



(51) International Patent Classification:

E21B 34/10 (2006.01) E21B 34/14 (2006.01)

(21) International Application Number:

PCT/US2023/017289

(22) International Filing Date:

03 April 2023 (03.04.2023)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

17/716,669 08 April 2022 (08.04.2022) US

(71) Applicant: **BAKER HUGHES OILFIELD OPERATIONS LLC** [US/US]; 17021 Aldine Westfield, Houston, Texas 77073 (US).

(72) Inventors: **BISHOP, David**; 17021 Aldine Westfield, Houston, Texas 77073 (US). **GARR, Ronald J.**; 17021 Aldine Westfield, Houston, Texas 77073 (US).

(74) Agent: **VIVENZIO, Marc** et al.; 17021 Aldine Westfield, Houston, Texas 77073 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: METHOD FOR OPERATING A SLEEVE

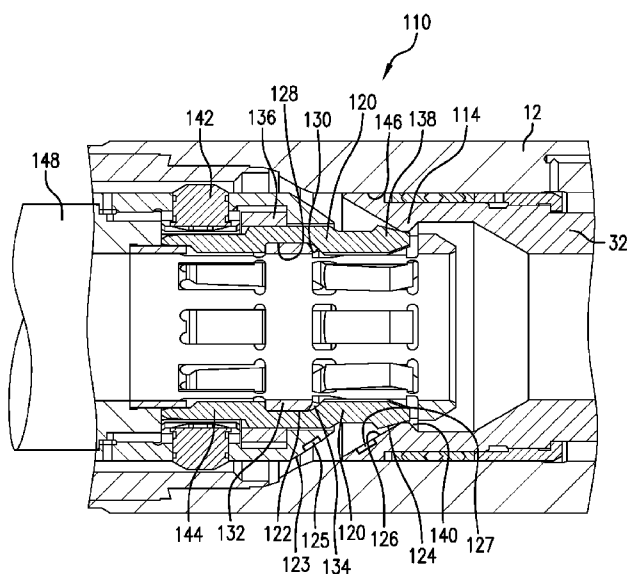


FIG. 6

(57) Abstract: A method for operating a sleeve including running a latch system into contact with the sleeve, latching the latch system to the sleeve, shifting the sleeve from a first position to a second position with the latch system moving in the same direction that the latch system moved during latching.



Published:

— *with international search report (Art. 21(3))*

METHOD FOR OPERATING A SLEEVE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Application No. 17/716669, filed
5 on April 8, 2022, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] In the resource recovery industry and fluid sequestration industries, Wet
connect systems can greatly improve functionality by allowing connection and disconnection
10 of hydraulic lines in the downhole environment. Difficulties include debris collecting at a
connection location that may interfere with fluid movement or pressure conveyance, and
physical limitations regarding running of the wet connect system. The art will appreciate
alternative ways and means for wet connect systems.

15 SUMMARY

[0003] An embodiment of a method for operating a sleeve including running a latch
system into contact with the sleeve, latching the latch system to the sleeve, shifting the sleeve
from a first position to a second position with the latch system moving in the same direction
that the latch system moved during latching

20

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The following descriptions should not be considered limiting in any way.
With reference to the accompanying drawings, like elements are numbered alike:

[0005] Figure 1 is a cross sectional view of a wet connect system as disclosed herein;

25 [0006] Figure 2 is a cross sectional view of a portion of Figure 1 illustrating a balance
piston thereof in a sleeve open position;

[0007] Figure 3 is a cross sectional view of a portion of Figure 1 illustrating a balance
piston thereof in a sleeve closed position;

[0008] Figure 4 is a cross sectional view of a portion of Figure 1 illustrating a latch
30 thereof;

[0009] Figure 5 is a cross sectional view of the system illustrating a burst disk in the
hydraulic line;

[0010] Figure 6 is a cross section view of a latch system as disclosed herein in an
unlatched unactuated position;

[0011] Figure 7 is a view of the system of Figure 6 during a latching engagement:

[0012] Figure 8 is a view of the same system fully latched;

[0013] Figure 9 is a view of the system partially unlatched during an unlatching operation;

5 [0014] Figure 10 is a view that shows more of a downhole tool with which the latch may be employed wherein hydraulic ports are illustrated open such that the downhole tool is in the actuated position; and

[0015] Figure 11 is a view of a borehole system including the latch system disclosed herein.

10

DETAILED DESCRIPTION

[0016] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

15 [0017] Referring to Figure 1, a wet connect system 10 is illustrated. The system 10 comprises a first connector housing 12 having a first communication line 14 (see Fig. 10) therein. Line 14 is disposed within a wall of the housing 12 extending therealong for some distance. A second connector housing 16 is concentrically positionable within the first connector housing 12. Second connector housing 16 includes a second communication line 18 (see Fig. 5) within a wall thereof. The first and second connector housings 12 and 16 are positionable such that a port 156 of first communication line 14 and a counter port 158 of second communication line 18 may be communicated to one another through a manifold area 24 defined radially by the first housing 12 and the second housing 16 and axially by seals 160 and 162. Further, a balance piston 30 is disposed in the first housing 12 and functions to
20 ensure pressure of a clean hydraulic fluid remains essentially the same (e.g., hydrostatic pressure) as a pressure of fluid in the first communication line 14 so that debris does not get into the first communication line 14 during portions of operation when the manifold area 24 is not sealed. The balance piston 30 is sealed to the first housing 12 and to a sleeve 32 within the housing 12. Referring to Figures 2 and 3, the sleeve 32 is movable within the housing
25 and spaced therefrom to produce an annular space 34 between the sleeve 32 and the housing 12. It is in this space that the piston 30 may move in order to ensure that fluid disposed in the annular space between the balance piston 30 and the first communication line 14 (see Figure 10) remains at hydrostatic pressure such that no debris is forced into line 14. The position of
30

the balance piston 30 is illustrated with the sleeve 32 in the open position in Figure 2 and the closed position in Figure 3.

[0018] Referring to Figures 1 and 4, the system 10 also includes a running latch 35. The running latch 35 is commercially available as a part of Baker Hughes' SureConnect™ connection movement restriction device, that is ordinarily used for running in the borehole, hence the name running latch used herein. Latches such as this have not however been employed heretofore in connection with a set connect system such as system 10 since there has been no need to cause the systems of the prior art to carry weight until specifically released. The capability employed here is important to facilitate A one trip system where the weight of the lower completion must be supported. The running latch 35 maintains a load carrying configuration until it is hydraulically released.

