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(54) Title: METHODS AND SYSTEMS FOR DEPLOYING CABLE INTO A WELL

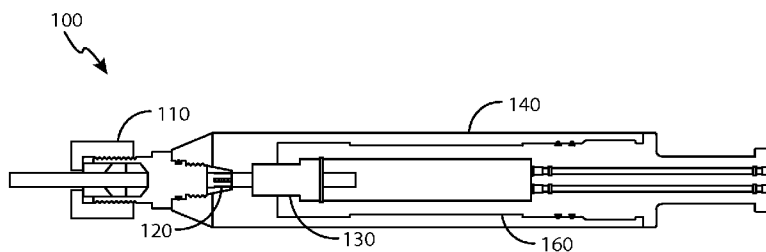


FIG. 1

(57) Abstract: An apparatus or system comprising, or a method utilizing, a pressure-tight head assembly coupling a multi-conductor wireline cable operable for downhole operations within a borehole extending into a subterranean formation. The head assembly comprises: an upper head attachment; a lower head attachment; an upper compression seal assembly; a gripper cone; and a rope socket. The upper compression seal assembly is threaded into and/or otherwise coupled to the upper head attachment in a manner causing the gripper cone to tighten onto the cable jacket.

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METHODS AND SYSTEMS FOR DEPLOYING CABLE INTO A WELL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to US Patent Application 61/817789, filed April 30, 2013 and entitled "Sealing Wireline Cable Termination", which is incorporated herein in its entirety.

BACKGROUND

[0002] Existing wireline cables are often terminated in a rope socket inside the tool head of the downhole tool assembly. The layers of strength members in the rope socket may be wedged into place via a series of concentric cones. The cable core passes through the center of the rope socket, and the conductor wires are separated out and connected to conductor wires inside the downhole tool. Insufficient sealing may allow pressurized well fluids and gases to come into contact with the ends of the armor wires and the wiring connections. Such pressurized fluids may travel up the cable along conductors and strength members, perhaps causing damage as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. 1 depicts an example head assembly.

[0004] FIG. 2 depicts an example lower head attachment.

[0005] FIG. 3 depicts an example feed-through tube assembly.

[0006] FIG. 4 depicts an example of an upper head attachment.

[0007] FIG. 5A depicts an example upper compression seal assembly.

[0008] FIG. 5B depicts the example upper compression seal assembly in a pre-assembled configuration.

[0009] FIG. 6 depicts an example gripper cone.

[0010] FIG. 7 depicts an example upper head attachment.

[0011] FIG. 8 depicts an example head assembly.

[0012] FIG. 9 depicts an exploded view of the head assembly of FIG. 8.

[0013] FIG. 10 depicts a pressure seal.

[0014] FIG. 11 depicts an example head assembly.

[0015] FIG. 12 depicts an exploded view of the head assembly of FIG. 11.

[0016] FIG. 13 depicts an example implementation utilizing a cable with a sealing termination during tractoring.

[0017] FIG. 14 depicts an example implementation utilizing a cable with a sealing termination.

[0018] FIG. 15 depicts an implementation for subsea intervention.

[0019] FIG. 16 depicts an example implementation utilizing a cable with a sealing termination.

DETAILED DESCRIPTION OF THE INVENTION

[0020] Certain examples are shown in the above-identified figures and described in detail below. In describing these examples, like or identical reference numbers are used to identify common or similar elements. The figures are not necessarily to scale and certain features and certain views of the figures may be shown exaggerated in scale or in schematic for clarity and/or conciseness.

[0021] FIG. 1 depicts an example head assembly. The head assembly 100 includes an upper head attachment 140. A lower head attachment 160 is located within the upper head attachment 140. A rope socket 130 is located in the lower head attachment 130. A gripper cone is connected with the upper head attachment 140, and an upper compression seal assembly 110 is connected with the gripper cone 120.

[0022] FIG. 2 depicts an example lower head attachment. FIG. 3 depicts an example feed-through tube assembly. Referring to FIGS. 2 and 3, the lower head attachment 160 has seals 240 located thereabout. The lower head

attachment 140 also has feed-through tubes 230 located therein. The feed-through tubes 230 can be operatively aligned with a breakout chamber 220. A slot 210 for operatively receiving a retaining feature, such as a clip, is formed in the lower head attachment 160, and a rope socket is adjacent the slot 210.

[0023] FIG. 4 depicts an example of an upper head attachment. The upper head attachment 140 is configured to receive at least a portion of the lower head attachment. The upper head attachment can be threaded, fastened, or otherwise connected with the lower head attachment.

[0024] FIG. 5A depicts an example upper compression seal assembly. FIG. 5B depicts the example upper compression seal assembly in a pre-assembled configuration. The upper compression seal assembly 110 includes a first member 510. The first member 510 can be connected with the upper head attachment. The first member 510 can thread or otherwise be fastened to the upper head attachment. The first member 510 can have an internal shape configured to receive compression members 520. The second member 530 can also have an internal shape to receive the compression members 520.

[0025] The compression nut 540 can be connected with the first member 510. The compression nut 540 can compress the compression members 520 as it is tightened onto the first member 510.

