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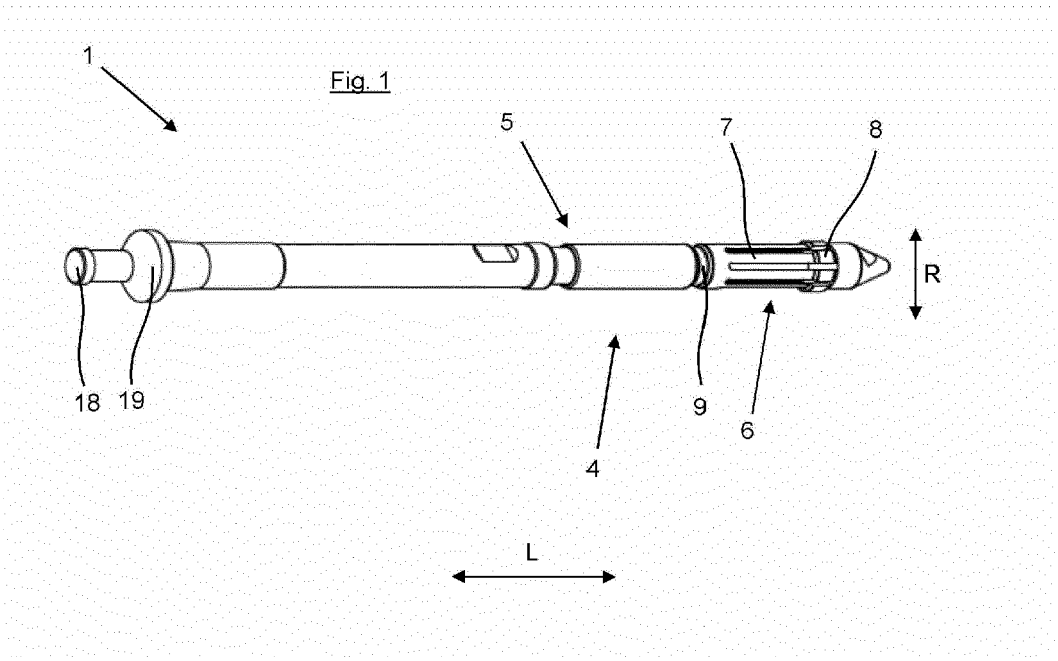
(54) RETRIEVING TOOL FOR A COILED TUBING LOGGING PLUG

(57) The invention relates to a retrieving tool for retrieving a coiled tubing logging plug from a downhole wherein the retrieving tool is insertable into a through hole of the coiled tubing logging plug and comprises a tool body and a retrieving element that is movable relative to the tool body and that is coupleable to the coiled tubing logging plug in order to retrieve the coiled tubing logging plug.

Fig. 1



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Description

[0001] The invention relates to a retrieving tool for retrieving a coiled tubing logging plug from a downhole. Additionally, the invention relates to a well system with such a retrieving tool and a method for retrieving a coiled tubing logging plug from a downhole. In addition, the invention relates to a use of the retrieving tool for retrieving the coiled tubing logging plug.

[0002] A deployment of an electrical submersible pump in an oil or water well is common practice. Additionally, the use of an associated bypass-system is well known. The bypass system is designed to allow access to a well below an electrical submersible pump assembly in order that logging and/or well intervention operation could be performed without the removal of the completion, thus enabling work to be carried out under dynamic well conditions. Continual development of the system has maximized the operational benefits and includes permanent downhole monitoring of the well parameter and electrical submersible pump performance using a multi sensor system.

[0003] Bypass systems are available for an extensive range of casing weights and can be supplied to suit all well environments, using a wide range of materials to suit individual well chemistry and being internally coated to provide added protection and reduce friction as required. Each bypass system is individually designed to provide the optimum completion, affording full protection to the electrical submersible pump power cable and auxiliary service lines whilst providing uninterrupted access to the well below the electrical submersible pump.

[0004] Bypass-systems usually comprise a Y-Tool. The Y-Tool provides the facility by which the electrical submersible pump assembly is deployed with bypass tubing to allow access to the well in order that logging and/or intervention work may be carried out below without retrieval of the completion. The Y-Tool provides a single connection to the production string above and has a bypass connection below directly in line with the production string to allow the passage of logging tools to the well below via the bypass Tubing. The Y-tool comprises a fluid tubing and a further fluid tubing in which the electrical submersible pump is arranged.

[0005] A further connection at the base of the Y-Tool allows the electrical submersible pump assembly to be suspended. The Y-Tool has a groove on either side to allow the passage of the electrical submersible pump power cable, or other auxiliary service lines. These umbilicals are secured in the Y-Tool groove with clips thus ensuring full protection during deployment. The internal profile of the Y-Tool is designed to ensure a smooth flow path from electrical submersible pump discharge to production tubing.

[0006] Bypass-systems are designed and built to suit specific well completion. A well completion can be for example a cleanout logging operation and/or a means of running downhole samplers below the electrical submersible pump on horizontal reservoir sections. For performing such operations a coiled tubing logging plug is used.

[0007] The coiled tubing logging plug can be deployed in all standard bypass systems and is used as a means of sealing between the fluid tubing, in particular a tubing nipple bore, and the coiled tubing outside diameter. The plug can be used for various combinations of coiled tubing strings and tubing nipple sizes. It is utilized successfully for clean out operations, production logging runs and also as a means of running downhole samplers below the electrical submersible pumps on horizontal reservoir sections.

[0008] The plug is attached to the coiled tubing string via a retaining sleeve and collets, the latter being activated to a release position on engagement of the tubing nipple profile.

[0009] On release of the retaining sleeve from the holding collets the plug is automatically locked in the nipple profile. The plug cannot be released prior to engagement in the nipple. Once locked in place the plug can only be released or unseated if the retaining sleeve or sleeve is pulled into the plug from below and pin is sheared and/or a bottom crossover shoulders the bottom edge of the collet lock on the coiled tubing plug. This aligns up the collet locking fingers with the groove in the sleeve allowing them to collapse and to unseat. Only if the tool string is pulled into the plug it will be unseated.

[0010] When cleanout/logging operations are complete the electrical submersible pump is switched off, and after a short period to allow equalization across the pump, the tool string is pulled out of the hole. As the tool string with retaining sleeve or sleeve or crossover engages the bottom of the plug, a pin is sheared and/or the bottom crossover shoulders the bottom edge of the collet lock on the coiled tubing plug and in turn allows the locking mechanism to collapse and the plug to be retrieved to surface along with the tool string.

[0011] If the coiled tubing logging plug cannot be removed from the fluid tubing of the bypass system, it is not possible to continue with the fluid extraction from the well. It is necessary to remove the coiled tubing logging plug as otherwise a self-circulation situation occurs in which the fluid is pumped within the bypass-system. This can lead to self-circulating problems and, thus, to a damage of the electrical submersible pump.

[0012] In such situations it is known to stop the fluid extraction and exchange the bypass-system including the stuck coiled tubing logging plug. Said operation leads to high costs for the company because the fluid extraction has to be interrupted.

[0013] The object of the invention is to reduce the costs for situations in which the coiled tubing logging plug cannot be retrieved from the fluid tubing.

[0014] The object is solved by a retrieving tool for retrieving a coiled tubing logging plug from a downhole wherein the retrieving tool is insertable into a through hole of the coiled tubing logging plug and comprises a

tool body and a retrieving element that is movable relative to the tool body and that is couplable to the coiled tubing logging plug in order to retrieve the coiled tubing logging plug.

[0015] Another object of the invention is to provide a method to reduce costs for situations in which the coiled tubing logging plug cannot be retrieved from the fluid tubing.

[0016] The invention is solved by a method for retrieving a coiled tubing logging plug from a downhole comprising the step of inserting a retrieving tool according to the invention into a through-hole of the coiled tubing logging plug along an insertion direction to a position in which a retrieving element is couplable with an end portion of the coiled tubing logging plug and afterwards move the retrieving tool in an opposite direction to retrieve the coiled tubing logging plug.

