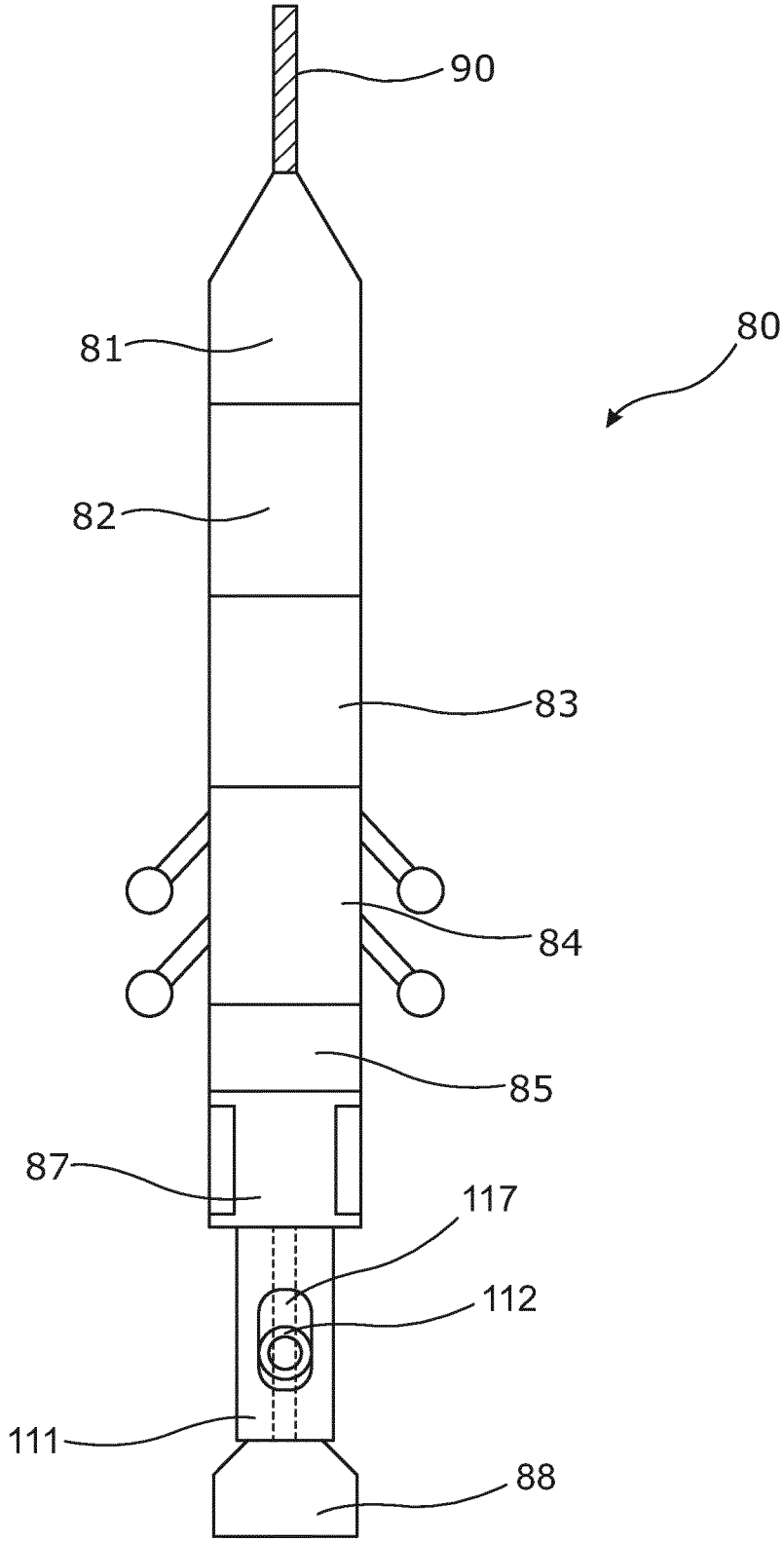


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/073615

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B17/02 E21B41/00 E21B43/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 297 988 A (BAKER HUGHES INC [US]) 21 August 1996 (1996-08-21) the whole document -----	1,25
A	US 6 332 498 B1 (GEORGE GRANT E E [CA]) 25 December 2001 (2001-12-25) the whole document -----	1,25
A	US 2005/241830 A1 (STEELE DAVID J [US]) 3 November 2005 (2005-11-03) the whole document -----	1-26

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 January 2012	10/02/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Manolache, Iustin

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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