[0019] Referring to Figure 5, there is illustrated in the second communication line 18 an optional rupture disk 36 that may be employed to ensure the fluid within communication line 18 be clean at least until the disk 36 is ruptured.

[0020] Referring to Figure 6, an open/close latch system 110, that is usable with system 10 or otherwise, is illustrated. System 110 is configured to engage and latch the sleeve 32 that includes a profile 114 in order to move that sleeve 32 from an unactuated position to an actuated position and back to an unactuated position. As disclosed herein, the system 110 is configured to take this action with only a straight push and straight pull action, thus simplifying the process while also being reliable. The system 110 comprises a plurality of rocker latches 120 that are distributed about a rocker support 122. The number of rocker latches 120 could be one but one would introduce side loads that would be less desirable and accordingly the system 110 uses a plurality of rocker latches in even or odd number. Each of the rocker latches 120 include an insertion face 124 having an angle that helps the rocker latches 120 deflect radially inwardly when contacting a reception face 126 of the profile 114. After the insertion face 124 passes the reception face 126, a seal face 123 comes into contact with the reception face 126. In embodiments, seal face 123 and reception face 126 have differing angles from each other relative to a reference such as a longitudinal axis of the system 10. The difference in angle helps to create a seal between the faces as the system 10 is manipulated. Further, in embodiments, it is contemplated to add a seal material to face 123, face 126 or both. The seal material may be a softer material such as rubber, composite, or soft metal, for example, and serves the same purpose to enhance a seal between the faces during manipulation of the system 10. For clarity, the optional seal material is illustrated with numerals 125 (at face 123) and 127 (at face 126) in Figure 6. Each rocker latch also has

in an embodiment, a rocker recess 128 having a geometry that contributes to ease of radially inward deflection of the rocker latches 120. In an embodiment, the recess has a curved geometry 130 at one end interacting with a rocker pivot 132 of the support 122. It will be appreciated that the rocker pivot 132 may include a curved end 134 that interacts with the curved geometry 130 when the rocker latch 120 is deflected radially inwardly. Urging the insertion face 124 of the rocker latches 120 in the radially outward direction is a resilient retainer 136 that may in some embodiments comprise a snap ring or similar. The retainer 136 will help the rocker latches 120 engage a catch 138 of the latches 120 with a hold face 140 of profile 114. In order to prevent disengagement of the catch 138 and hold face 140 at an inappropriate time, a dog 142 is positioned to interfere with a back end 144 of each latch 120. Specifically, when the dog reaches a seal bore 146 of the sleeve 32, the dog is pushed radially inwardly and not permitted to move radially outwardly while resident in the seal bore 146. While dog 142 cannot move radially outwardly, the rocker latches 120 cannot rock about the rocker pivot 132 to allow the insertion face 124 to move radially inwardly. Accordingly, while the system 110 including the dog 142 is in the seal bore 146, the latches 120 remain engaged and locked with the profile 114. Movement of a string 148 upon which the system 10 is mounted will thus move the sleeve 32 with a simple push or pull movement of the string.

[0021] With these components introduced reference is made to Figures 6-10 sequentially since they show the system 110 moving into and out of engagement with the sleeve 32 of wet connect system 10. Figure 6 shows the system 110 having reached the profile 114 after being run in the hole. Figure 7 illustrates what happens in the system 110 with continued downhole movement of the system 110 relative to the sleeve 32. It will be appreciated from Figure 7 that the latches 120 are deflected inwardly so that the catch 138 of each latch 120, which includes the insertion face 124, can reposition to move past the reception face 126 and lockingly engage profile 114. Note that it is possible for the latches 120 to move in this way at this stage illustrated in Figure 7 because the dogs 142 are not yet within the seal bore 146 and hence can be pushed radially outwardly by the back end 144 of latches 120. Moving to Figure 8, such movement of the latches 120 is no longer possible since the dogs 142 are now in the seal bore 146 and cannot move radially outwardly. In this condition the system 110 is firmly connected to sleeve 32 and sleeve 32 will move either downhole or uphole based simply upon a push or a pull, respectively, on the string 148. The sleeve 32 may have many different actuation operations associated with it to operate many kinds of tools that need the sleeve to be repositioned. One specific example is a wet connect

since the sleeve 32 may be employed to cover or uncover hydraulic ports 156 that are used to flush a connection area clean of debris and are to be protected when not in use. In the Figure 9 view, the wet connect hydraulic ports 156 are closed. The sleeve 32 has been moved uphole by a pull on the string 148 and catch 138 interacting with hold face 140 transfers that pull to the sleeve 32. Also, to be appreciated in Figure 9 is that dogs 142 are no longer in the seal bore 146 and accordingly can now move radially outwardly. With this mobility, rocker latches 120 back ends 144 may also move radially outwardly as a consequence of the catch 138 moving radially inwardly to clear the profile 114. This action is in progress in the Figure 9 view, which also shows the ports 156 closed off by seal 157.

[0022] Referring to Figure 10, a particular embodiment where a wet connect is the tool 10 being actuated, the hydraulic ports 156 are seen open in Figure 10 allowing fluid communication into counter ports 158 between seals 160 and 162.

[0023] Referring to Figure 11, a borehole system 170 is illustrated. The system 170 comprises a borehole 172 in a subsurface formation 174. A string 176 is disposed within the borehole 172. A latch system 110 is disposed within or as a part of the string 176.

[0024] Set forth below are some embodiments of the foregoing disclosure:

[0025] Embodiment 1: A method for operating a sleeve including running a latch system into contact with the sleeve, latching the latch system to the sleeve, shifting the sleeve from a first position to a second position with the latch system moving in the same direction that the latch system moved during latching.

[0026] Embodiment 2: The method as in any previous embodiment wherein the latch system moves only along a longitudinal axis thereof in a straight push/straight pull manner.

[0027] Embodiment 3: The method as in any previous embodiment wherein the shifting to the second position uncovers hydraulic ports of a wet connect.

[0028] Embodiment 4: The method as in any previous embodiment wherein within the latching system a plurality of rocker latches rock to a radially inward position upon contact with a reception face of a profile of the sleeve and radially outwardly after passing the reception face.