[0017] According to the invention it was recognized that it is possible to retrieve the coiled tubing logging plug from the fluid tubing by usage of a retrieving tool. In particular, it has been recognized that it is possible to retrieve the coiled tubing logging plug if the retrieving tool is adapted and formed such that it can pass partly through the through hole of the coiled tubing logging plug and that it comprises retrieving elements that can be coupled with the end portion of the coiled tubing logging plug. Such a retrieving tool enables to release the stuck coiled tubing logging plug and enables to retrieve the coiled tubing logging plug. Thus, it is not necessary anymore to remove the complete bypass system when the coiled tubing logging plug is stuck so that the operator saves costs by using the retrieving tool.

[0018] Retrieving a coiled tubing logging plug from a downhole means that the coiled tubing logging plug that is arranged downhole in the fluid tubing is retrieved from the downhole by moving the retrieving tool along a removal direction. The removal direction is opposite to the insertion direction. A fluid can be extracted via the downhole. The fluid can be gas or a liquid, in particular oil.

[0019] The position to which the coiled tubing logging plug is moved can be a position in which at least a part of the retrieving element has passed through the end portion of the coiled tubing logging plug. In said position the retrieving element is in a state in which the coiled tubing logging plug can be retrieved. It is possible that the retrieving tool is moved to such a position in which the retrieving element, in particular a hook-shaped end of a collapsible element, is not in direct contact with the coiled tubing logging plug. This is explained below more in detail. The end portion of the coiled tubing logging plug comprises an outlet opening through which the tool or a part of the tool can leave the coiled tubing logging plug. The end of the coiled tubing logging plug can have a sleeve-shape.

[0020] According to an embodiment the retrieving element can surround the tool body. This means, the tool body is arranged within an interior of the retrieving element. In particular, the retrieving element can have a cylindrical shape.

[0021] The extension of the retrieving element in the length direction of the retrieving element can be shorter than the extension of the tool body in the length direction. Thus, the retrieving element only surrounds a part of the tool body in length direction of the retrieving element. The retrieving element can, in particular fully, surround the tool body in circumferential direction of the tool body. Thus, the retrieving element can be designed to be in form of a sleeve. The retrieving element can be translatorily movable relative to the tool body and/or cannot rotate relative to the tool body. In particular, the retrieving element can move along the length direction of the tool body relative to the tool body.

[0022] The retrieving element can be made from or comprise a solid body so that no fluid can flow through the retrieving element in axial or length direction of the retrieving tool. That means, the position of the retrieving element is not controlled by a liquid but a position change occurs mechanically as it is explained below more in detail.

[0023] The retrieving tool is not released or deactivated hydraulically to disengage it from the coiled tubing logging plug. In particular the retrieving tool is configured so that the tool does not allow fluid, in particular liquid, through or pressurized fluid, in particular liquid, to pass through with in the tool, as tool is from bulk or solid material. Additionally, in the tool there is no hydraulically connection or activation of parts but all connections between the parts can be mechanical.

[0024] The retrieving tool does not have any external ports or a meaning for hydraulics fluids movement to enter through the tool or interact with parts of the coiled tubing logging plug. The retrieving tool does not have any fluid chambers to help release the collects from the engagement area of the coiled tubing logging plug. Additionally, the retrieving tool does not allow annulus flow around it to pass through the coiled tubing plug due to the fact that it generates a seal in the upper end of the coiled tubing plug. In addition, the retrieving tool does not have any holes, ports or cavities so that no fluid, in particular liquid, can pass through the tool. This is not possible as the tool is from bulk or solid material. "Upper" and "lower" refer to a gravitational direction.

[0025] The retrieving element can comprise an element body and a collapsible portion that is movable relative to the element body. The collapsible portion enables that the retrieving tool can partly pass through the through hole of the coiled tubing logging plug. As the cross section of the through hole can change along the length direction of the coiled tubing logging plug, the collapsible portion enables in an easy way that the retrieving element can be inserted into the through hole and pass through the through hole of the coiled tubing logging plug without to stuck. This is possible because the collapsible portion can move in a radial direction relative to the element body in order to reduce the cross-section and thus avoid that the retrieving element cannot move further within the

through hole of the coiled tubing logging plug. The collapsible portion can be fixedly connected with the element body.

[0026] The collapsible portion and the element body can be a single piece component. This means, the retrieving element is formed as a single piece component. The collapsible portion can comprise at least one finger or a plurality of fingers that are arranged adjacent to each other in circumferential direction of the collapsible portion. The finger can be connected at one end with the element body.

[0027] If a plurality of fingers are provided, a space can be provided between the respective fingers in circumferential direction of the retrieving element. In particular, the fingers can be arranged such that they can move relative to each other.

[0028] The collapsible portion can have a hook-shaped end. In particular, another end of the finger that is distal to the element body can be hook-shaped. The hook-shape simplifies to couple the retrieving element and the coiled tubing logging plug when the coiled tubing logging plug is retrieved.

[0029] The collapsible portion can be formed such that a plane exists comprising the collapsible portion and the tool body and in which the collapsible portion has an inner cross section, in particular an inner diameter, that is greater than an outer cross section of the tool body, in particular an outer diameter. This enables that the collapsible portion can move towards the tool body. In particular, the collapsible portion can move from a collapsed state to an expanded state or vice versa in radial direction of the retrieving tool. In the collapsed state the retrieving tool can be moved through the coiled tubing logging plug. In the expanded state the coiled tubing logging plug can be retrieved by the retrieving tool and/or cannot be moved within the through hole of the coiled tubing logging plug. In order to move through the through hole the collapsible portion has to be transferred to the collapsed state. This can be done by the end portion of the coiled tubing logging plug when the tool is moved within the through hole.

[0030] The retrieving tool, in particular the hook shaped end of the collapsible portion, can engage a lower sub end of the coiled tubing plug item which considered as external shoulder. In other words, the there is no internal engagement of the collapsible portion with an inner part of the coiled tubing plug which is arranged between the two ends of the coiled tubing logging plug.

[0031] In the retrieving process the retrieving tool has to pass through a specific geometry and dimensions, in particular changes of inner diameters, of the coiled tubing plug to reach the bottom lower sub which is the end of the coiled tubing plug. Then the retrieving tool can engage on the bottom shoulder of the lower sub of the coiled tubing logging plug on the way out in order to release the plug and retrieve it from the Y tool nipple.

[0032] According to an embodiment the retrieving element can comprises a recess for receiving a protrusion of the coiled tubing logging plug when the coiled tubing logging plug is retrieved. The protrusion can protrude from a remaining part of the coiled tubing logging plug. In particular, the protrusion can protrude into the through hole of the coiled tubing logging plug. The protrusion is arranged between the two ends of the through hole of the coiled tubing logging plug.

[0033] The recess can be designed with specific dimensions to match the protrusion of the coiled tubing plug. Thus, while applying the required force in the retrieving direction, the protrusion can retract radially which releases the locking mechanism of the stuck coiled tubing logging plug hence releasing coiled tubing logging plug from it's stuck position.

[0034] The recess can be arranged in the element body of the retrieving element. In particular, the recess can be within a certain and specific length from the top end of the tool to ensure that the protrusion can engage within the recess when a force is applied to retract the protrusion radially inwards during the retrieval process. The provision of the recess has the advantage that a recess wall is in contact with the protrusion of the coiled tubing logging plug and transfers a force to the coiled tubing logging plug when the coiled tubing logging plug is retrieved. Thus, a retrieving force is applied by the retrieving element and by the element body on the coiled tubing logging plug.

[0035] The retrieving element can be moved into a retracted position when the retrieving tool is inserted into the coiled tubing logging plug. Additionally, the retrieving element can be arranged in a retrieving position when the retrieving tool retrieves the coiled tubing logging plug. In particular, the collapsible portion can be arranged in the collapsed state when the retrieving element is arranged in and/or moved to the retracted position. Thus, it is possible that the retrieving element being in the collapsed state can at least partly pass through the through hole of the coiled tubing logging plug.

[0036] The retrieving element, in particular the collapsible portion, can seat on the tool body when the retrieving element is in the retrieving position. The tool body prevents that the collapsible portion can be transferred to the collapsed state in which the retrieving tool cannot retrieve the coiled tubing logging plug. Thus, the retrieving tool can be formed such that the collapsible portion can only be moved into the collapsed state when the retrieving element is in or is moved to the retracted position and/or is not in the retrieving position.

