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[Continued on next page]

- (54) Title:** APPARATUS AND METHOD FOR DETERMINING ORIENTATION OF A DEVICE AND MILL POSITION IN A WELLBORE UTILIZING IDENTIFICATION TAGS

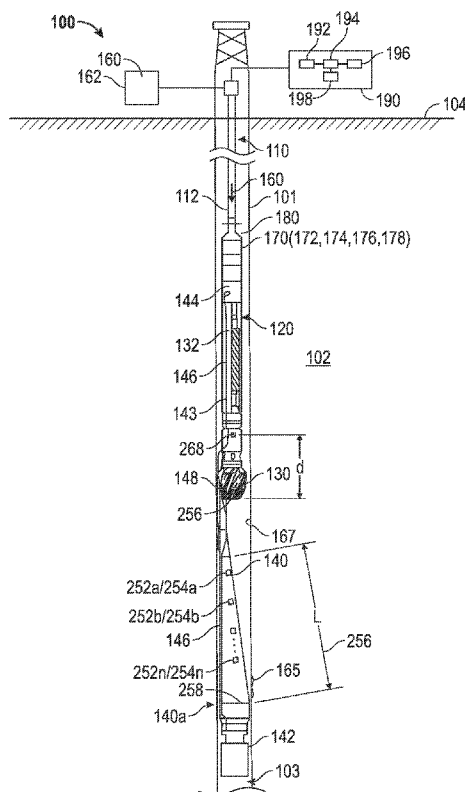


FIG. 2

- (57) Abstract:** In one aspect, a method of performing an operation in a wellbore is disclosed that in one embodiment may include: placing a first device at a first location in the wellbore, wherein the first device includes a plurality of circumferentially placed tags at known orientations in the wellbore, conveying a second device in the wellbore, the second device including a sensor that provides signals in response to detecting signals from each of the tags in the first device, determining from the signals from the sensor orientation of the second device in the wellbore. In another aspect the method may include a plurality of axially placed tags on a first device and the sensor on a second device, wherein the sensor provides signals when it passes proximate each of the axially spaced tags and determining from the sensor signals location of the second device relative to the first device.

**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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APPARATUS AND METHOD FOR DETERMINING ORIENTATION OF A DEVICE AND MILL POSITION IN A WELLBORE UTILIZING IDENTIFICATION TAGS

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Application No. 13/709698, filed on December 10, 2012, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

[0001] The present disclosure relates generally to orienting a tool and performing an operation in a wellbore.

2. Description of the Related Art

[0002] Many operations are performed in wellbores for recovery of hydrocarbons (oil and gas) include milling a portion of a casing in the wellbore or forming a lateral wellbore from a main cased or open wellbore. Windows are milled or the lateral wellbores are formed at specified locations in the main wellbore. To perform such a cutting operation, a downhole tool is conveyed in the wellbore that includes a whipstock connected to a cutting device or tool, such as a mill or drill bit. The cutting tool is typically operated by a fluid-driven motor, such as a progressive cavity motor. The downhole tool is rotated to orient the whipstock along the direction where the milling operation is desired to be performed. Once the tool is oriented, an anchor connected below the whipstock is positioned to fixedly set the whipstock along the desired direction. The mill is disengaged from the whipstock and moved along the drill whipstock to contact the wellbore. The mill is rotated to mill a window in the casing and/or to drill a lateral wellbore from the main wellbore. It is desirable to determine the whipstock orientation before setting the anchor and to determine the mill location relative to the whipstock depth (down the whipstock) when milling a window during a casing exit operation.

[0003] The disclosure herein provides apparatus and method for orienting the whipstock and determining location of the mill relative to the whipstock in a wellbore.

SUMMARY

[0004] In one aspect, a method of performing a downhole operation is disclosed that in one embodiment may include: In one aspect, a method of performing an operation in a wellbore is disclosed that in one embodiment may include: placing a first device at a first

location in the wellbore, wherein the first device includes a plurality of circumferentially placed tags at known orientations in the wellbore, conveying a second device in the wellbore, the second device including a sensor that provides signals in response to detecting signals from each of the tags in the first device, determining orientation of the second device in the wellbore from the signals from the sensor.