[0029] Embodiment 5: The method as in any previous embodiment further including trapping dogs against the plurality of rocker latches thereby preventing disengagement of the plurality of rocker latches from the sleeve.

[0030] Embodiment 6: The method as in any previous embodiment further including shifting the sleeve to the first position from the second position by moving the latch system in a direction opposite the movement direction during latching.

[0031] Embodiment 7: The method as in any previous embodiment wherein the shifting the sleeve to the first position covers hydraulic ports.

[0032] The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) are to
5 be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. Further, it should be noted that the terms “first,” “second,” and the like herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another. The terms “about”, “substantially” and “generally” are intended to include the degree of error associated with measurement of the particular
10 quantity based upon the equipment available at the time of filing the application. For example, “about” and/or “substantially” and/or “generally” can include a range of $\pm 8\%$ or 5%, or 2% of a given value.

[0033] The teachings of the present disclosure may be used in a variety of well operations. These operations may involve using one or more treatment agents to treat a
15 formation, the fluids resident in a formation, a borehole, and / or equipment in the borehole, such as production tubing. The treatment agents may be in the form of liquids, gases, solids, semi-solids, and mixtures thereof. Illustrative treatment agents include, but are not limited to, fracturing fluids, acids, steam, water, brine, anti-corrosion agents, cement, permeability modifiers, drilling muds, emulsifiers, demulsifiers, tracers, flow improvers etc. Illustrative
20 well operations include, but are not limited to, hydraulic fracturing, stimulation, tracer injection, cleaning, acidizing, steam injection, water flooding, cementing, etc.

[0034] While the invention has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without
25 departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the
30 claims. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they are unless otherwise stated used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention therefore not being so limited.

What is claimed is:

1. A method for operating a sleeve (32) characterized by:
running a latch system (110) into contact with the sleeve (32);
latching the latch system (110) to the sleeve (32);
5 shifting the sleeve (32) from a first position to a second position with the latch system (110) moving in the same direction that the latch system (110) moved during latching.
2. The method as claimed in claim 1 wherein the latch system (110) moves only along a longitudinal axis thereof in a straight push/straight pull manner.
3. The method as claimed in claim 1 wherein the shifting to the second position
10 uncovers hydraulic ports (156) of a wet connect (10).
4. The method as claimed in claim 1 wherein within the latching system (110) a plurality of rocker latches (120) rock to a radially inward position upon contact with a reception face (126) of a profile of the sleeve (32) and radially outwardly after passing the reception face (126).
- 15 5. The method as claimed in claim 4 further including trapping dogs (142) against the plurality of rocker latches (120) thereby preventing disengagement of the plurality of rocker latches (120) from the sleeve (32).
6. The method as claimed in claim 1 further including shifting the sleeve (32) to the first position from the second position by moving the latch system (110) in a direction
20 opposite the movement direction during latching.
7. The method as claimed in claim 6 wherein the shifting the sleeve (32) to the first position covers hydraulic ports (156).