[0037] According to an embodiment of the invention the retrieving tool can comprise a shifting member for shifting the retrieving element from the retracted position to the retrieving position or vice versa. Thus, the transfer of the retrieving element from the retracted position to the retrieving position can occur easily. In particular, the shifting member can be tensioned when the retrieving element is moved from the retrieving position to the retracted position. This can happen when the retrieving tool is inserted into the through hole and the end portion of the coiled tubing logging plug prevents that the collaps-

ible portion in its expanded position passes through the through hole of the coiled tubing logging plug. Thus, a further movement of the tool leads to that the end portion of the coiled tubing logging plug causes that the retrieving element is moved towards the retracted position when the tool is moved through the through hole of the coiled tubing logging plug. The shifting member can be a spring. The collapsible portion is transferred to the collapsible state by the end of the coiled tubing logging plug when the retrieving tool is further moved along the insertion direction.

[0038] The shifting member can apply a force on the retrieving element to move it from the retracted positon to the retrieving position. The retrieving element can be moved by means of the shifting member when the collapsible portion is in the collapsed state.

[0039] The end of the coiled tubing logging plug can prevent that the retrieving element passes further when the collapsible portion is in the expanded position. This is possible because the inner diameter of the through hole of the end coiled tubing logging plug is smaller than the outer diameter of a part of the collapsible portion being in the expanded state.

[0040] The shifting member can be arranged between the retrieving element and the tool body. In particular, the shifting member can be arranged in radial direction of the retrieving tool between the retrieving element and the tool body. Thus, a compact formed retrieving tool is achieved.

[0041] The tool body can comprise a first body portion and a second body portion that are connected to each other in a detachable matter. This means that the tool body comprises of two parts that can be connected to each other. The provision of two parts simplifies to attach the retrieving element to the tool body.

[0042] The first body portion can function as a sealing element. That means, the first body portion is in contact with a part of the coiled tubing logging plug after the retrieving tool is moved to its final retrieving position within the coiled tubing logging plug. The first body portion can seal an upper part of the coiled tubing logging plug. The upper part can comprise an end of the coiled tubing logging. The sealing can be realized by a metal to metal contact between the retrieving tool and the upper part of the coiled tubing logging plug. In the retrieving position the retrieving tool is arranged such within the coiled tubing logging plug so that it can retrieve the coiled tubing logging plug. The first body portion is arranged in portion of the retrieving tool that has an extension between 0-50% of the complete length of the retrieving tool. Said portion extends from an upper end of the retrieving tool, when the retrieving tool is inserted into the coiled tubing logging plug, and/or comprises the spacer portion and/or fishing portion.

[0043] The retrieving element and the tool body can be arranged coaxially to each other. In addition, the retrieving element can be arranged partially on the first body portion and the second body portion. The hook shaped end of the finger of the collapsible portion can have a greater diameter than the tool body, in particular the first body portion and the second body portion.

[0044] The retrieving tool can be formed such that the shifting member can abut against one end on the first body portion and against another end on the retrieving element. Additionally, the element body can abut against the second body portion when the retrieving element is in the expanded position and/or the element body cannot abut against the second body portion when the retrieving element is in the retracted position.

[0045] Of particular advantage is a well system that comprises a coiled tubing logging plug and a retrieving tool according to the invention.

[0046] The well completion system can comprise a bypass-system, wherein the coiled tubing logging plug is located at a seating element of a fluid tubing of the bypass-system. That means, the retrieving tool is in direct contact with the coiled tubing logging plug and/or is not in direct contact with the fluid tubing. The seating element can be a part of the fluid tubing that protrudes in a radial inner direction from the remaining part of the fluid tubing. The well system can be fluidically connected with the production tubing.

[0047] The bypass-system comprises a further fluid tubing. A pump of the well system, in particular an electrical submersible pump, can be arranged in the further fluid tubing and/or can be fluidically connected with the further fluid tubing. The further fluid tubing is arranged partially parallel to the fluid tubing. The two tubings are fluidically connected with each other at their upper and lower end.

[0048] An outer contour of a cross section of the tool body is smaller than an outer contour of a cross section of the coiled tubing logging plug. In particular, an outer diameter of the tool is smaller than an outer diameter of the coiled tubing logging plug. Additionally, the outer diameter of the tool body, in particular the first body portion, is smaller an inner diameter of the fluid tubing. In other words, the first body portion and thus the retrieving tool cannot seal the fluid tubing. The same applies if the retrieving tool is used in the further tubing in which the electrical submersible pump is arranged. The retrieving tool can be coaxially arranged with the coiled tubing logging plug after the retrieving tool is arranged in the through hole of the coiled tubing logging plug.

[0049] In the following, the method for retrieving the coiled tubing logging plug is described. After it is determined that the coiled tubing logging plug is stuck and cannot be removed from a fluid tubing of a bypass-system a tube passing through the coiled tubing logging plug can be cut. The tube passes completely through the coiled tubing logging plug. The coiled tubing logging plug is fixedly seated on the seating element of the fluid tubing.

[0050] As a result of the cutting step a part of the cut tube falls downward due to gravity force. The remaining part of the cut tube can be removed in the next step. Afterwards, the retrieving tool can be moved along the

insertion direction until a part of the retrieving element has passed the coiled tubing logging plug. The end portion of the coiled tubing plug is adapted to act on the collapsible portion such that it moves from the expanded state to the collapsed state when the retrieving tool is moved within the through hole of the coiled tubing logging plug. In particular, in a first step the retrieving element can move from the retrieving position to the retracted position when the end of the coiled tubing logging plug comes into contact with the collapsible portion. After the retrieving element is arranged in the retracted position the end of the coiled tubing logging plug can apply a force on the collapsible portion so that the collapsible portion is transferred into the collapsed state. Afterwards, the retrieving element can pass through the through hole, in particular through the end of the coiled tubing plug when the tool is moved further through the through hole. After passing the end of the coiled tubing plug, the collapsible portion is transferred to the extracted state. This is possible as the collapsible portion is tensioned when it is moved from the expanded state to the collapsed state.

[0051] In the next step the retrieving tool can be moved along the removal direction so that the retrieving element, in particular the hook shaped end of the collapsible portion, gets into contact with the end of the coiled tubing logging plug. The retrieving element applies a force on the coiled tubing logging plug in order to retrieve the coiled tubing logging plug. The force is applied such that a protrusion of the coiled tubing logging plug inserts into the recess of the retrieving element when the coiled tubing logging plug is retrieved. After the protrusion is inserted within the recess the coiled tubing logging plug can be moved along the removal direction. The electrical submersible pump can be activated so that it pumps the fluid through the bypass system towards the production tubing after the coiled tubing logging plug is retrieved and a blanking plug has been inserted into the fluid tubing.

[0052] According to an embodiment the retrieving tool running procedures can be done using coiled tubing bottom hole assembly with standard ball drop hydraulic release disconnect, hence once the retrieving tool lands inside the coiled tubing, and fishing process deemed unsuccessful then a ball will be dropped to activate a disconnect to separate the retrieving tool from the coiled tubing bottom hole assemble leaving the tool inside the coiled tubing plug to seal it allowing the well to flow via ESP. The retrieving tool can have the first body portion made of steel to seal the coiled tubing plug should the retrieving or fishing process deemed not possible. As well the upper part of the retrieving tool in particular, the fishing portion and the tapering end portion can be arranged at opposite ends of the retrieving tool. The fishing portion can be connected with a fishing tool when the retrieving tool retrieves the coiled tubing logging plug. The retrieving tool can be designed for specific oil producing wells with Y tool completion design (artificial lift completion) and meant to fish and retrieve the coiled tubing plug or if not possible then to seal the flow through coiled tubing plug and allow production through production tubing and ESP pump side.

[0053] In the figures, the subject-matter of the invention is schematically shown, wherein identical or similarly acting elements are usually provided with the same reference signs. Here shows:

Fig. 1 shows a perspective view of the retrieving tool according to an embodiment of the invention,

Fig. 2 shows a cross section of the retrieving tool shown in fig. 1,

Fig. 3 shows a part of a well system in a state in which the coiled tubing logging plug is stuck,

Fig 4 shows the well system according to fig. 3 after a tube is cut,

Fig. 5 shows the well system according to fig. 3 after the retrieving tool is inserted into the through hole of the coiled tubing logging plug,

Fig. 6 shows the well system according to fig. 3 when the retrieving tool retrieves the coiled tubing logging plug,

Fig. 7 shows the well system according to fig. 3 after the retrieving tool removed the coiled tubing logging plug from the fluid tubing,

Fig. 8 shows a well system with a bypass-system, the retrieving tool according to the embodiment shown in fig. 1 and the coiled tubing logging plug.