[0026] FIG. 6 depicts an example gripper cone. The gripper cone 610 can have a base and a tapered end 620. The tapered end 620 can have slit to allow the gripper cone to close onto a cable as the gripper cone is tightened into place. The gripper cone has small angled teeth to hold a cable in place.

[0027] FIG. 7 depicts an example upper head attachment. The upper head attachment 140 can have an area 720 to attach with the gripper cone and area 710 to attach with the upper compression seal assembly.

[0028] FIG. 8 depicts an example head assembly. FIG. 9 depicts an exploded view of the head assembly of FIG. 8. Referring to FIGS. 8 and 9, the head assembly 800 includes a fishing neck 810, an upper packoff bushing 840, a compression tool 810, a lower packoff bushing 810, the rope socket 130, the breakout chamber 220, a piston 820, and a fill port 830. The breakout chamber 220 can be filled with filler material. The filler material can be oil,

liquid, grease, or fluid. The filler material can be supplied to the breakout chamber using the fill port 830.

[0029] The filler material may expand when in the presence of elevated downhole temperatures. The resulting pressure of the expanding filler material trapped inside the breakout chamber 220 may damage the conductors and/or other components of a cable. The piston 820 can be used to compensate for the expanding pressure.

[0030] For example, the cable may be terminated to the rope socket 130 and wiring may be completed in the breakout chamber. The compression tool 820 located between upper and lower packoff bushings 840 and 810 at the uphole end of the rope socket 130 may provide a high-pressure seal at the uphole end of the breakout chamber 220. After the head assembly is assembled, the breakout chamber 220 is filled with the filler material (e.g., oil, grease, and/or any other materials) via the fill port 830. The fill port may then be sealed with a plug and/or other means.

[0031] As the head assembly 800 is exposed to elevated downhole pressures, the expanding filler material in the breakout chamber 220 may push, force, and/or otherwise urge the piston 820 away from the breakout chamber 220. Such movement of the piston 820 may thus relieve the pressure building within the breakout chamber. As the temperature subsequently decreases, the borehole pressure may similarly urge the piston back toward the breakout chamber. The piston may, thus, also aid in preventing cross-contamination of borehole fluids into the breakout chamber, which may otherwise damage the conductors and/or other components therein. The lower head attachment may also comprise stops operable to limit travel of the piston.

[0032] FIG. 10 depicts a pressure seal. The pressure seal 910 can be a one way seal that allows flow in one way but prevents flow in a second direction. The pressure seal 910 can be located in a housing 930. Seals in the housing 930 or around the seal 910 can prevent movement of the seal 910. The housing 930 can have channels 940 in an uphole face.

[0033] FIG. 11 depicts an example head assembly. FIG. 12 depicts an exploded view of the head assembly of FIG. 11. The head assembly includes

the fishing neck 810, the upper packoff bushing 840, the housing 930 with the pressure seal 930, a lower packoff bushing 810, the rope socket 130, the breakout chamber 220, a fill port 830, and the lower head attachment 160.

[0034] The channels in the housing 930 can provide a flow path for fluid exiting the breakout chamber and the seal can allow fluid to flow out of the breakout chamber. The seal can prevent other fluid from entering the breakout chamber.

[0035] Referring now to FIG. 13, a cable having a sealing termination according to one or more aspects of the present disclosure is indicated generally at 1400. FIG. 13 depicts an example implementation utilizing a cable with a sealing termination during tractoring, in which a tractor 1402 is attached to the end of the cable 1400 when deployed in a wellbore or borehole 1404, which may have one or more vertical, horizontal, deviated, dog-legged, and/or multi-lateral wellbore sections.

[0036] Referring now to FIG. 14, a cable having a sealing termination according to one or more aspects of the present disclosure is indicated generally at 1500. Many offshore platforms utilize a means of supporting the wellhead equipment 1502 when performing a wireline operation without the use of the drilling derrick (not shown). A crane 1504 may be one manner of doing this. A mast unit or other temporary derrick (not shown) may also or alternatively be utilized. A standard wireline rig up offshore may utilize a crane 1504 or mobile mast unit (not shown) to support both the upper sheave wheel and the pressure equipment itself. A pack off assembly 1506 may utilize an upper sheave 1508 mounted to the well head equipment 1510 itself at the top of the lubricator 1512.

[0037] Referring now to FIG. 15, a cable having a sealing termination according to one or more aspects of the present disclosure is indicated generally at 1700. FIG. 19 depicts an implementation for subsea intervention. A lubricator system may be lowered onto the subsea well head 1702, using grease injection into flow tubes to establish a dynamic pressure seal (stuffing box 1710), with the cable returning through open water back to surface on the intervention vessel (not shown) or the rig/platform 1704. For shallow water

applications, the grease injection system, including the grease tank, can be installed on the vessel or rig/platform 1704, and pressurized grease can be conveyed to the grease head at the seabed 1706 through a control umbilical (not shown) or through a dedicated hose (not shown). For well intervention operations with a subsea lubricator in deep water, the injection system 1708 may be placed subsea.

[0038] Referring now to FIG. 16, a cable having a sealing termination according to one or more aspects of the present disclosure is indicated generally at 1800. The cable 1800 may be utilized in combination with a spoolable compliant guide system 1802. A pack-off type dynamic seal may be retrievable through the compliant guide 1802.