[0005] In another aspect, the method may include conveying a first device having a plurality of axially placed tags on the first device and passing a second device proximate the sensors to provide signals detected from the tags and determining location of the second device relative to the first device using the signals from the sensor.

[0006] In another aspect, an apparatus for performing a downhole operation is disclosed that in one embodiment includes a first device having a plurality of tags axially spaced apart along a length of the first device, a second device having a sensor for providing signals when the sensor is proximate the tags, and a processor for determining location of a selected point on the second device from the signals provided by the sensor when the sensor passes proximate the tags.

[0007] In yet another aspect, an apparatus for performing a downhole operation may include a first device for placement at first location in the wellbore, the first device including a plurality of circumferentially placed tags at known orientations in the wellbore, a second device conveyable into the wellbore, the second device including a sensor that provides signals in response to signals provided detected from the tags in the first device, and a processor for determining orientation of the second device from the signals provided by the sensor.

[0008] Examples of certain features of the apparatus and method disclosed herein are summarized rather broadly in order that the detailed description thereof that follows may be better understood. There are, of course, additional features of the apparatus and method disclosed hereinafter that will form the subject of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] For detailed understanding of the present disclosure, references should be made to the following detailed description, taken in conjunction with the accompanying drawings, in which like elements have been given like numerals and wherein:

FIG. 1 is a schematic diagram of an exemplary wellbore system for performing an operation in a wellbore, wherein a first device disposed in the wellbore includes a plurality of

circumferentially disposed tags and a second device conveyable in the wellbore that includes a sensor that provides signals detected from the tags; and

FIG. 2 is a schematic diagram of an exemplary wellbore system for performing an operation in a wellbore, a first device includes a number axially placed tags and a second device including a sensor for providing signals from the tags when the sensor is proximate each of the tags.

DESCRIPTION OF THE DISCLOSURE

[0010] FIG. 1 is a schematic diagram of an exemplary system 100 for performing an operation in a wellbore 101 formed in a formation 102, such as a milling/cutting operation. The system 100 includes drill string or work string 110 placed or conveyed in the wellbore 101 at a desired depth 103. In aspects, the drill string 110 includes a downhole assembly or tool 120 conveyed in the wellbore by a conveying member or tubular 112, such as a coiled tubing or another tubular. The downhole tool 120 includes a cutting device, such as a mill or a drill bit 130 connected to a fluid-operated motor, such as a progressive cavity motor 132. The motor 132 rotates the bit 130 when fluid 160 under pressure is pumped from storage unit 162 at the surface location 104 into the tubular 112. The fluid 160 rotates the motor 132 that, in turn, rotates the bit 130. The downhole tool 120 further includes a detachable whipstock 140 connected to the bit 130 or at another suitable location above or up hole of the bit 130. An anchor 142 is connected below the whipstock 140. In aspects, the anchor 142 may be a hydraulically-set packer or another suitable device. A hydraulic control sub 144 supplies a fluid under pressure to the hydraulically-operated anchor 142 via fluid control line 146 to set the anchor 142.

[0011] Still referring to FIG. 1, the downhole tool 120 further includes an orientation device 150 that includes a member 152 placed along an inside of the wellbore 101 at a selected location 154. The member 152 includes a plurality of circumferentially spaced tags T1, T2 through Tn. The tags may be any devices that transmit or radiate active or passive signals that can be detected by a suitable detector or sensor. In one aspect, the tags are radio frequency identification tags, wherein each such tag transmits a unique radio frequency signal. Each such tag may be battery powered. Alternatively, the tags may be electromagnetic transmitters, acoustic transmitter or any other type of device that transmits known signals. The device 150 may be any device that can be installed or securely placed inside the wellbore 101. For example, the device 150 may be a packer that can be hydraulically or mechanically set or anchored at the location 154. The tags may be placed or embedded along an inner

surface of the packer. The device 150 may be any device that can be installed temporarily (for example, removable) or permanently in the wellbore.