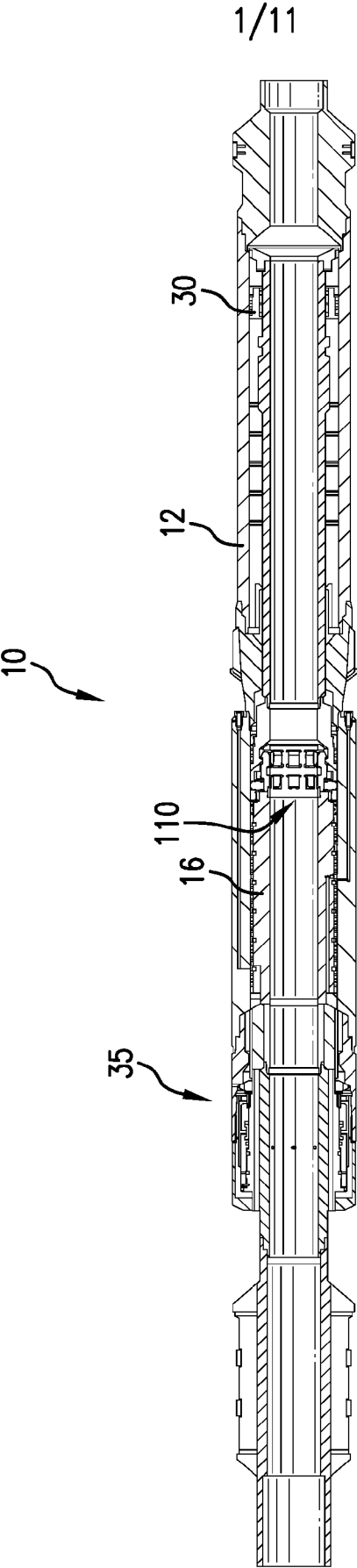


FIG. 1

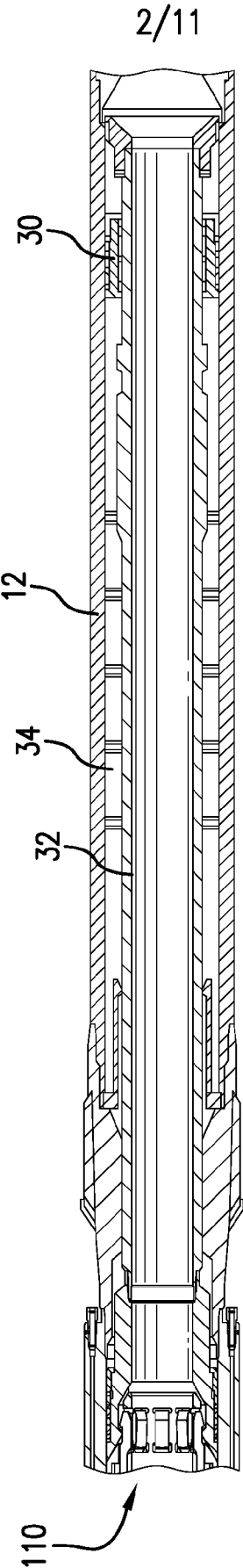


FIG. 2

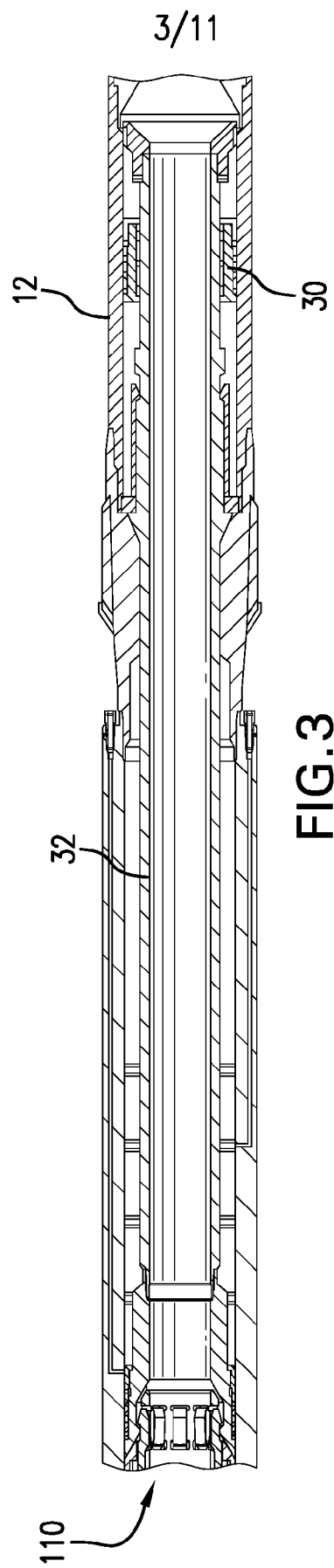