[0039] Other implementations within the scope of the present disclosure may logging with a cable having a sealed termination as described above while a fluid is injected in the well.

What is claimed is:

1. A head assembly for a cable, wherein the head assembly comprises:
 - an upper head attachment;
 - a lower head attachment;
 - an upper compression seal assembly;
 - a gripper cone; and
 - a rope socket.
2. The head assembly of claim 1, wherein the upper compression seal is configured to connect with the upper head attachment and cause the gripper cone to tighten onto the cable.
3. The head assembly of claim 1, wherein the lower head attachment is connected with the upper head attachment.
4. The head assembly of claim 1, wherein the rope socket is located in the lower head attachment.
5. The head assembly of claim 1, wherein the lower head attachment has a retaining feature for securing the rope socket therein.
6. The head assembly of claim 1, further comprising a breakout chamber in the lower head attachment.
7. The head assembly of claim 6, further comprising a feed-through tube assembly operatively aligned with the breakout chamber.
8. The head assembly of claim 1, wherein the upper compression seal assembly comprises a pair of polymeric compression seal members.
9. A downhole system comprising:
 - a head assembly for a cable, wherein the head assembly comprises:

an upper head attachment;
a lower head attachment;
an upper compression seal assembly;
a gripper cone; and
a rope socket;
a cable connected with the rope socket;
a downhole tool connected with the head assembly, wherein the
cable is in electrical communication with the downhole tool.

10. The system of claim 9, further comprising a breakout chamber in the lower head attachment.

11. The system of claim 10, further comprising a feed-through tube assembly operatively aligned with the breakout chamber.

12. The system of claim 11, wherein the cable is connected with the feed-through tube assembly in the breakout chamber.

13. A method of connecting a cable with a tool, comprising:

terminating a cable with a rope socket, wherein the rope socket is located in a lower head attachment that is connected with an upper head attachment;

connecting at least a portion of the cable to a connecting wire of a tool in a breakout chamber formed in the lower head attachment;

placing the cable through a gripper cone, wherein the gripper cone is adjacent the upper head assembly;

placing the cable through an upper compression seal assembly; and

tightening the compression seal assembly to provide a pressure tight seal about the cable and tighten the gripper cone about the cable.