[0012] Still referring to FIG. 1, the tool 120 further includes a sensor 156 ("S") at a suitable location. One such location may be at the body of the tool 120, such as shown by location 158a. Another location may be proximate the bit 130, such as shown by location 158b. Any other suitable location on the tool 120 may also be selected for the sensor 156. Also, more than one sensor may be utilized. To set the anchor 140 in the wellbore 101, the device 150 is conveyed by a tool that sets the device 150 in the wellbore and determines the orientation of at least one tag. The tool 120 is then conveyed in the wellbore 102, the sensor S detects one or more of the tags T1 through Tn and transmits the detected tag signals to a controller 170 in the tool 120 and/or a controller 190 at the surface. The signals to the controller 190 may be sent by a telemetry unit 180 in the tool 120. Any suitable telemetry device or system may be utilized, including, but not limited to, acoustic telemetry, electromagnetic telemetry, wired telemetry, and mud pulse telemetry or any other telemetry system known in the art. In one embodiment, the downhole controller 170 includes an electric circuit 172 that pre-processes (for example, amplifies) signals from sensors 152, a processor 174, such as microprocessor, that further processes signals from circuit 172 and transmits the processed signals to the surface controller 190 via the telemetry unit 180. The controller 170 may further include a memory device 176, such as a solid state memory, that stores data and programmed instruction 178 accessible to the processor for processing the signals and performing one or more downhole operations. Similarly, the surface controller 190 may include a circuit 192 that receives and conditions signals transmitted by the device 180, a processor 194, a memory device 196 and programmed instructions 198.

[0013] To perform an operation in the wellbore, the tool 120 is conveyed into the wellbore 101, where the sensor 156 transmits signals detected from one or more tags T1, Tn to the controllers 170 and/or 190. The controllers 170 and/or 190 determine the orientation of the tool 120 and thus the whipstock 140 from the sensor signals, since the orientation of the tags relative to the tool 120 and whipstock 140 is known. The tool 120 is then rotated to orient whipstock 140 along a desired direction. The anchor 142 below the whipstock is then hydraulically set by flowing fluid 143 from a source, such as storage unit 162, to the anchor 142 via a fluid line 146. The whipstock bit 130 is then disengaged from the whipstock 140 by applying a mechanical force to break the connection 148. The bit 130, along with the rest of the tool 120, is then free to be moved in the wellbore. The bit 130 is then rotated and moved downhole to perform a desired operation, such as cutting a window 165a in the casing 167 in

the wellbore or to form a lateral wellbore from a location, such as a location 165b. The orientation of the whipstock 140 may be monitored and confirmed by continually processing the signals from the sensor 156.

[0014] FIG. 2 is a schematic diagram of an exemplary wellbore system 200 for performing another operation in a wellbore 101. The system 200 is substantially the same as described in reference to FIG. 1, except that system 200 does not include the circumferentially spaced tags 150, but includes tags along the whipstock 140 as described below. In the system 200, a number of tags 252a, 252b through 252n are axially or serially placed along an axial length “L” of the whipstock 140. The tags 252a through 252n may be sensed by a suitably positioned sensor in the tool 120, such as sensor 268 positioned a known distance “d” from a bottom 256 of the bit 130. The tags 252a through 252n are spaced at known distances from a reference point, such as a bottom 258 of the whipstock 140. During performance of an operation using a whipstock 140, it is often desirable to know where the bottom 256 of the bit 130 is located as the bit 130 moves down and along the whipstock 140. This aids an operator at the surface to control the movement and the placement of the bit 130 adjacent to location of the window 165a.

[0015] Still referring to FIG. 2, once the whipstock 140 has been set in the wellbore and the bit 130 detached from the whipstock 140, the tool 120 and thus the bit 130 is moved downward toward the location of the window 165a. As the bit 130 moves, the sensor 268 passes proximate to the tags 252a-252n and transmits signals to the controller 170 and/or 190 corresponding to the detected tags. The controllers 170 and/or 190 processes the sensor signals and determines the location of a point on the tool 120, such as the bit bottom 256, relative to a location in the well, such as the location of the tag, center of the whipstock, window location 165a, etc., and may display such information on a screen or monitor at the surface 104. An operator at the surface may utilizes such information and control the lowering or movement of the bit 130 toward the window location 165a.