FIG. 3

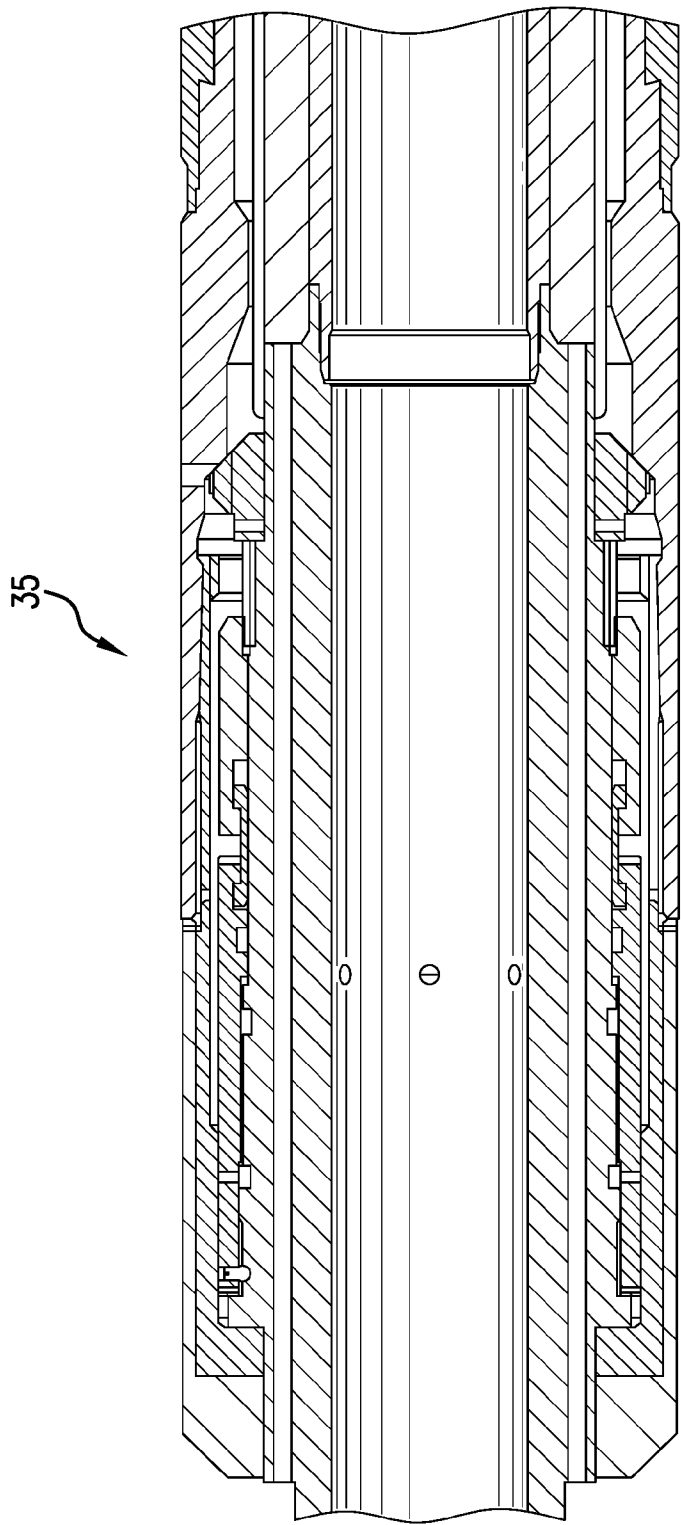


FIG.4

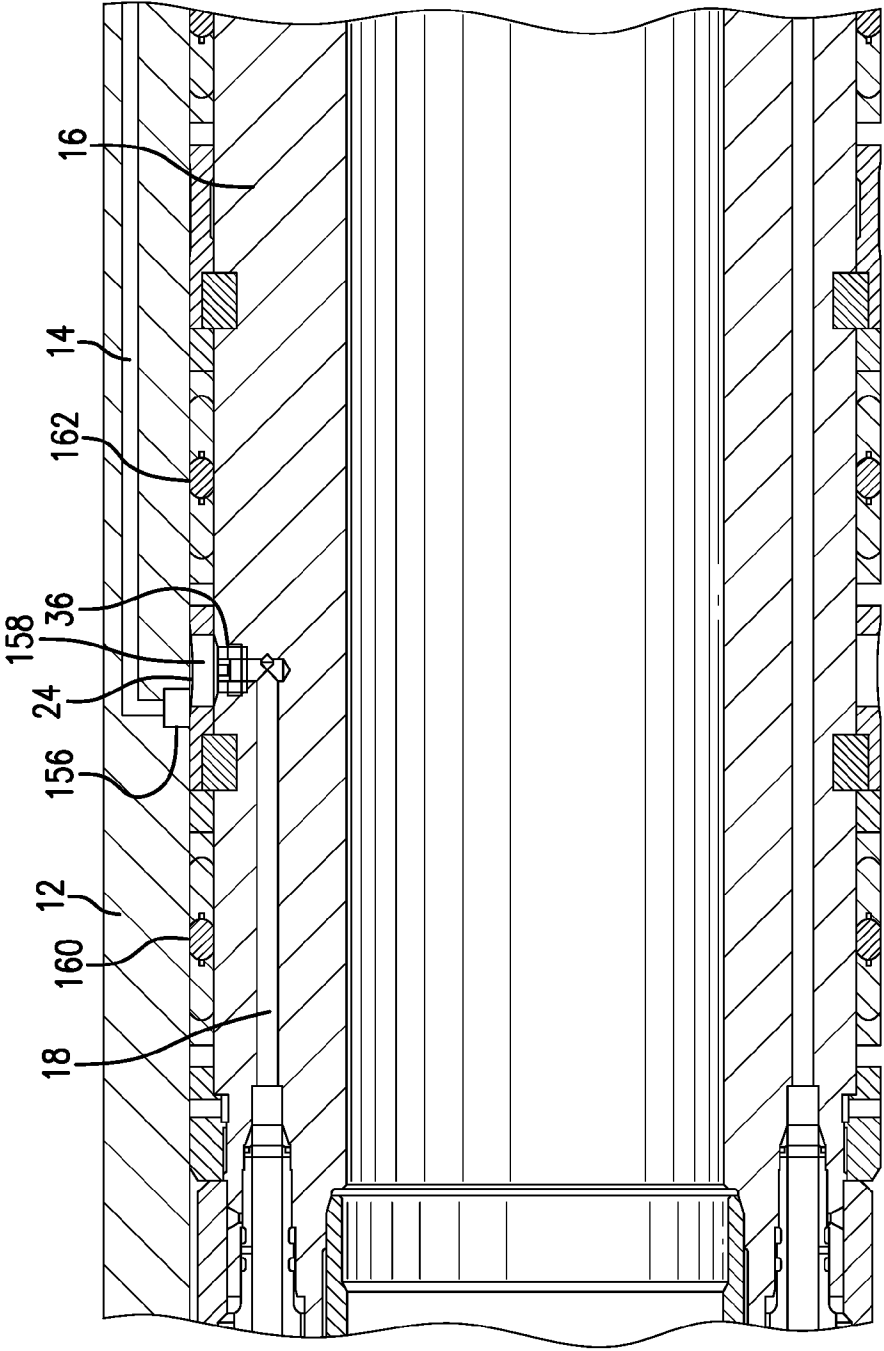


FIG.5