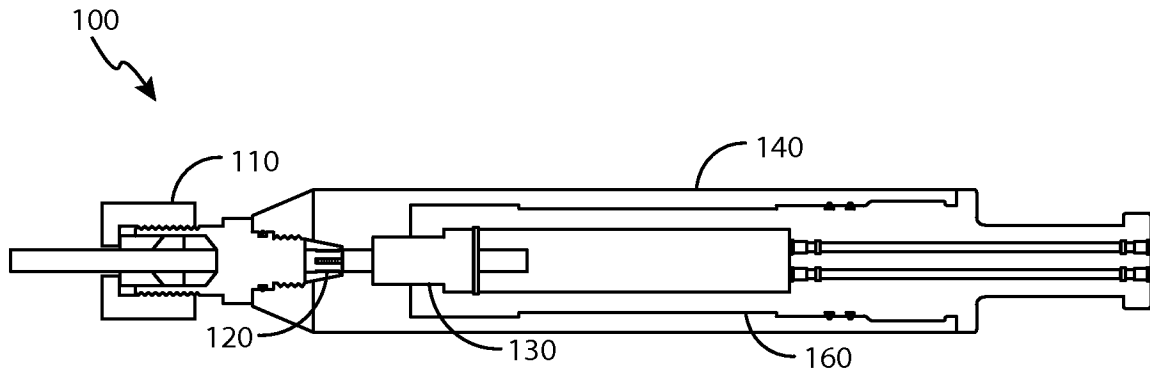


FIG. 1

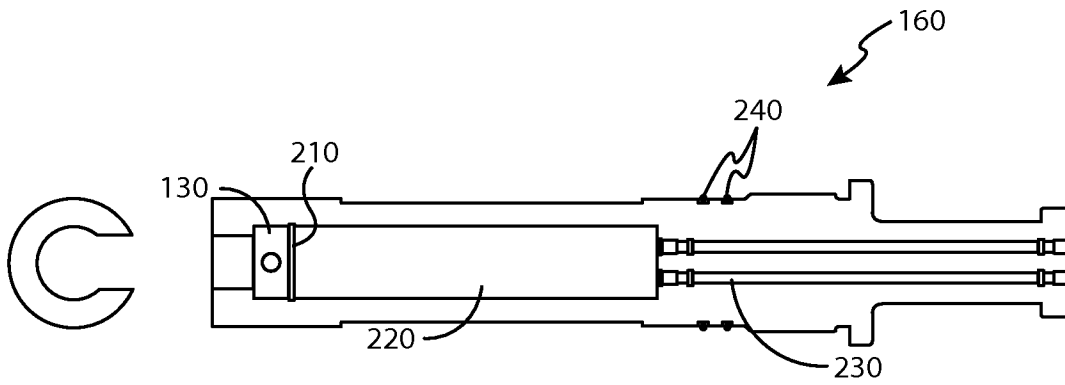


FIG. 2

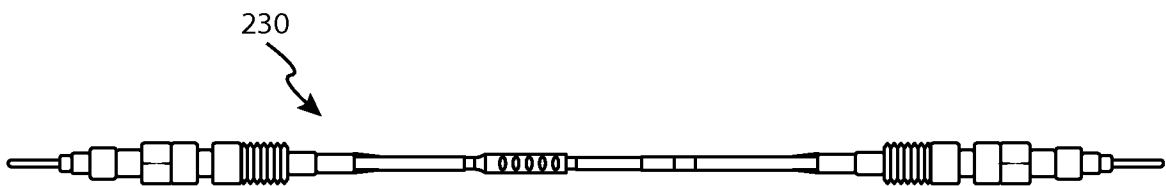
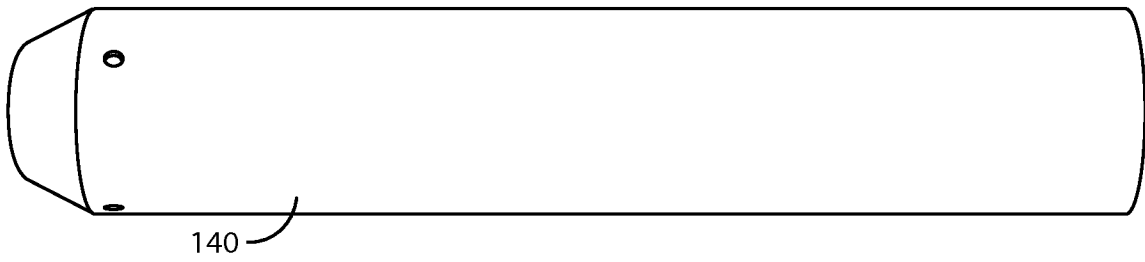