[0016] Referring to FIGS. 1 and 2, the tags 252a – 252n may also be placed on whipstock of FIG. 1 for determining the location of the bit relative to the whipstock for performing an operation in the wellbore. Although, FIGS. 1 and 2 show systems for performing a milling operation using a whipstock, the apparatus and methods for determining or estimating the orientation of a tool downhole and for determining the location of a movable object in the wellbore are equally applicable to bottomhole assemblies used for drilling wellbores and other downhole device for which orientation determination is desired and for which determining the location of a tool relative point in the wellbore is useful.

[0017] While the foregoing disclosure is directed to the preferred embodiments of the disclosure, various modifications will be apparent to those skilled in the art. It is intended that all variations within the scope and spirit of the appended claims be embraced by the foregoing disclosure.

CLAIMS

1. A method of performing an operation in a wellbore, comprising:
placing a first device at a first location in the wellbore, the device including a plurality of circumferentially placed tags at known orientation in the wellbore;
conveying a second device in the wellbore, the second device including a sensor that provides signals in response to detecting each of the circumferentially placed tags in the first device; and
processing the signals from the sensor to determine orientation of the second device in the wellbore.
2. The method of claim 1, wherein the circumferentially placed tags are selected from a group consisting of: radio frequency identification tags; electromagnetic tags; and acoustic tags.
3. The method of claim 1, wherein the first device is a removable device placed around an inside of the wellbore.
4. The method of claim 1, wherein the second device includes a whipstock and a milling device and wherein performing an operation in the wellbore comprises:
orienting the whipstock in the wellbore based on the determined orientation of the second device; and
performing a milling operation with the milling device in the wellbore.
5. The method of claim 1, wherein each tag in the plurality of circumferentially placed tags transmits a unique signal detected by the sensor.
6. The method of claim 1 further comprising transmitting signals from the sensor to a processor via a telemetry system using telemetry selected from a group consisting of: wireless electromagnetic telemetry; mud pulse telemetry; wireline telemetry; and fiber optic telemetry.
7. The method of claim 4 further comprising:
providing a plurality of tags along a length of the whipstock;
passing the milling device along the length of the whipstock;
detecting signals from the tags along the length of the whipstock
providing signal from the sensor in response to the detected signals; and
determining from signals from the sensor in response to the signals detected from the tags along the length of the whipstock location of a point on the second device.
8. The method of claim 7, wherein the point on the second device relates to the milling device.

9. A method of performing an operation in a wellbore, comprising:
 - providing a tool that includes a whipstock having a plurality of tags axially spaced apart along a length of the whipstock and a device having a sensor for detecting signals from the tags;
 - performing the operation in the wellbore;
 - conveying the tool to a selected location in the wellbore;
 - moving the device past the tags on the whipstock for the sensor to provide signals received from the tags; and
 - determining a location of the device relative to the tags from the sensor signals.
10. The method of claim 9, wherein each tag transmits a unique signal.
11. The method of claim 9, wherein the determining the location of the device comprises determining when the tool is proximate a center of the whipstock.
12. A tool for performing an operation in a wellbore, comprising:
 - a first device having a plurality of tags axially spaced apart along a length of the first device;
 - a second device having a sensor for providing signals from the tags when the sensor is proximate the tags; and
 - a processor for determining a location of a selected point on the second device from the signals provided by the sensor when the sensor passes proximate the tags.
13. The apparatus of claim 12, wherein the first device is a whipstock and the second device is a milling device.
14. The apparatus of claim 12, wherein each tag provides a unique signal.
15. The apparatus of claim 14, wherein the tags are selected from a group consisting of: radio frequency identification tags; electromagnetic tags and acoustic tags.
16. The apparatus of claim the apparatus of claim 12, wherein the first device a device installed in the wellbore and the second device is one of: a completion device; and a drilling device.
17. An apparatus for performing an operation in a wellbore, comprising:
 - a first device for placement at first location in the wellbore, the first device including a plurality of circumferentially placed tags at known orientation in the wellbore;
 - a second device for conveying into the wellbore, the second device including a sensor that provides signals in response to signals provided by each of the tags in the first device;
 - and

a processor for determining orientation of the second device from the signals provided by the sensor.