[0054] The retrieving tool 1 shown in fig. 1 is used to retrieve a coiled tubing logging plug 2 from a downhole that is stuck in a fluid tubing 21 of e.g. a bypass system. The coiled tubing logging plug 2 and the fluid tubing 21 are shown in fig. 3. The retrieving tool 1 is insertable into a through hole 15 of the coiled tubing logging plug 2 and comprises a tool body 3 and a retrieving element 4. The retrieving element 4 is movable relative to the tool body 3 along a length direction L of the retrieving element 4 and can be coupled to the coiled tubing logging plug 2 in retrieve the coiled tubing logging plug 2. The length direction L corresponds with an axial direction of the retrieving tool 1.

[0055] The retrieving element 4 surrounds the tool body 3 in circumferential direction of the tool body 3. In length direction L of the retrieving tool 1 the tool body 3 is longer than the retrieving element 4. The retrieving element 4 is formed as a one part component and comprises an element body 5 and a collapsible portion 6. The collapsible portion 6 comprises a plurality of fingers 7 that are arranged adjacent to each other along the circumferential direction of the retrieving element 4. One end of

the fingers 7 is connected with the element body 5, respectively. The other end of the finger has a hook-shape 8. The collapsible portion 6 can be moved relative to the element body 5. In particular, the collapsible portion 6 moves in radial direction R of the retrieving tool 1 relative to the element body 5.

[0056] The retrieving element 4 comprise a recess 9 that is arranged in the element body 5. The recess 9 is used to receive a protrusion 10 of the coiled tubing logging plug 2. The protrusion 10 is shown in fig. 6.

[0057] The retrieving tool 1 comprises a tapering end portion 17 arranged at one end of the retrieving tool 1. The tapering end portion 17 decreases in a direction away from the retrieving element 4. The retrieving tool 1 comprises a fishing portion 18 that is arranged at another end of the retrieving tool 1. In particular, the fishing portion 18 and the tapering end portion 17 are arranged at opposite ends of the retrieving tool 1. The fishing portion 18 is connected with a non-shown fishing tool when the retrieving tool 1 retrieves the coiled tubing logging plug 2.

[0058] The retrieving tool 1 comprises a spacer portion 19 that is arranged between the fishing portion 18 and the retrieving element 4. The spacer portion 19 has a greater diameter than the remaining part of the retrieving tool 1. As can be seen in fig. 5 the spacer portion 19 remains outside the through-hole 15 when the retrieving tool 1 is inserted into the through-hole 15 of the coiled tubing logging plug 2. Additionally, the spacer portion 19 is arranged on the coiled tubing logging plug 2 so that in said position the spacer portion 19 also functions as seal.

[0059] Fig. 2 shows a cross section of the retrieving tool 1 shown in fig. 1. The tool body 3 comprises a first body portion 12 and a second body portion 13. The first body portion 12 and the second body portion 13 are connected with each in a removable manner. The first body portion 12 comprises the spacer portion 19 and the fishing portion 18. The second body portion 13 comprises the tapering end portion 17. The first body portion 12 has an outer diameter that corresponds to an inner diameter of a part of the coiled tubing logging plug 2. Thus, after the retrieving tool 1 is inserted into the coiled tubing logging plug, the first body portion 12 functions as seal and thus no fluid flows between the first body portion 12 and the part of the coiled tubing logging plug 2.

[0060] The retrieving element 4 has the form of a sleeve. The element body 5 is partly arranged on the first body portion 12 and partly on the second body portion. 13. A shifting member 11 that can be a spring is arranged between the first body portion 12 and the element body 5. In particular, the shifting member 11 is arranged between the retrieving element 4 and the tool body 3 in radial direction R of the retrieving tool 1. The shifting member 11 is in contact with the first body portion 12 and the retrieving element 4, in particular the element body 5.

[0061] The collapsible portion 6 and the second body portion 13 are designed such that a plane E exist comprising the collapsible portion 6 and the second body portion 13 wherein the collapsible portion 6 has a greater inner diameter than an outer diameter of the second body portion 13. Thus, a space exists between the collapsible portion 6 and the second body portion 13 in radial direction R of the retrieving tool 1.

[0062] Fig. 2 shows a state of the retrieving tool 1 in which the retrieving element 4 is arranged in a retrieving position. In the retrieving position the collapsible portion 6 cannot be transferred in a collapsed state. This is prevented by an abuting part 20 of the second body portion 13 as is explained below more in detail. In the retrieving position of the retrieving element 4 the element body 5 abuts against the second body portion 13.

[0063] In the following, the method for retrieving the coiled tubing logging plug 2 by means of the retrieving tool 1 is described. The method is described under usage of fig. 3 to 7.

[0064] Fig. 3 shows a part of a well system in a state in which the coiled tubing logging plug 2 is stuck. This means that the connection between the coiled tubing logging plug 2 and the fluid tubing 21 cannot be released so that the coiled tubing logging plug 2 cannot be moved in a removal direction O. The removal direction O is opposite to an insertion direction I of the retrieval tool 1.

[0065] The coiled tubing logging plug 2 seats on a seating element 22 of the fluid tubing 21.A tube 16 extends through the complete coiled tubing logging plug 2, in particular through the through-hole 15 of the coiled tubing logging plug 2. Fig. 3 shows only a part of the tube 16.

[0066] After, it has been determined that the coiled tubing logging plug 2 is stuck, the tube 16 is cut. The tube 16 can be cut at a portion that is arranged above the coiled tubing logging plug 2. Fig. 3 shows the cutting position 23 at which the tube 16 is cut.

[0067] One part of the cut tube 16 falls downwards due to gravitationally force. This part is shown in Fig. 4 whereas the other cut tube part has been removed by moving it along the removal direction O. The removal direction O is opposite to the insertion direction I.

[0068] .By moving the retrieving element 4 along the insertion direction I the retrieving element 4, in particular the hook shaped end 8 of the finger 7 gets into contact with an end of the coiled tubing logging plug 24. As the hook shaped end 8 of the finger 7 has a greater diameter than the inner diameter of the end of the coiled tubing plug 24, the retrieving element 4 is moved in the removal direction O that is opposite to the insertion direction I of the retrieving element 4 by means of the end of the coiled tubing logging plug 24. This is not shown in fig. 5.

[0069] After the retrieving element 4 is moved to the retracted position a further movement of the retrieving tool 1 along the insertion direction I leads to that the collapsible portion 6 is transferred into the collapsed state by means of the end of the coiled tubing logging plug 24. Afterwards the collapsible portion 6 is in the collapsed state and, thus, the retrieving element 4 can be moved through the end of the coiled tubing logging plug 24.

[0070] The shifting member 11 shifts the retrieving element 4 to the retrieving position after the collapsible

portion 6 is transferred to the collapsed state. After the collapsible portion 6 has moved out of the end of the coiled tubing logging plug 24 the collapsible portion 6 moves back into the expanded state. The tool 1 is moved to such a position in which the hook shaped end 8 of the finger 7 is not in contact with the end portion of the coiled tubing logging plug 24. This state is shown in fig. 5.

[0071] The retrieving tool 1 is moved relative to the coiled tubing logging plug 2 until the spacer portion 19 abuts against the coiled tubing logging plug 2. Said state is shown in fig. 5. Fig. 5 shows the well system according to fig. 3 after the retrieving tool 1 is inserted into the through hole 15 of the coiled tubing logging plug 2.

[0072] Afterwards, the retrieving tool 1 is moved in a removal direction O that is opposite to the insertion direction I. The retrieving element 4, in particular the hooked shaped end 8 of the finger 7 comes into contact with the end of the coiled tubing logging plug 24. At said state the spacer portion 19 is not in contact with the coiled tubing logging plug 2. Said state is shown in Fig. 6. The collapsible portion 6 cannot be transferred into the collapsed state as the collapsible portion 6, in particular the hook shaped end 8 of the finger 7, abuts against the abuting part 20 of the second body portion 13. That means, the abuting part 20 prevents that the collapsible portion 6 moves to the collapsed state.