6/11

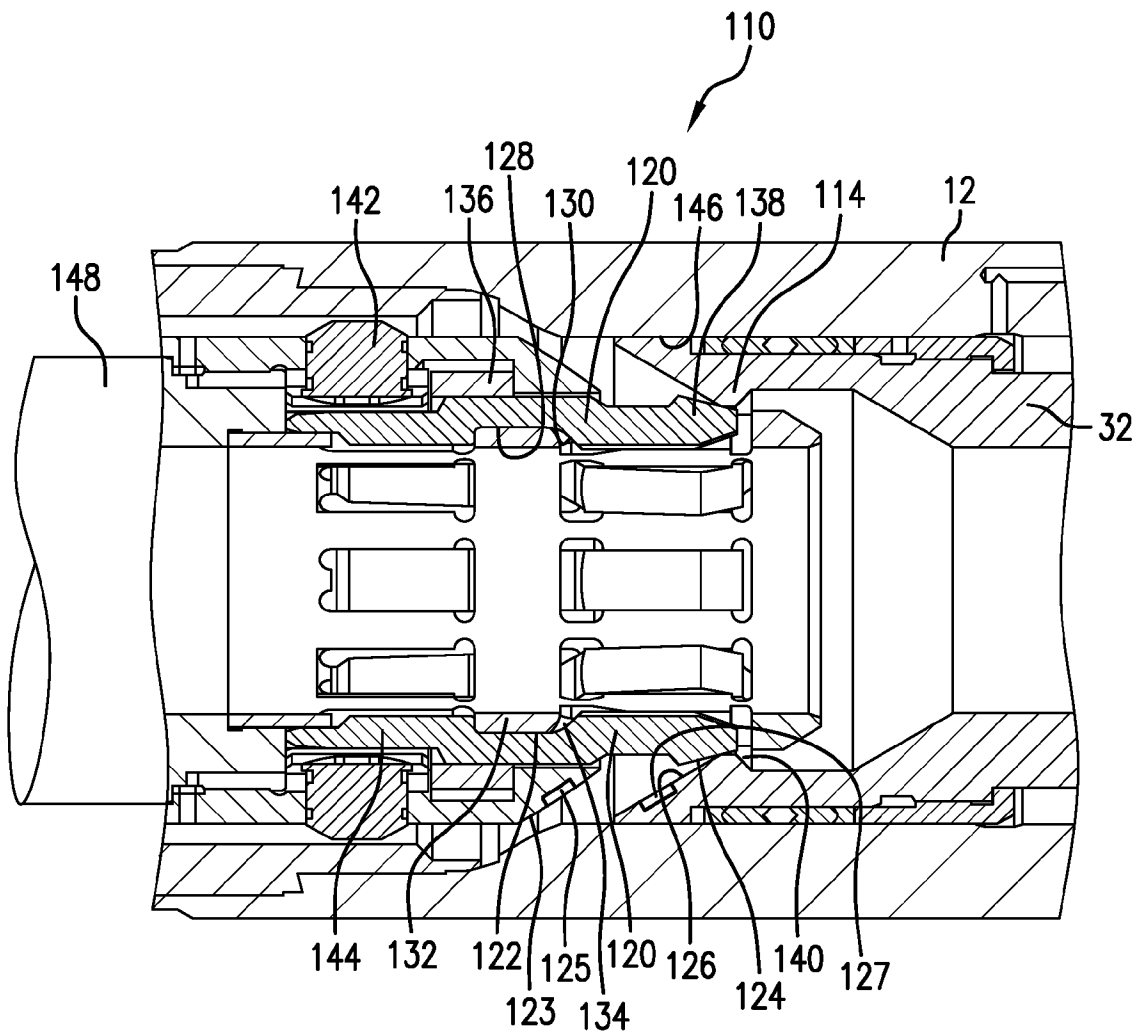


FIG.6

7/11

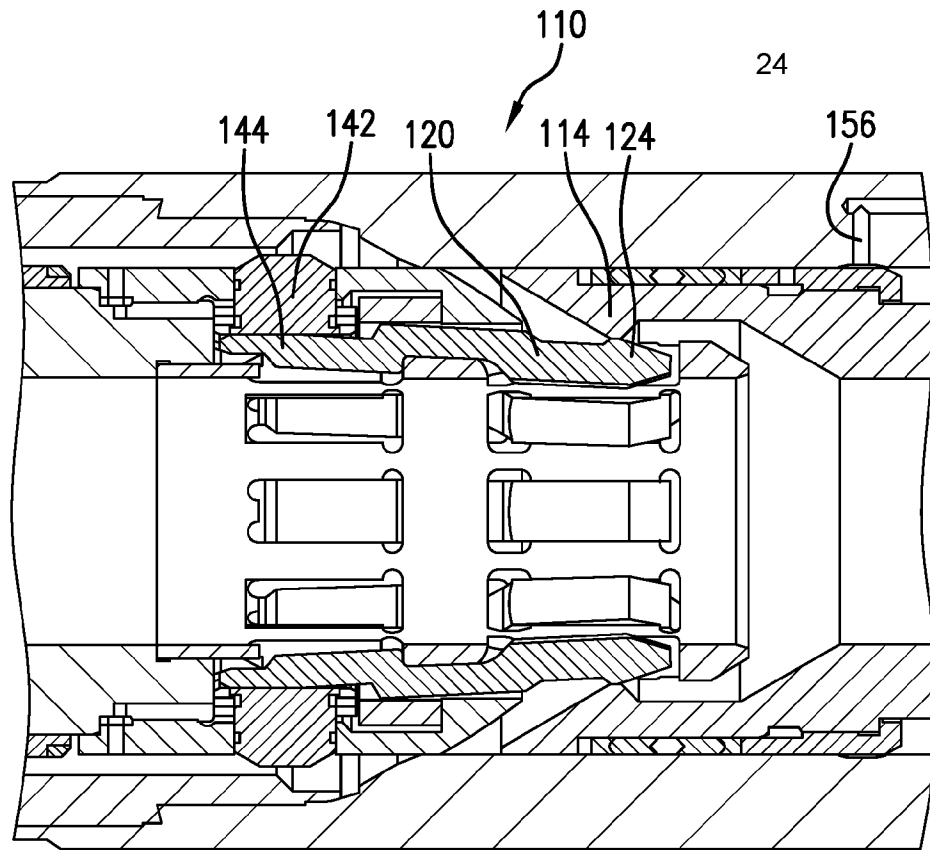


FIG. 7

8/11