18. The apparatus of claim 17, wherein the tags are selected from a group consisting of: radio frequency identification tags; electromagnetic tags; and acoustic tags.

19. The apparatus of claim 17, wherein the first device is device configured to be placed around an inside of the wellbore and the second device is selected from a group consisting of: a completion device; and a drilling device.

20. The apparatus of claim 17, wherein the first device is a device configured to be anchored in the wellbore and the second device includes a whipstock and a milling device.

21. The apparatus of claim 17, further comprising a telemetry device for transmitting signals from the sensor selected from a group consisting of: an acoustic transmitter; an electromagnetic transmitter; a mud pulse transmitter; and a transmitter sending signals by a communication link.

22. The apparatus of claim 17, wherein the first device is a whipstock that comprises a plurality of spaced apart tags along a length of the whipstock and wherein the processor is configured to determine location of a point in the second device relative to the whipstock from signals provided by the sensor when the sensor passes proximate the tags along the length of the whipstock.

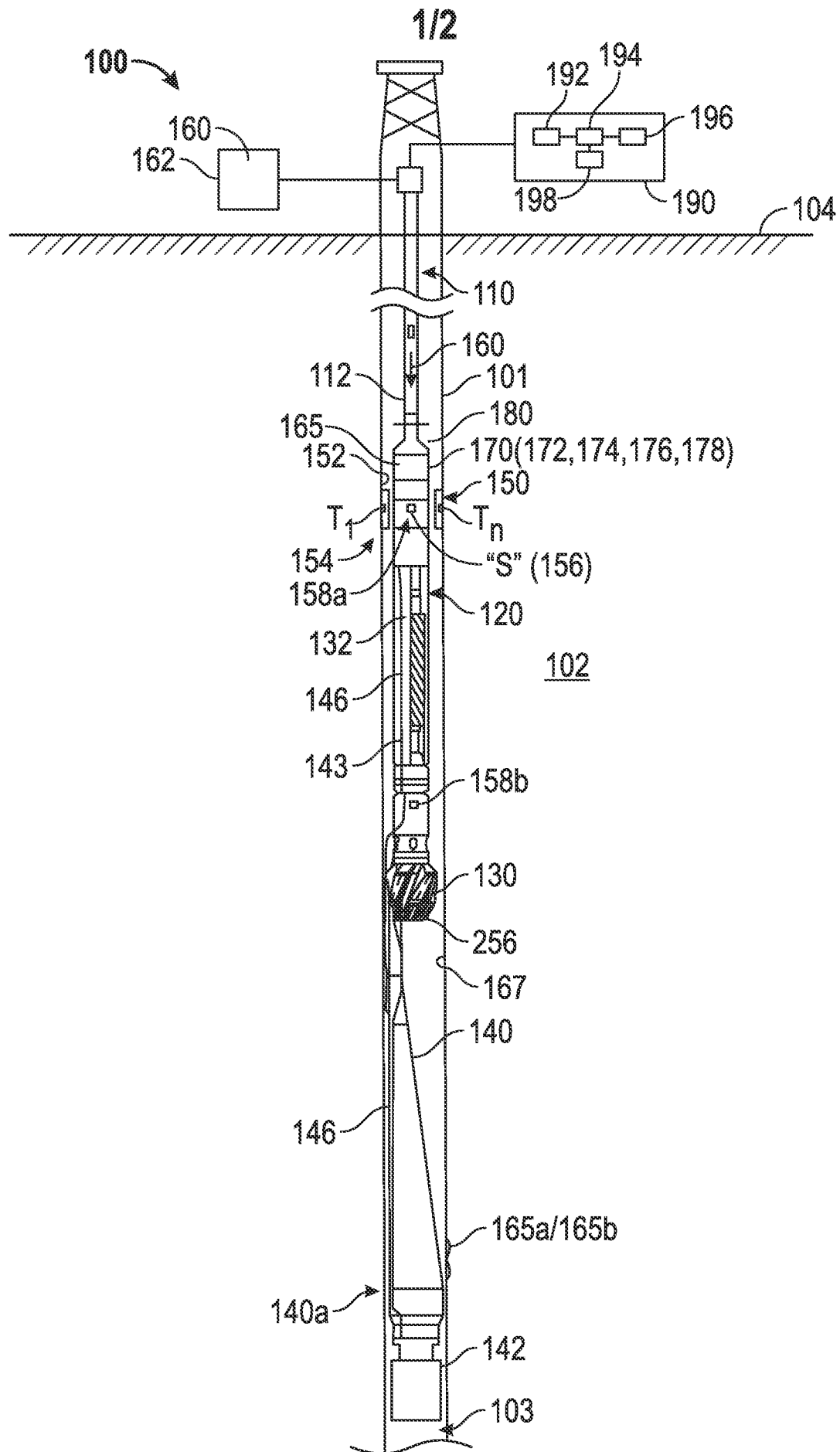
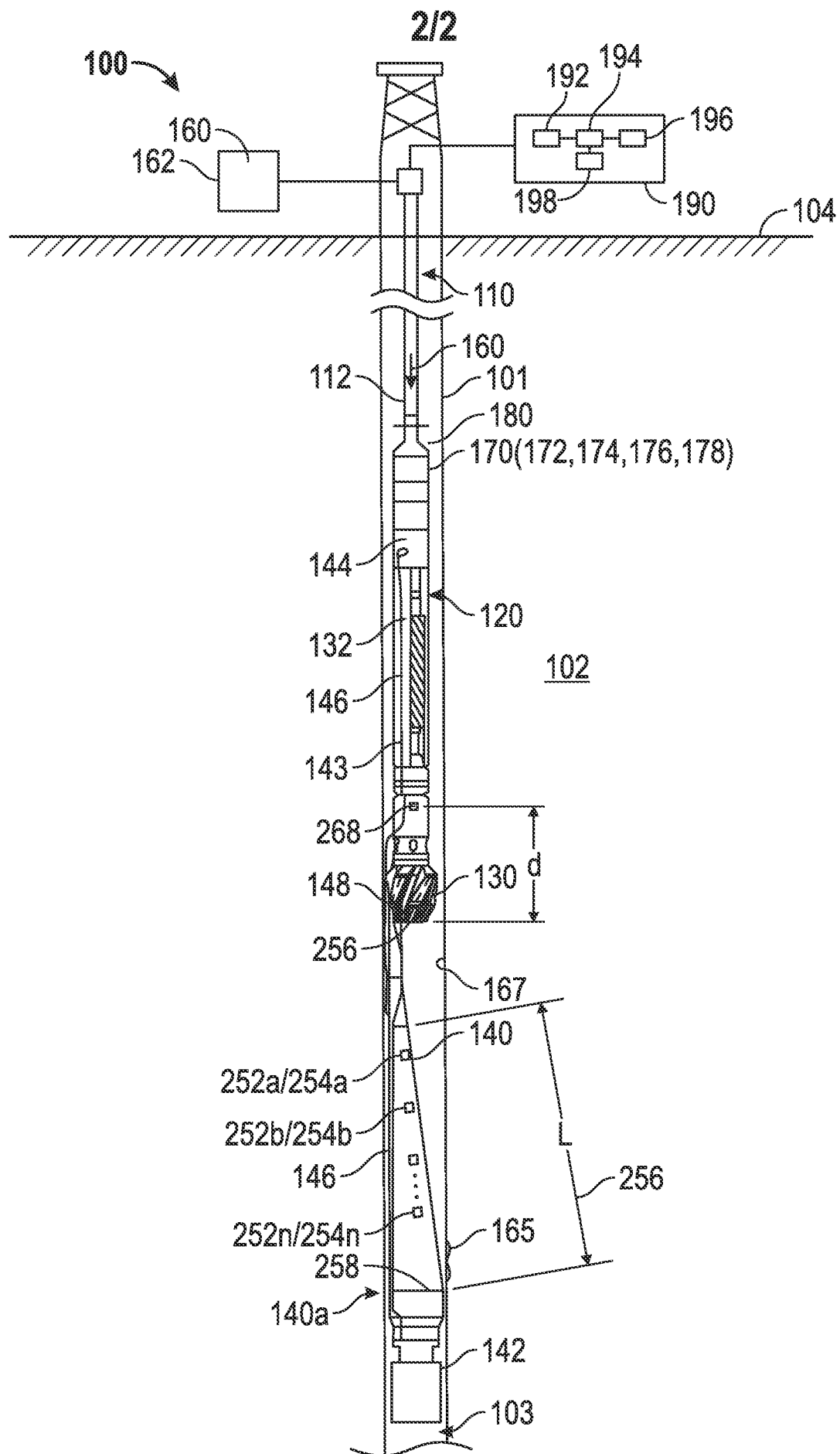
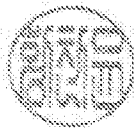