[0073] By further moving the retrieving tool 1 in removal direction O the retrieving element 4 applies a force against the end portion of the coiled tubing logging plug 24. This force causes that protrusion 10 of the coiled tubing logging plug 2 is moved radial inwards in the through hole 15. The protrusion 10 is mechanically connected with the end portion of the coiled tubing logging plug 24. In particular the protrusion 10 is moved into in the recess 9 of the retrieving element 4. This movement is necessary as otherwise the coiled tubing logging plug 2 cannot be removed from the fluid tubing as the protrusion 10 would otherwise abut against a wall of the fluid tubing 21.

[0074] Fig. 7 shows the well system according to fig. 3 after the retrieving tool 1 retrieves the coiled tubing logging plug 2 from the fluid tubing 21. The retrieving tool 1 can be moved into a production tubing 28 of the well system 14 shown in fig. 8.

[0075] Fig. 8 shows a well systems 14 with a bypass-system 25, the retrieving tool 1 and the coiled tubing logging plug 2. The retrieving tool 1 is arranged inside the coiled tubing logging plug 2.

[0076] The bypass-system 25 comprises a Y-tool. The Y-tool comprises the fluid tubing 21 discussed above. Additionally, the bypass-system 25 comprises a further fluid tubing 26 that is arranged parallel to the fluid tubing 21. A pump 27 is arranged in the further fluid tubing 26 wherein the pump 27 can be an electrical submersible pump. The bypass-system 25 is fluidically connected with a production tubing 28. The production tubing 28 is arranged above the bypass system 25. Additionally, the production tubing 28 is fluidically connected to the bypass system 25, in particular to the fluid tubing 21 and the further fluid tubing 26.

[0077] The retrieving tool 1 has an outer contour, in particular such a diameter, that there is always a fluid connection between the production tubing 28 and the further fluid tubing 26. As is evident from fig. 8, the spacer portion 19 is arranged on one end of the coiled tubing logging plug 2 and thus is not arranged within the through hole 5.

Reference signs

[0078]

1	retrieving tool
2	coiled tubing logging plug
3	tool body
4	retrieving element
5	element body
6	collapsible portion
7	finger
8	hook-shaped end
9	recess
10	protrusion
11	shifting member
12	first body portion
13	second body portion
14	well system
15	through hole
16	tube
17	tapering end portion
18	fishing portion
19	spacer portion
20	abuting part
21	fluid tubing
22	seating element
23	cutting position
24	end of the coiled tubing logging plug
25	bypass system
26	further fluid tubing
27	pump
28	production tubing
E	plane
I	Insertion direction
L	length direction
R	radial direction
O	removal direction

Claims

1. Retrieving tool (1) for retrieving a coiled tubing logging plug (2) from a downhole wherein the retrieving tool (1) is insertable into a through hole (15) of the coiled tubing logging plug (2) and comprises a tool body (3) and a retrieving element (4) that is movable relative to the tool body (3) and that is couplable to

the coiled tubing logging plug (2) in order to retrieve the coiled tubing logging plug (2).

2. Retrieving tool (1) according to claim 1, **characterized in that**

a. the retrieving element (4) surrounds the tool body (3) and/or **in that**
b. the retrieving element (4) is designed in form of a sleeve and/or **in that**
c. the retrieving element (4) is translatorily movable relative to the tool body (3) and/or **in that**
d. the retrieving element (4) is made of or comprises a solid body so that no fluid can flow through the retrieving element (4) in axial direction of the retrieving tool (1).

3. Retrieving tool (1) according to claim 1 or 2, **characterized in that** the retrieving element (4) comprises an element body (5) and a collapsible portion (6) that is movable relative to the element body (5).

4. Retrieving tool (1) according to claim 3, **characterized in that**

a. the collapsible portion (6) comprises at least one finger (7) or a plurality of fingers (7) that are arranged adjacent to each other in circumferential direction of the collapsible portion (6) and/or **in that**
b. the collapsible portion (6) has a hook-shaped end (8) and/or **in that**
c. the collapsible portion (6) is designed such that a plane (E) exists comprising the collapsible portion (6) and the tool body (3) and in which the collapsible portion (6) has an inner cross section that is greater than an outer cross section of the tool body (3) and/or **in that**
d. the collapsible portion (6) is movable from a collapsed state, in which the retrieving tool (1) can be moved through the coiled tubing logging plug (2), to an expanded state, in which the coiled tubing logging plug (2) can be retrieved by the retrieving tool (1).

5. Retrieving tool (1) according to at least one of the claims 1 to 4, **characterized in that**

a. the retrieving element (4) comprises a recess (9) for receiving a protrusion (10) of the coiled tubing logging plug (2) when the coiled tubing logging plug (2) is retrieved and/or **in that**
b. the recess (9) is arranged in the element body (5) of the retrieving element (4).

6. Retrieving tool (1) according to at least one of the claims 1 to 5, **characterized in that**

a. the retrieving element (4) is movable into a retracted position when the retrieving tool (1) is inserted into the coiled tubing logging plug (2) and/or **in that**
b. the retrieving element (4) is movable between a retracted position and a retrieving position and/or **in that**
c. the retrieving element (4) is arranged at a retrieved position when the retrieving tool (1) retrieves the coiled tubing logging plug (2) and/or
d. the collapsible portion (6) is arranged in the collapsed state and/or movable to the collapsed state when the retrieving element (4) is in the retracted position and/or **in that**
e. the retrieving element (4) seats on the tool body (3) when the retrieving element (4) is in the retrieving position.

7. Retrieving tool (1) according to at least one of the claims 1 to 6, **characterized in that**

a. the retrieving tool (1) comprises a shifting member (11) for shifting the retrieving element (4) from the retracted position to the extended position or vice versa.
b. the shifting member (11) is tensioned when the retrieving element (4) is moved from the retrieving position to the retracted position and/or **in that**
c. the shifting member (11) applies a force on the retrieving element (4) to move it from the retracted position to the retrieving position and/or **in that**
d. the shifting member (11) is a spring.

8. Retrieving tool (1) according to at least one of the claims 1 to 7, **characterized in that** the tool body (3) comprises a first body portion (12) and a second body portion (13) that are connected to each other in a detachable matter.

9. Retrieving tool (1) according to claim 8, **characterized in that**

a. the retrieving element (4) is arranged partially on the first body portion (12) and the second body portion (13) and/or **in that**
c. the shifting member (11) abuts against one end on the first body portion (12) and on another end on the retrieving element (4) and/or **in that**
d. the element body (5) abuts against the second body portion (13) when the retrieving element (4) is in the retrieving position and/or the element body (5) does not abut against the second body portion when the retrieving element is in the retracted position.

10. Well system (14) comprising a coiled tubing logging

plug (2) and a retrieving tool (1) according to one of the claims 1 to 9.

11. Well system (14) according to claim 10, **characterized in that** an end portion of the coiled tubing logging plug (24) is adapted to act on the collapsible portion (6) such that it moves from the expanded state to the collapsed state when the retrieving tool (1) is moved through the through hole (15) of the coiled tubing logging plug (2).

12. Well system (14) according to claim 10 or 11, **characterized in that**

a. an end portion of the coiled tubing logging plug (24) is in contact with the retrieving element (4) when the coiled tubing logging plug (2) is retrieved and/or **in that**
b. the retrieving element (4) acts on an end portion of the coiled tubing logging plug (24) such that a protrusion (10) of the coiled tubing logging plug (2) inserts into the recess (9) of the retrieving element (4) when the coiled tubing logging plug (2) is retrieved.

13. Method for retrieving a coiled tubing logging plug (2) from a downhole comprising the step of inserting a retrieving tool (1) according to one of the claims 1 to 9 into a through-hole (15) of the coiled tubing logging plug (2) along an insertion direction (I) to a position in which a retrieving element (4) of the retrieving tool (1) is coupleable with an end portion of the coiled tubing logging plug (2) and afterwards move the retrieving tool (1) in an opposite direction to retrieve the coiled tubing logging plug (2).

14. Method according to claim 13, **characterized in that**

a. the retrieving tool (1) is moved along the insertion direction (I) until a part of the retrieving element (4) has passed the end portion of the coiled tubing logging plug (2) and/or **in that**
b. a tube (16) passing through the coiled tubing logging plug (2) is cut before the retrieving tool (1) is inserted.

