FULL BORE SELECTIVE LOCATION AND ORIENTATION SYSTEM AND METHOD OF LOCATING AND ORIENTATING A DOWNHOLE TOOL.

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Abstract
A full bore selective location and orientation system includes a nipple installable in a tubular string and having internal location and orientation features of known configuration and a locating device runnable within the tubular string and having location and orientation features engageable with said internal features of said nipple. A method of locating and orientating a downhole tool including installing a tubular nipple having a particular inside dimensions configuration in a tubular string running a locating device having a complementary outside dimensions configuration to engage with said inside dimensions configuration and rotating said locating device to a position where a biased member extends from said locating device into a recess in said tubular member.

SLD
(SLOPE Locating Device)
Locates and latches in the nipple for orientation and depth control of wellbore equipment

Collet(s) - Collets are interchangeable to match the selected SLOPE nipple profile. Collets will only land and locate in the selected matching nipple and locates and latches when travelling down the wellbore. When the collet engages the matching collet profile it can not travel any further down the well.

Spline - adjustable in 3 degree increments for alignment of oil well tools to the correct position in the wellbore

Orientation Key - Matches the orientation slot and is activated by a spring to engage the slot. The SLD is rotated such that the key engages the slot and will not rotate further when engaged.
**SLOPE Nipple**

*Collet Profile(s)*

*Orientation Slot*

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**Orientation Key** - Matches the orientation slot and is activated by a spring to engage the slot. The SLD is rotated such that the key engages the slot and will not rotate further when engaged.
Straddle Wiper Plug System

Wiper Plug 40
SLOPE Nipple

Fig. 3
FULL BORE SELECTIVE LOCATION AND ORIENTATION SYSTEM AND METHOD OF LOCATING AND ORIENTATING A DOWNHOLE TOOL

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of an earlier filing date from U.S. Provisional Application Serial No. 60/365,488 filed Mar. 18, 2002, the entire disclosure of which is incorporated herein by reference.

BACKGROUND

[0002] In the hydrocarbon exploration and recovery industry, operations commonly take place many thousands of feet below the surface of the earth. Not an insubstantial number of these operations require both a known positioned and known orientation in order to ensure of the operation proceeds as intended. Many devices have been used in the past to assist with positional and orientational accuracy, however, most of those create a restriction in the inside dimensions of the tubular member in which they are installed. Since all restrictions present issues relative to tools and equipment located farther downhole of the restriction, such restrictions are not desirable.

SUMMARY

[0003] A full bore selective location and orientation system includes a nipple installable in a tubular string and having internal location and orientation features of known configuration and a locating device runable within the tubular string and having location and orientation features engageable with said internal features of said nipple.

[0004] A method of locating and orientating a downhole tool including installing a tubular nipple having a particular inside dimensions configuration in a tubular string running a locating device having a complementary outside dimensions configuration to engage with said inside dimensions configuration and rotating said locating device to a position wherein a biased member extends from said locating device into a recess in said tubular member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Referring now to the drawings wherein like elements are numbered alike in the several figures:

[0006] FIG. 1 is a schematic view of a tubular member particularly constructed for a specific purpose disclosed in this application;

[0007] FIG. 2 is a schematic representation of a locating device in configured to interact with a nipple such as that shown in FIG. 1; and

[0008] FIG. 3 is an illustration of a nipple with a wiper plug system installed therein.

DETAILED DESCRIPTION

[0009] The system described herein comprises two main sections, the first being a nipple illustrated in FIG. 1 and the second being a locating device illustrated in FIG. 2. The nipple is to be installed positioned and oriented as part of whatever tubular string is being deposited downhole and the locating device is configured to interact with the nipple in a way that ensures both positive position and positive orientation in the downhole environment. It will be understood by one of ordinary skill in the art that the figures presented hereinafter are illustrations of a single embodiment of the system disclosed herein and that different collet profiles, orientation slot locations, etc. may be employed to render the system stackable and selectively engageable by a locating device or simply to form different embodiments. In addition, the collets (illustrated in FIG. 2) on the locating device are to be interchangeable to allow late decision as to which nipple is intended to be engaged.

[0010] Referring to FIG. 1, a nipple 10 is a tubular member having the capability of being connected into a tubing string at an uphole end 12, and a downhole end 14. The ends are respectively illustrated to be threaded connections of the box thread (12) and pin thread (14) type. Within an inside dimensions of the nipple is machined one or more collet grooves 16 which will serve as a position locator for the locating device. In the illustrated embodiment of FIG. 1 there are two collet grooves, however, it will be understood by one of ordinary skill in the art that one or more of those grooves could be machined into nipple 10. The width and configuration of those grooves may be whatever is desirable to serve the purpose. In a stack system where more than one nipple is connected into the tubing string, it may be desirable to have the nipples be selective with respect to the locating device to be run thereafter. In one embodiment the largest collet groove width may be on the deepest nipple within the well such that a locating device being run will skip earlier collet grooves and engage the smallest groove in which the collet can fit. Alternate embodiments are also contemplated. For example, the particular collet groove profile can allow a smaller collet to bridge over certain features such as raised portions in a larger total collet groove size.