FIG. 1

**FIG. 2**

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/069077

A. CLASSIFICATION OF SUBJECT MATTER E21B 47/09(2006.01)i, E21B 19/00(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 47/09; E21B 43/118; E21B 29/06; E21B 7/08; E21B 7/06; E21B 23/00; E21B 7/04; E21B 23/03; E21B 19/00		
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: wellbore, drillstring, tag, sensor, whipstock, orient and signal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6192748 B1 (MILLER, ROBERT G.) 27 February 2001 See abstract; column 3, lines 48-63, column 4, lines 17-51; claims 1,6,10,15,17; and figures 1-2.	1-22
A	US 2012-0152566 A1 (BELL, DOUGLAS BRUCE) 21 June 2012 See abstract and paragraphs [0006]-[0010].	1-22
A	US 2012-0111636 A1 (STEELE et al.) 10 May 2012 See abstract; paragraphs [0007]-[0023]; and figure 7.	1-22
A	US 2010-0307736 A1 (HEARN et al.) 09 December 2010 See abstract; claim 1; and figures 3-4.	1-22
A	US 2008-0185148 A1 (CARTER et al.) 07 August 2008 See abstract and claims 1,10,15.	1-22
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier 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 28 January 2014 (28.01.2014)	Date of mailing of the international search report 03 February 2014 (03.02.2014)	
Name and mailing address of the ISA/KR  Korean Intellectual Property Office 189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. +82-42-472-7140	Authorized officer HWANG, Chan Yoon Telephone No. +82-42-481-3347 	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2013/069077

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6192748 B1	27/02/2001	CA 2270720 A1 FR 2785330 A1 GB 2343206 A GB 9910047 D0	30/04/2000 05/05/2000 03/05/2000 30/06/1999
US 2012-0152566 A1	21/06/2012	US 2012-241144 A1 US 8230920 B2 US 8459345 B2	27/09/2012 31/07/2012 11/06/2013
US 2012-0111636 A1	10/05/2012	AU 2011-323443 A1 AU 2011-323443 B2 CA 2815860 A1 CN 103210168 A EP 2622165 A2 SG 190103 A1 US 8376066 B2 WO 2012-061465 A2 WO 2012-061465 A3	23/05/2013 01/08/2013 10/05/2012 17/07/2013 07/08/2013 28/06/2013 19/02/2013 10/05/2012 09/08/2012
US 2010-0307736 A1	09/12/2010	None	
US 2008-0185148 A1	07/08/2008	AU 2003-228520 A1 GB 2403494 A GB 2403494 B NO 20044601A NO 327939 B1 US 2006-027359 A1 US 7353867 B2 US 8245774 B2 WO 2003-087524 A1	27/10/2003 05/01/2005 12/10/2005 10/11/2004 26/10/2009 09/02/2006 08/04/2008 21/08/2012 23/10/2003