15. Use of a retrieving tool (1) according to at least one of the claims 1 to 9 for retrieving a coiled tubing logging plug (2) from a downhole.

Amended claims in accordance with Rule 137(2) EPC.

1. Retrieving tool (1) for retrieving a coiled tubing logging plug (2) from a downhole wherein the retrieving tool (1) is insertable into a through hole (15) of the coiled tubing logging plug (2) and comprises a tool body (3) and a retrieving element (4) that is movable relative to the tool body (3) and that is couplable to the coiled tubing logging plug (2) in order to retrieve the coiled tubing logging plug (2), wherein the retrieving element (4) comprises a recess (9) for receiving a protrusion (10) of the coiled tubing logging plug (2) when the coiled tubing logging plug (2) is retrieved.

2. Retrieving tool (1) according to claim 1, **characterized in that** the retrieving element (4) is translatorily movable relative to the tool body (3).

3. Retrieving tool (1) according to claim 1 or 2, **characterized in that** the retrieving element (4) comprises an element body (5) and a collapsible portion (6) that is movable relative to the element body (5).

4. Retrieving tool (1) according to claim 3, **characterized in that** the collapsible portion (6) is movable from a collapsed state, in which the retrieving tool (1) can be moved through the coiled tubing logging plug (2), to an expanded state, in which the coiled tubing logging plug (2) can be retrieved by the retrieving tool (1).

5. Retrieving tool (1) according to at least one of the claims 1 to 4, **characterized in that** the recess (9) is arranged in the element body (5) of the retrieving element (4).

6. Retrieving tool (1) according to at least one of the claims 1 to 5, **characterized in that** the retrieving element (4) is movable into a retracted position when the retrieving tool (1) is inserted into the coiled tubing logging plug (2).

7. Retrieving tool (1) according to at least one of the claims 1 to 6, **characterized in that** the retrieving tool (1) comprises a spring for shifting the retrieving element (4) from the retracted position to the extended position or vice versa.

8. Retrieving tool (1) according to at least one of the claims 1 to 7, **characterized in that** the tool body (3) comprises a first body portion (12) and a second body portion (13) that are connected to each other in a detachable matter.

9. Retrieving tool (1) according to claim 8, **characterized in that** the retrieving element (4) is arranged partially on the first body portion (12) and the second body portion (13).

10. Well system (14) comprising a coiled tubing logging plug (2) and a retrieving tool (1) according to one of the claims 1 to 9.

11. Well system (14) according to claim 10, **characterized in that** an end portion of the coiled tubing logging plug (24) is adapted to act on the collapsible portion (6) such that it moves from the expanded state to the collapsed state when the retrieving tool (1) is moved through the through hole (15) of the coiled tubing logging plug (2).

12. Well system (14) according to claim 10 or 11, **characterized in that** the retrieving element (4) acts on an end portion of the coiled tubing logging plug (24) such that a protrusion (10) of the coiled tubing logging plug (2) inserts into the recess (9) of the retrieving element (4) when the coiled tubing logging plug (2) is retrieved.

13. Method for retrieving a coiled tubing logging plug (2) from a downhole comprising the step of inserting a retrieving tool (1) according to one of the claims 1 to 9 into a through-hole (15) of the coiled tubing logging plug (2) along an insertion direction (I) to a position in which a retrieving element (4) of the retrieving tool (1) is coupleable with an end portion of the coiled tubing logging plug (2) and afterwards move the retrieving tool (1) in an opposite direction to retrieve the coiled tubing logging plug (2).

14. Method according to claim 13, **characterized in that** the retrieving tool (1) is moved along the insertion direction (I) until a part of the retrieving element (4) has passed the end portion of the coiled tubing logging plug (2).

15. Use of a retrieving tool (1) according to at least one of the claims 1 to 9 for retrieving a coiled tubing logging plug (2) from a downhole.