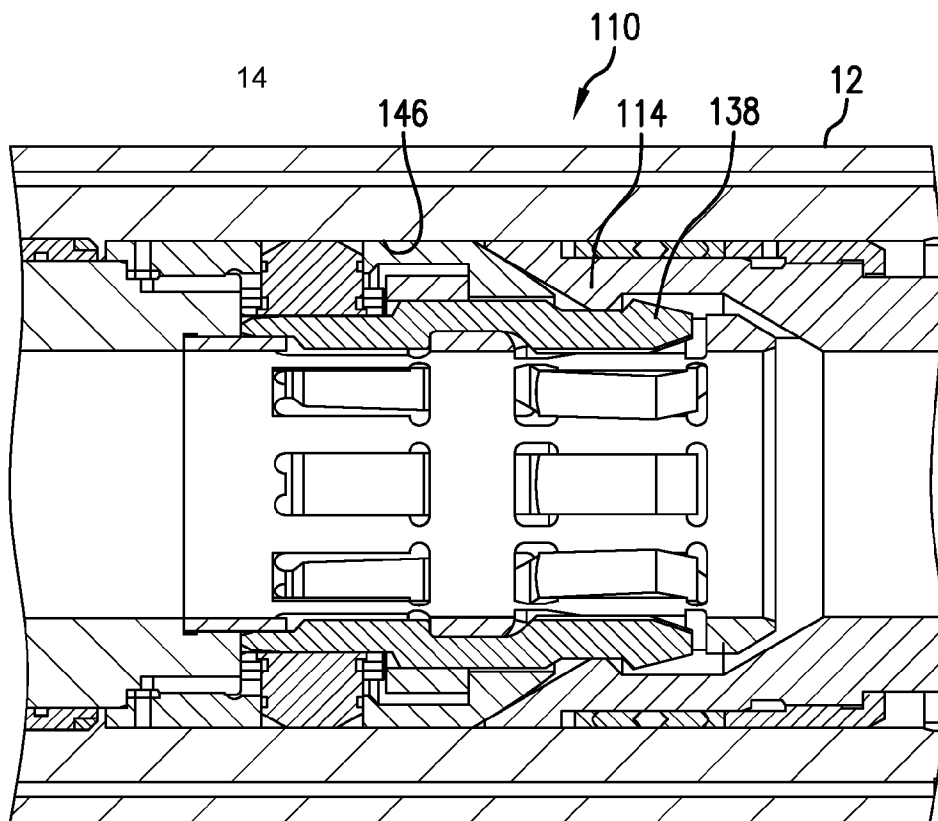


FIG.8

9/11

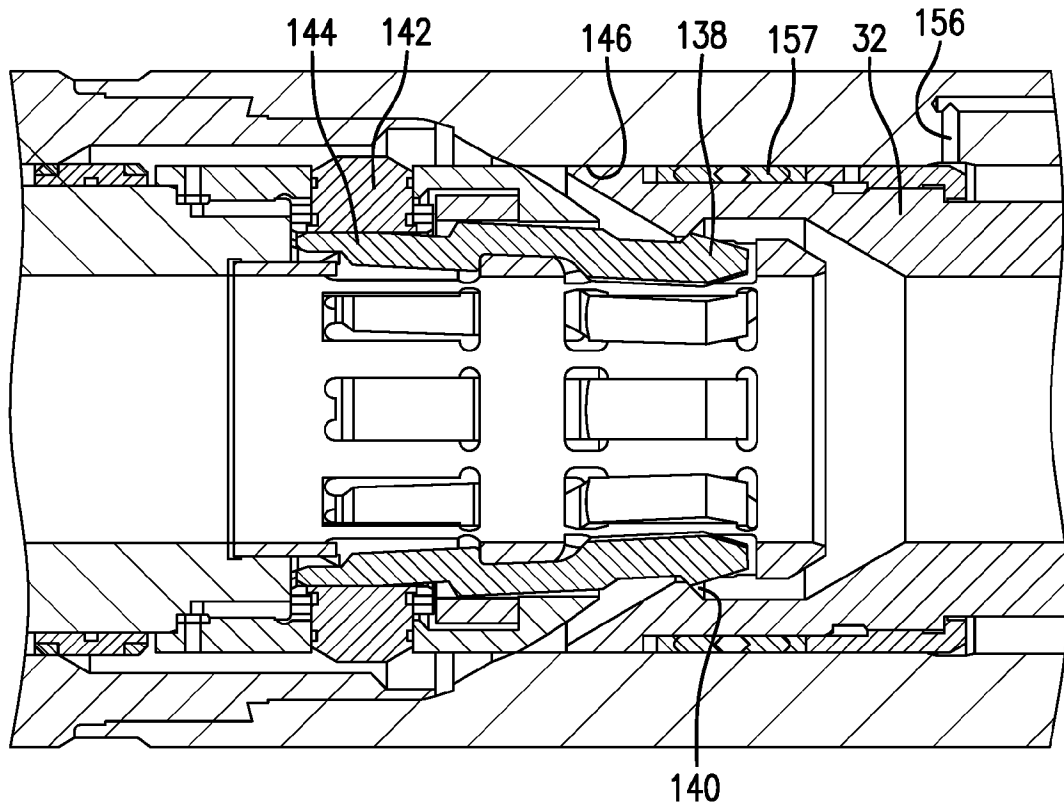
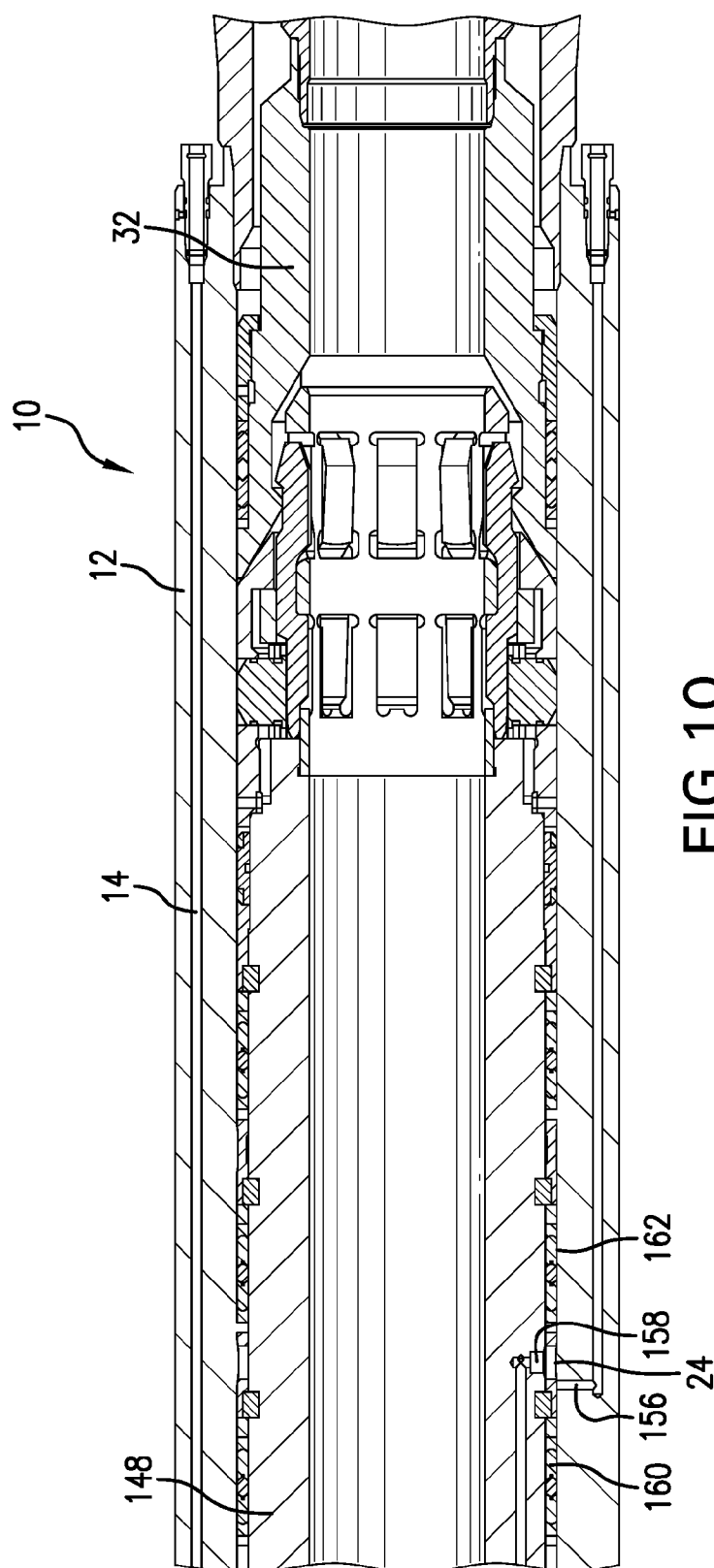