FIG. 3



110

FIG. 4

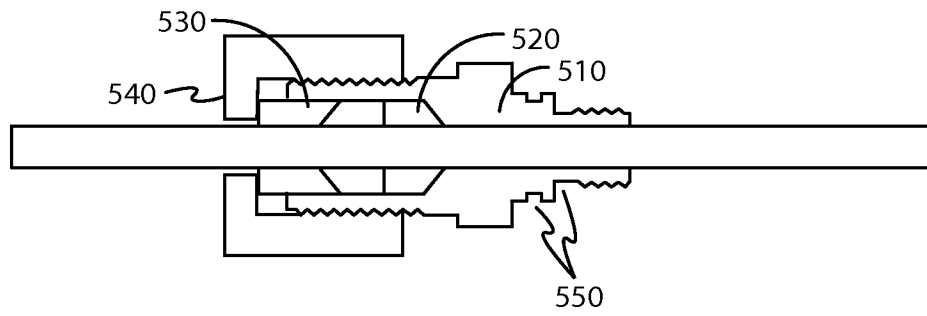


FIG. 5A

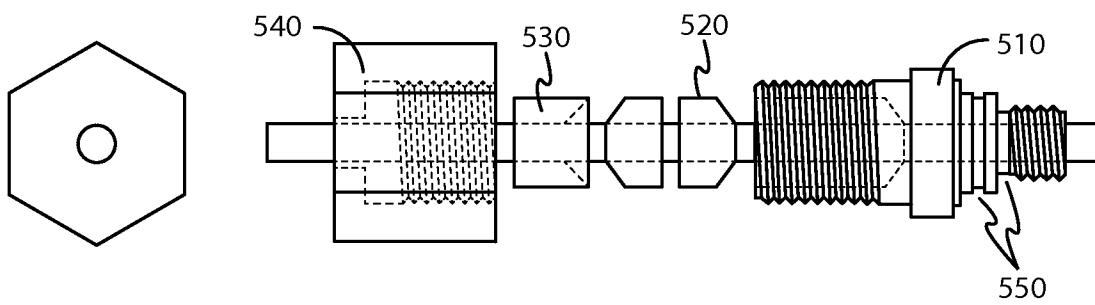


FIG. 5B

3/7

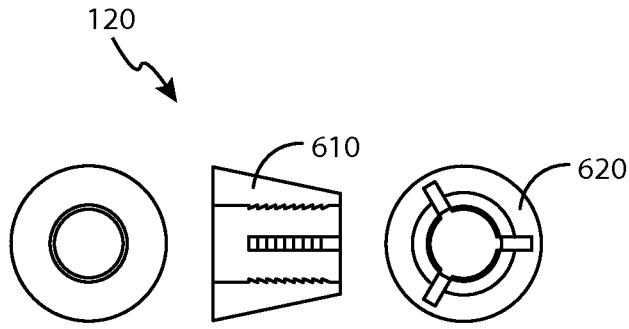


FIG. 6

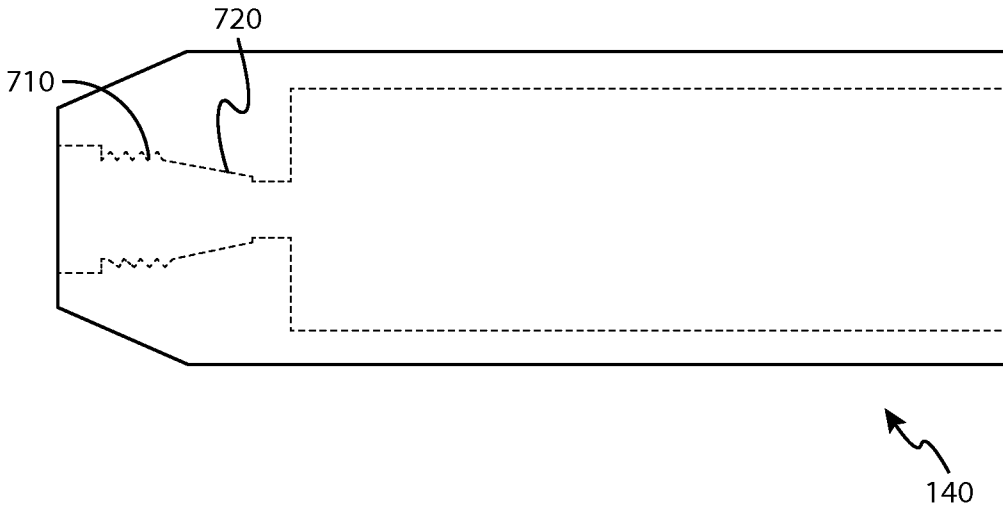


FIG. 7

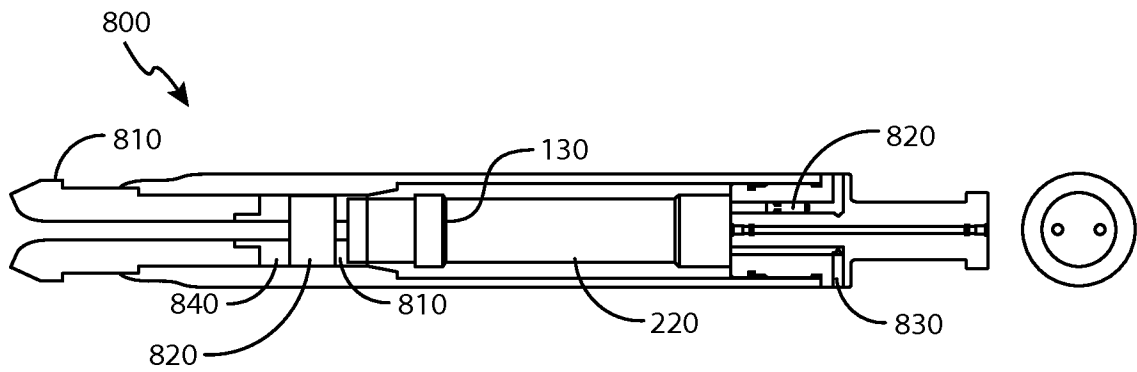


FIG. 8

4/7

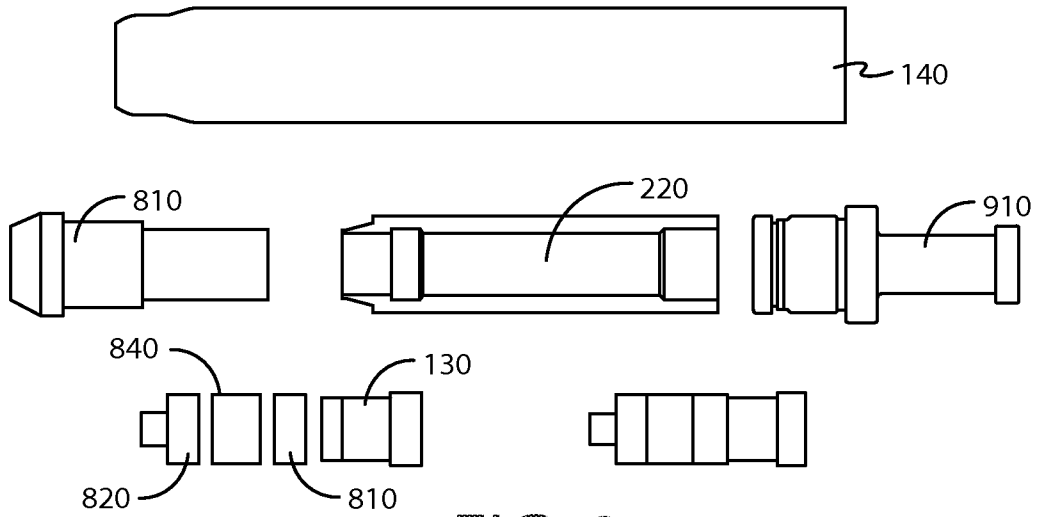


FIG. 9

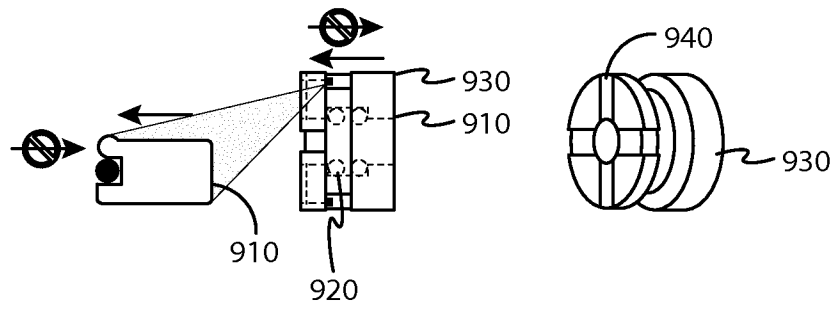


FIG. 10

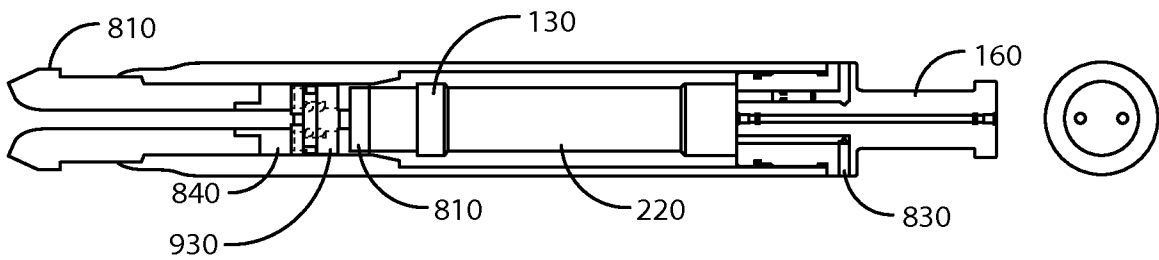


FIG. 11

5/7