Fig. 1

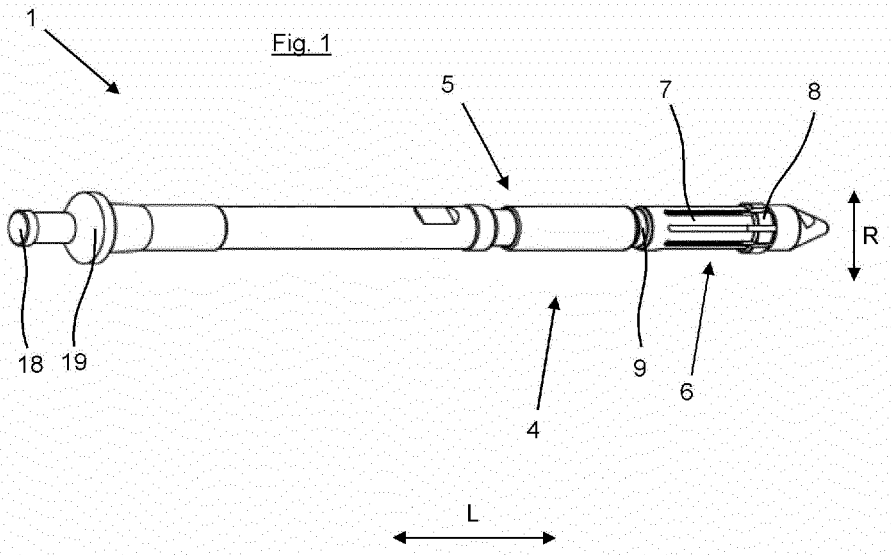


Fig. 2

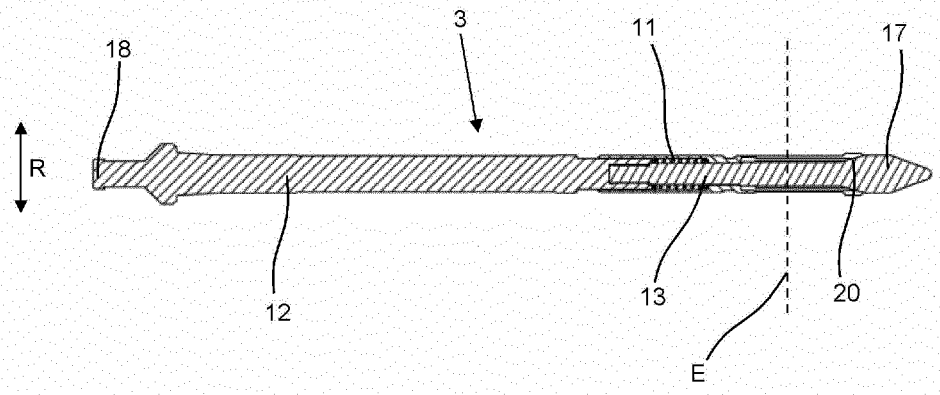


Fig. 3

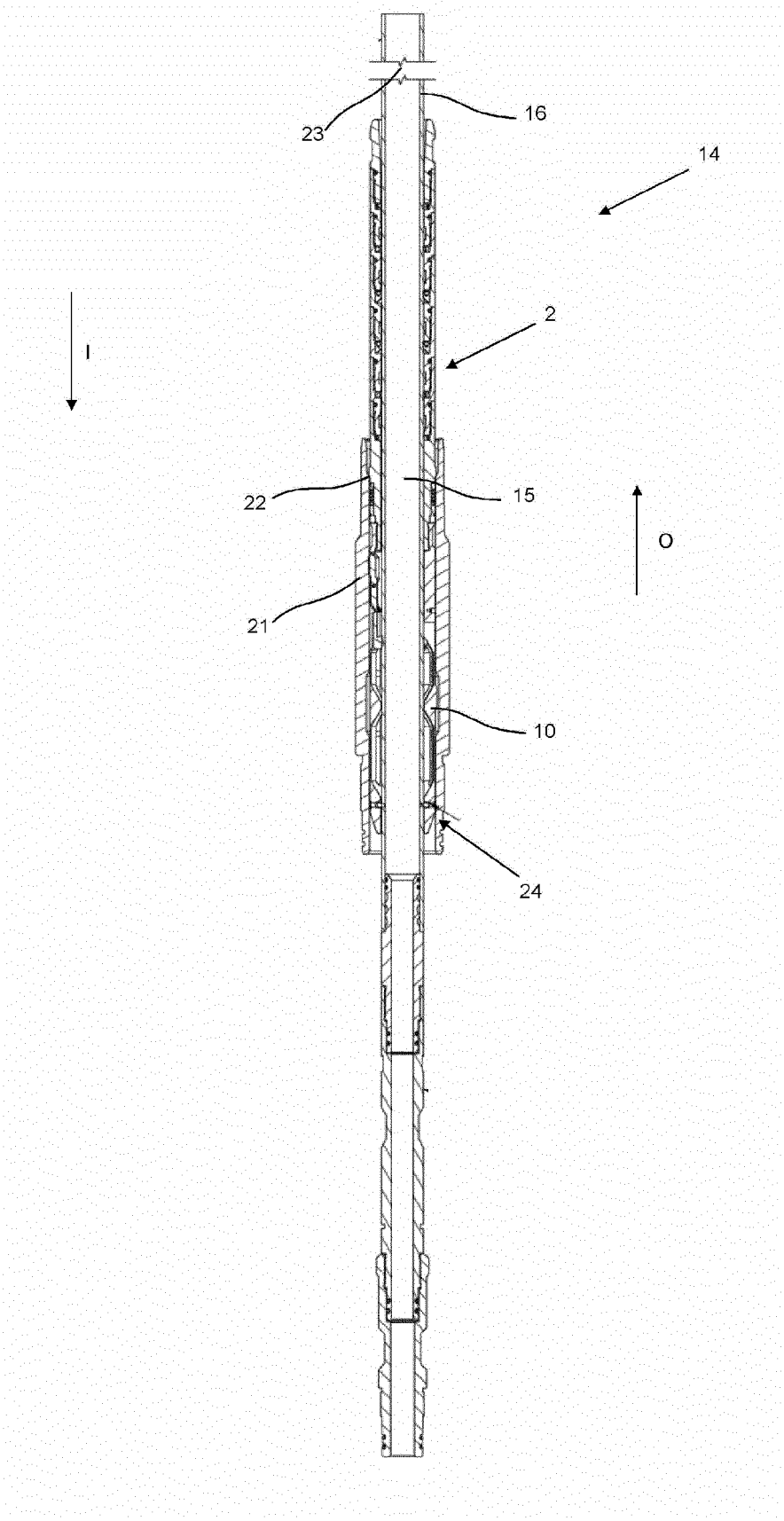


Fig. 4

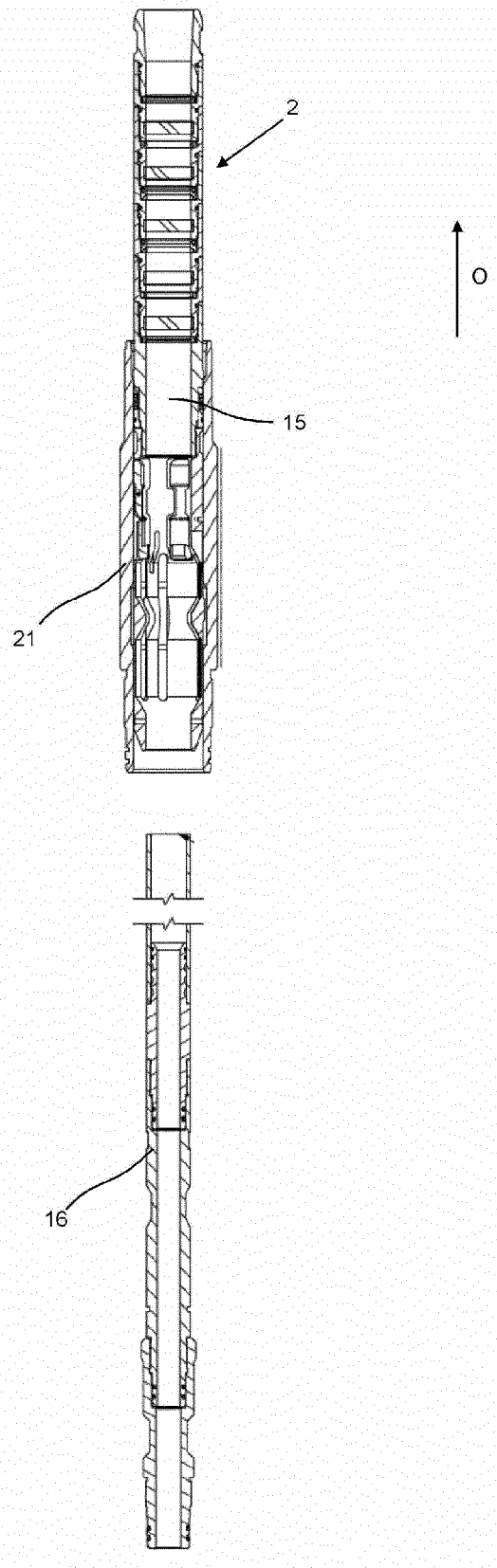


Fig. 5

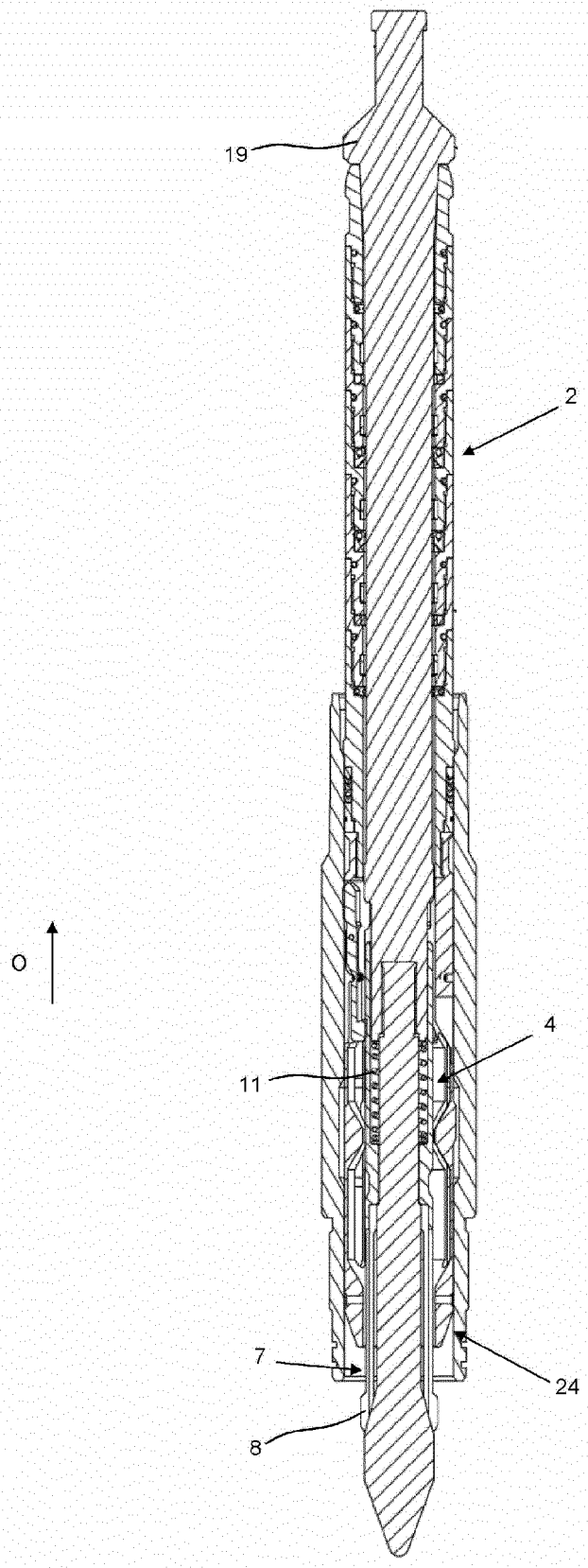


Fig. 6

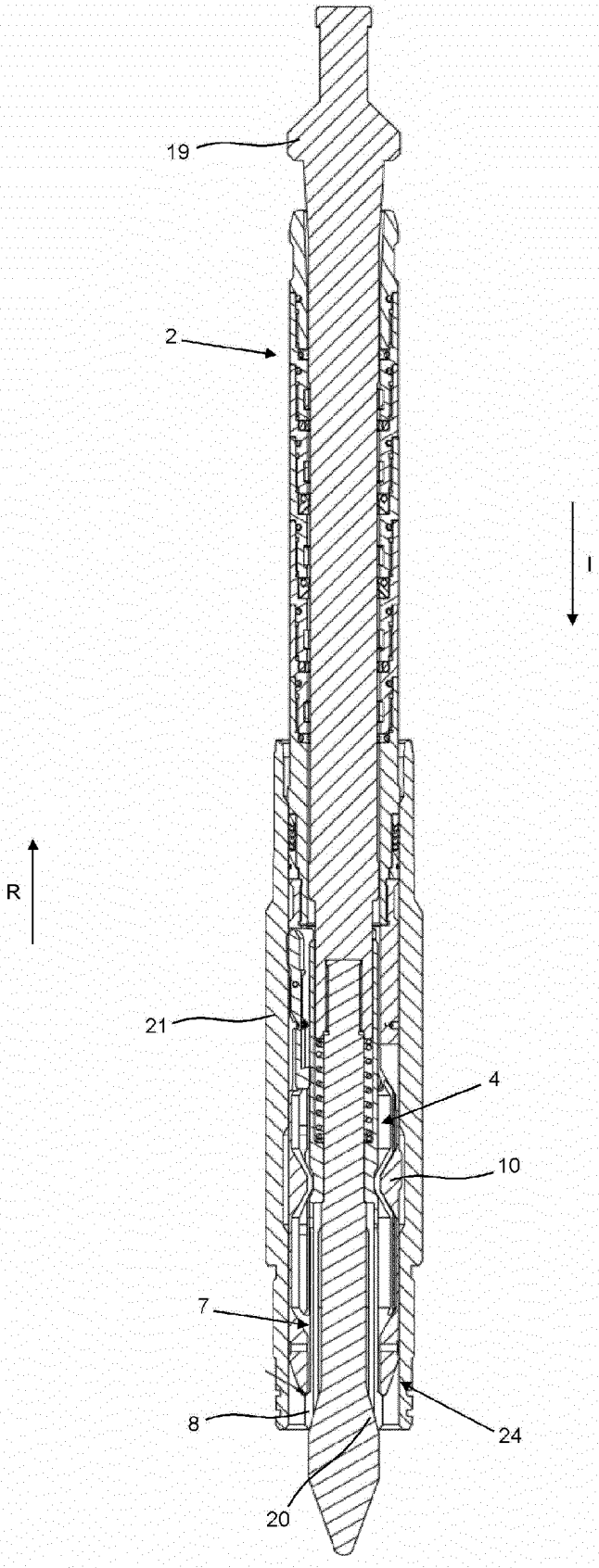


Fig. 7

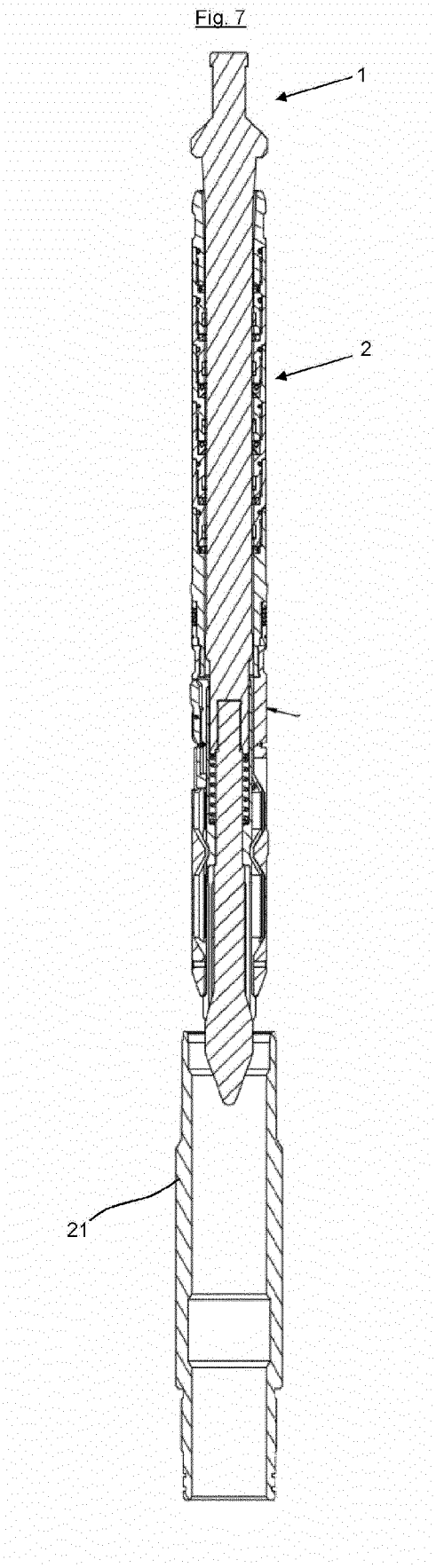
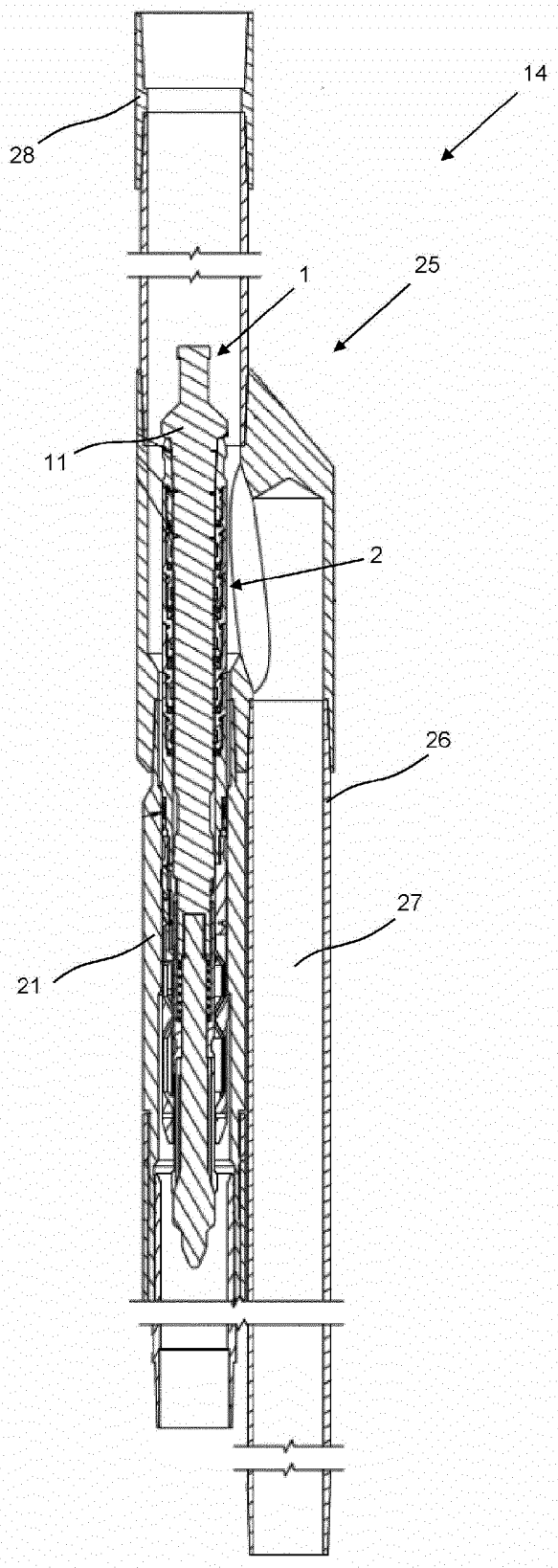


Fig. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 7149

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 99/09296 A1 (GAZEWOOD MICHAEL J [US]) 25 February 1999 (1999-02-25) * figures 8-10 *	1-15	INV. E21B23/00 E21B31/20
X	US 5 242 201 A (BEEMAN ROBERT S [US]) 7 September 1993 (1993-09-07) * figures 1-10 *	1-15	
X	US 2005/199398 A1 (COX JAY D [US]) 15 September 2005 (2005-09-15) * figures 1-4 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 July 2023	Georgescu, Mihnea

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 15 7149

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04-07-2023

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WO 9909296 A1	25-02-1999	AU 742159 B2	20-12-2001
		CA 2300086 A1	25-02-1999
		EP 1025337 A1	09-08-2000
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US 2005199398 A1	15-09-2005	NONE	

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