FIG.9

10/11



11/11

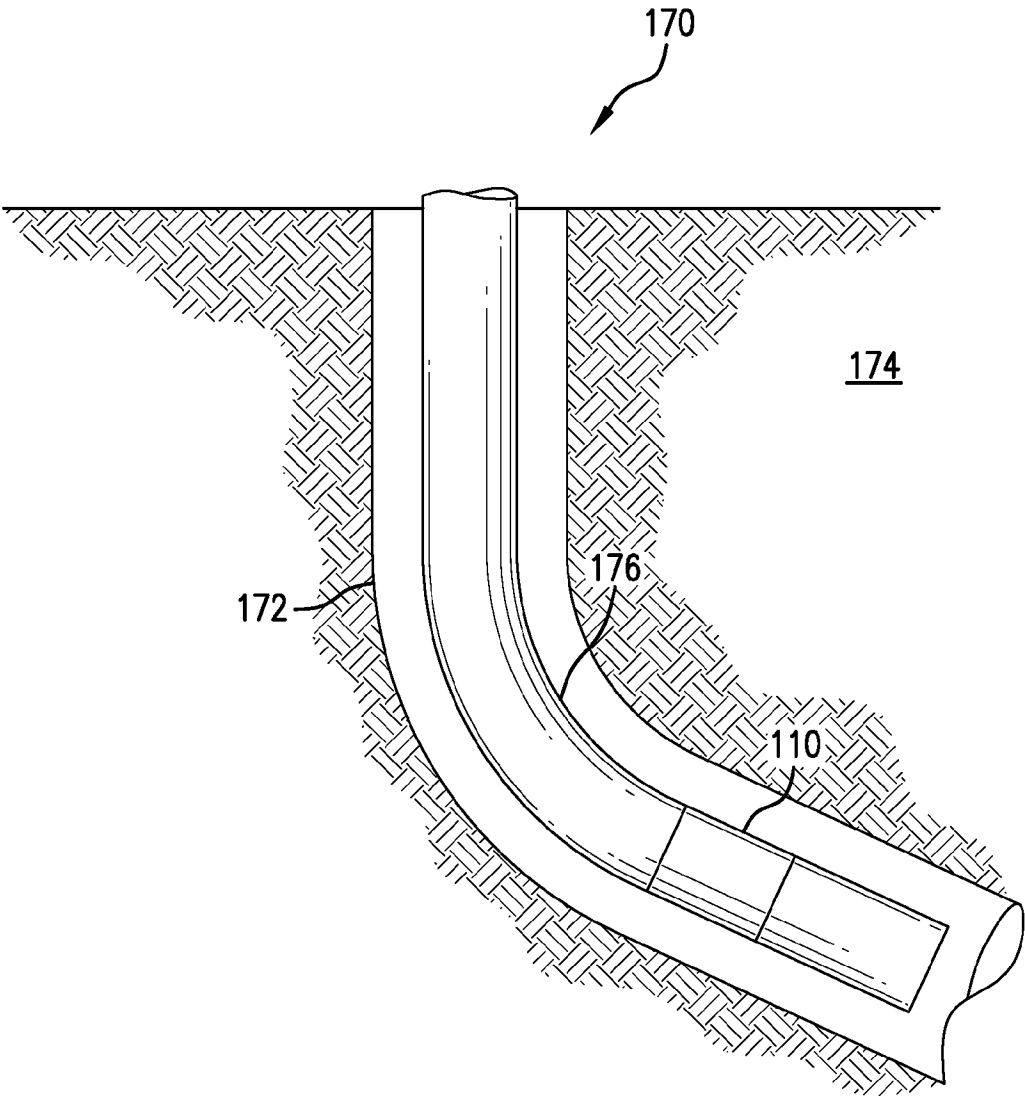


FIG.11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2023/017289

A. CLASSIFICATION OF SUBJECT MATTER**E21B 34/10(2006.01)i; E21B 34/14(2006.01)i**

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 34/10(2006.01); E21B 33/14(2006.01); E21B 34/12(2006.01); E21B 44/00(2006.01)

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: sleeve, latch system, shift, hydraulic port, wet connect

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013-0075109 A1 (FRISBY et al.) 28 March 2013 (2013-03-28) paragraphs [0035]-[0039] and figures 1-6	1-4,6-7
Y		5
Y	US 6098710 A (RHEIN-KNUDSEN et al.) 08 August 2000 (2000-08-08) column 7, line 56 - column 8, line 31 and figures 6-7	5
A	WO 2004-044379 A2 (BAKER HUGHES INCORPORATED) 27 May 2004 (2004-05-27) figures 1A-1B	1-7
A	US 2005-0095156 A1 (WOLTERS et al.) 05 May 2005 (2005-05-05) figures 1-3	1-7
A	US 2003-0211768 A1 (CAMERON et al.) 13 November 2003 (2003-11-13) paragraphs [0034]-[0039] and figures 4A-5B	1-7



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

“D” document cited by the applicant in the international application

“E” earlier application or patent 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

11 July 2023

Date of mailing of the international search report

12 July 2023

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon
35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

PARK, Tae Wook

Telephone No. +82-42-481-3405

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/US2023/017289

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2013-0075109	A1	28 March 2013	GB	2500094	A	11 September 2013
				GB	2500094	B	08 October 2014
				US	2012-0152569	A1	21 June 2012
				US	2013-0233563	A1	12 September 2013
				US	8550172	B2	08 October 2013
				US	9051811	B2	09 June 2015
				WO	2012-082469	A2	21 June 2012
				WO	2012-082469	A3	27 September 2012
US	6098710	A	08 August 2000	EP	0913554	A2	06 May 1999
				EP	0913554	A3	15 March 2000
				EP	0913554	B1	08 June 2005
				US	6267181	B1	31 July 2001
WO	2004-044379	A2	27 May 2004	AU	2003-290681	A1	03 June 2004
				AU	2003-290681	B2	27 August 2009
				AU	2009-222615	A1	29 October 2009
				AU	2009-222615	B2	07 April 2011
				CA	2504721	A1	27 May 2004
				CA	2504721	C	05 October 2010
				CN	101089358	A	19 December 2007
				CN	101089358	B	05 October 2011
				CN	1711405	A	21 December 2005
				CN	1711405	B	26 May 2010
				GB	2410763	A	10 August 2005
				GB	2410763	B	30 May 2007
				GB	2433526	A	27 June 2007
				GB	2433526	B	15 August 2007
				NO	20052147	L	10 June 2005
				NO	340813	B1	19 June 2017
				RU	2005118402	A	20 February 2006
				RU	2351758	C2	10 April 2009
				US	2004-0159444	A1	19 August 2004
				US	7487830	B2	10 February 2009
				WO	2004-044379	A3	15 July 2004
US	2005-0095156	A1	05 May 2005	US	7219743	B2	22 May 2007
				WO	2005-024176	A1	17 March 2005
US	2003-0211768	A1	13 November 2003	AU	2004-235616	B2	18 September 2008
				AU	7140200	A	10 May 2001
				AU	779822	B2	10 February 2005
				CA	2325164	A1	05 May 2001
				CA	2358288	A1	10 May 2001
				CA	2358288	C	28 June 2005
				GB	2360881	A	03 October 2001
				GB	2360881	B	17 March 2004
				GB	2394127	A	14 April 2004
				GB	2394127	B	19 May 2004
				NO	325395	B1	21 April 2008
				NO	335867	B1	09 March 2015
				US	6776636	B1	17 August 2004
				WO	01-33032	A1	10 May 2001

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2023/017289

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		WO 01-33032 A9	10 May 2002