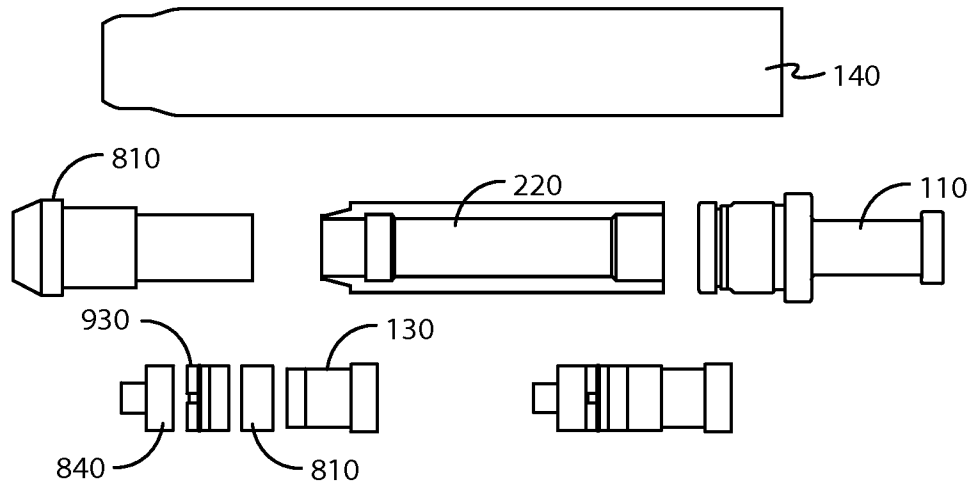


FIG. 12

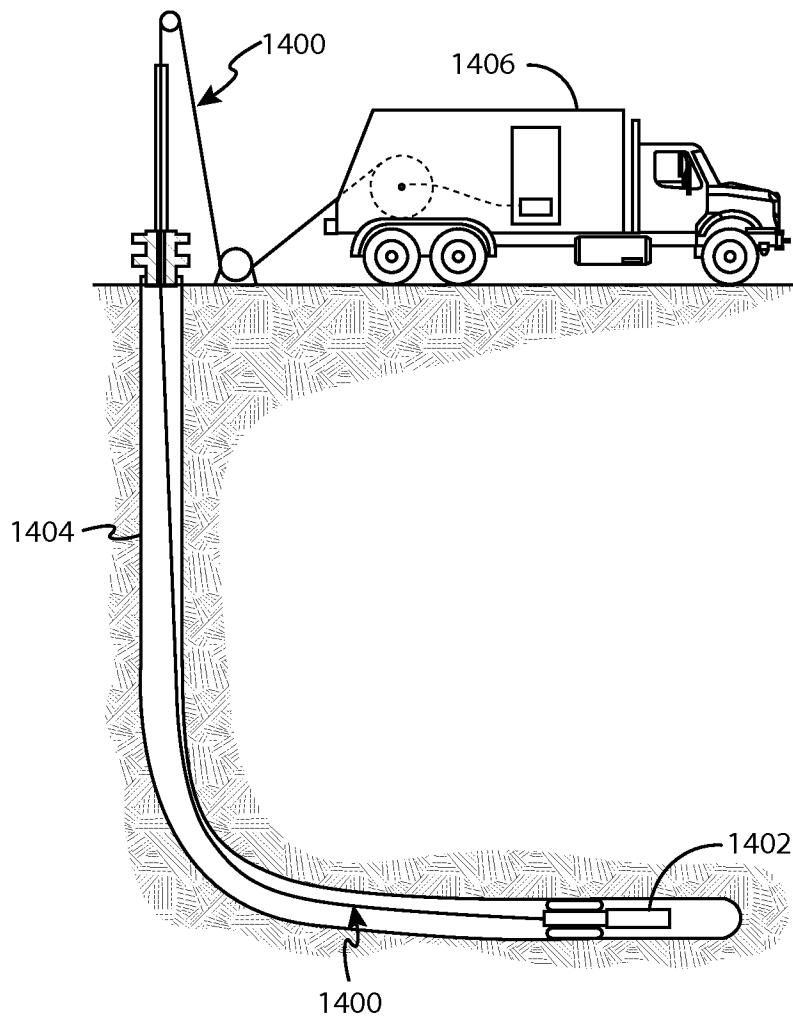


FIG. 13

6/7

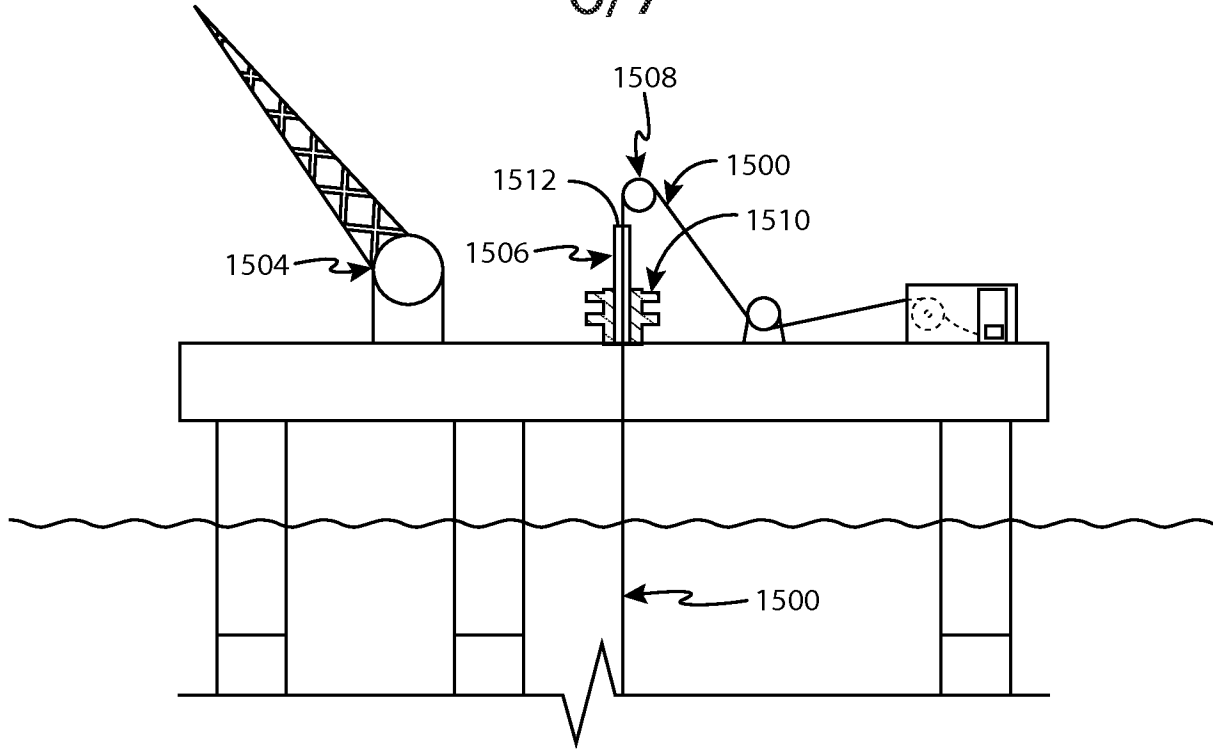


FIG. 14

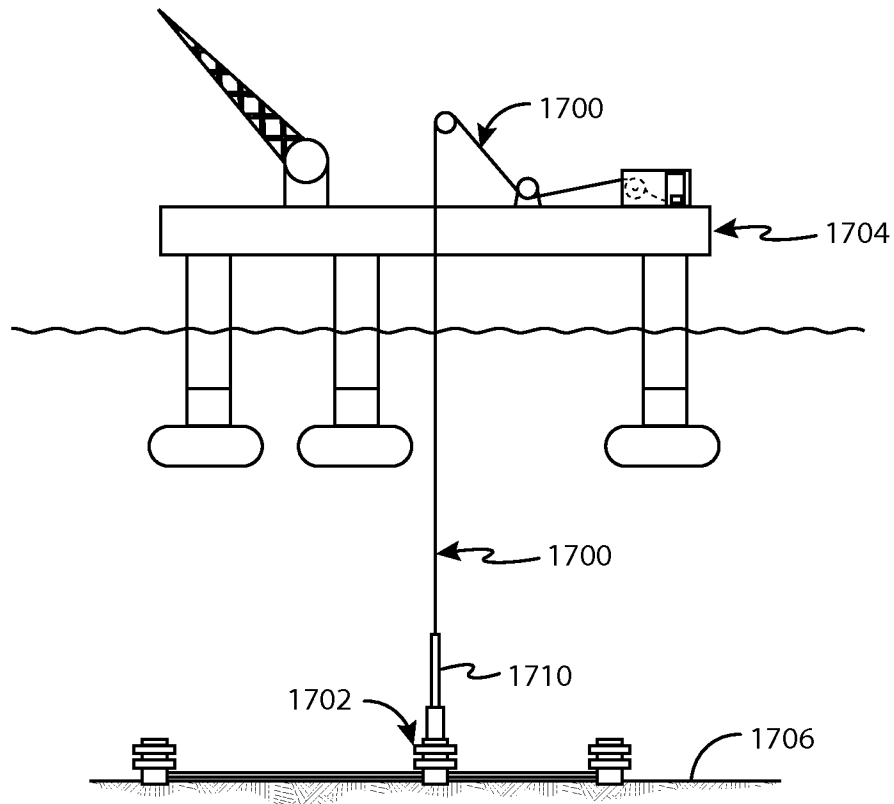


FIG. 15

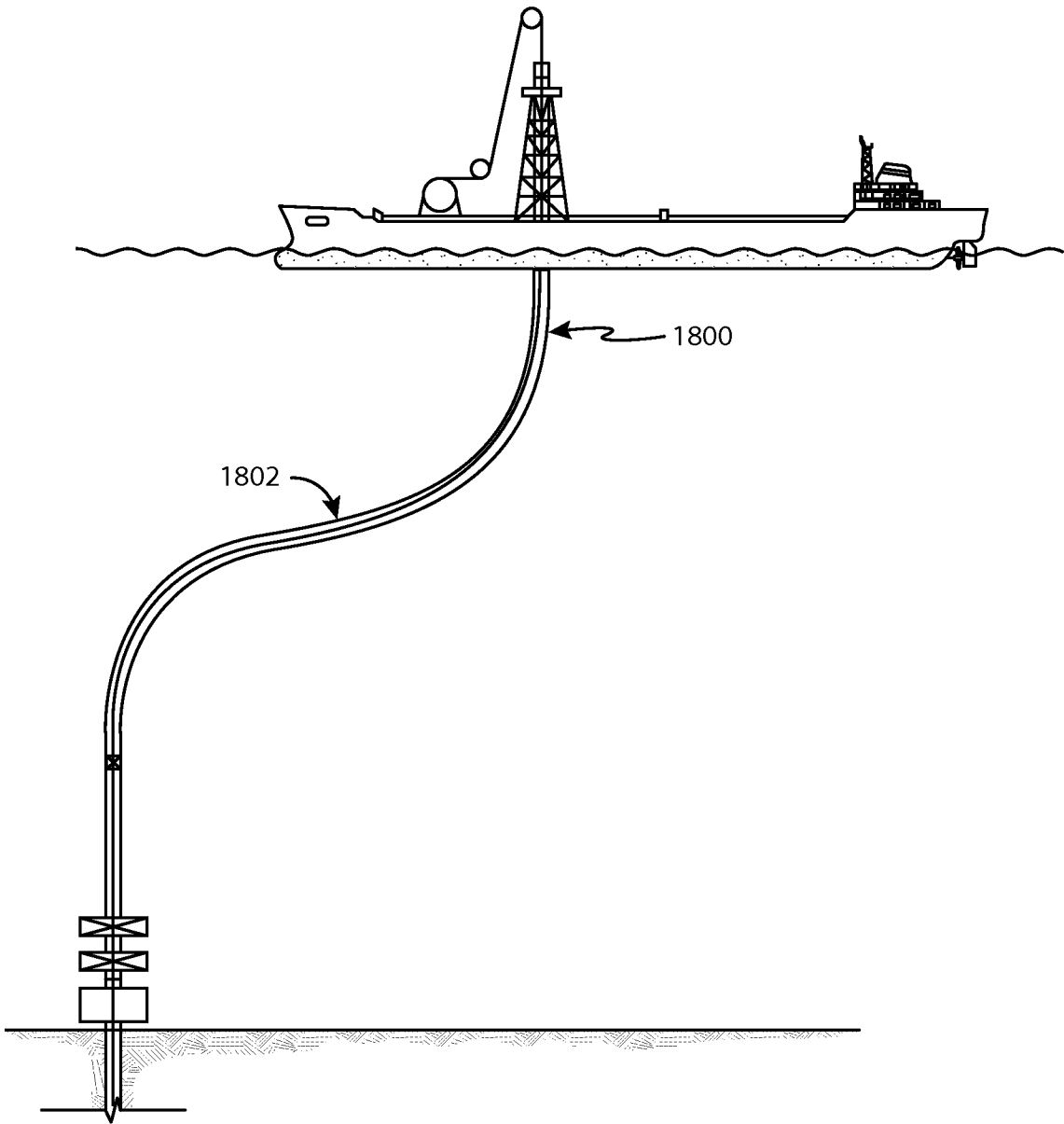


FIG. 16

A. CLASSIFICATION OF SUBJECT MATTER**E21B 19/00(2006.01)i, E21B 33/03(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 19/00; E21B 23/00; E21B 17/00; E21B 17/02; E21B 33/03

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: wireline, cable head, socket, seal, and downhole tool

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0198672 A2 (HALLIBURTON COMPANY) 22 October 1986 See page 5, line 7 - page 11, line 25; claims 7,12; and figures 2-4B.	1-13
A	US 6431269 B1 (POST, ROGER A. et al.) 13 August 2002 See claims 1-5 and figures 1-4.	1-13
A	EP 0511735 A2 (HALLIBURTON COMPANY) 04 November 1992 See claims 1-7 and figures 1A-10B.	1-13
A	US 2004-0134667 A1 (BREWER, JAMES E. et al.) 15 July 2004 See abstract and claims 1, 2.	1-13

 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

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"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 September 2014 (11.09.2014)

Date of mailing of the international search report

30 September 2014 (30.09.2014)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/036139

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