[0011] Still referring to FIG. 1, the nipple further includes an orientation slot, which is a recess of any desired configuration, for engagement with an orientation key existing on the locating device discussed below. The orientation slot provides for the angular orientation of the locating device within the wellbore. More specifically, since the orientation of the slot is known, the orientation of a locating device engaged therewith will be known.

[0012] It is important to note that although orientation slot 18 is illustrated downhole of collet grooves 16, the slot may also be positioned uphole of or within collet grooves 16 with similar results. Additionally, more than one slot could be employed if desired.

[0013] Referring to FIG. 2, a locating device 32 is illustrated which is configured to engage the nipple illustrated in FIG. 1. The locating device includes a pull nose 20 which is known one of ordinary skill in the art. The locating device comprises a tubular body 22 having an orientation key 24 mounted therein. The key is mounted such that the key may be urged radially inwardly so that an outer surface 26 of key 24 rests within the cylinder defined by tubular body 22. This allows the locating device to fit within the inside dimensions of whatever size tubular in which it was designed to travel.

In the compressed position, orientation key 24 is urged by any of number of means, illustrated herein as a spring 28, into a position similar to that illustrated in FIG. 2 and wherein when key 24 is positioned within nipple 10, key 24 will engage orientation slot 18.
The collets 30 illustrated, in FIG. 2, are complementary in shape to collet grooves 16 illustrated in FIG. 1. As mentioned in the discussion of FIG. 1, the collets are interexchangeable and may be of any width and of any number in order to selectively engage a specific collet groove arrangement 16 whose location in the well will be known because of its intentional placement at that location during installation of the string in which the nipple is installed. The specific orientation of the nipple after installation is known from either gyroscopic location or measurement while drilling (mwd).

An additional degree of specificity is provided within locating device 32 in that an adjustable spline connection 34 is provided. The spline is adjustable in three degree increments about 360 degrees in order to ensure alignment as desired. For example, it may be that it is desirable to exit a tubular string, within which nipple 10 is installed, in a direction opposite that of the orientation slot. By employing the spline adjustment at the surface one can adjust the specific tool associated with the locating device at any azimuth desired.

The method of employing the system is as follows. Regardless of what the dimension of the tubular is, including 9", 3\% or other dimensions, nipple 10 is fitted into the tubing string at the desired location and run downhole. In the event the tubing string is to be cemented in place in the borehole, a wiper plug system such as that commercially available from Baker Oil Tools, Houston, Tex. is installed to bridge from an area upstream of any nipple feature to an area downhole of any feature. For example, an area upstream of collet groove 16 to an area downhole of orientation slot 18. An upstream facing wiper plug (FIG. 3) is installed to ensure the cement being pumped down the tubing string is not provided an opportunity to come in contact with collet groove 16 or orientation slot 18. The wiper plug system 42 is schematically illustrated within the nipple of FIG. 1, in FIG. 3. The wiper plug could be preinstalled in the nipple or could be installed after the tubular string is run with the nipple in it. If the nipple 10 is not to be cemented in place within the borehole then the wiper plug system is not necessary.

Subsequent to installation of nipple 10, and/or several nipples 10 with distinct collet groove arrangements 16, when location and orientation to the specific location is desired, locating device 32 is fitted with an appropriate collet to land in the desired collet grooves and is run downhole. The run can be effected on any type of running tool. As illustrated in FIG. 2, collet 30 includes a squared off downhole edge 31 which when engaged with collet grooves 16 prevents further movement in the downhole direction. It is noted that edge 31 may also be configured as a reverse cut to hold a load in the downhole direction. Such a reverse cut, in one embodiment, would have an angle of about 80° to a longitudinal aspect of the nipple. It will be appreciated that any angle more acute, in the uphole direction, than 90° measured such that a radially inward aspect of the edge 31 is further uphole than a radially outward aspect of edge 31 would constitute a reverse cut. Locating device 32 is then rotated from the surface, or from a downhole running tool as desired, until orientation key 24 aligns with orientation slot 18 and is urged thereinto by spring 28. The rotation as one of ordinary skill in the art will appreciate could be as much as 359 degrees prior to locking into orientation slot 18. Positive engagement is confirmed when a torque buildup is sensed at the rotating initiator whether that be at the surface or at the running tool.

It is further intended for the system disclosed herein that a certain pull value on the collet groove or grooves for example, 20,000 pounds overpull, will release the locating device 32 from the collet grooves 16 and the orientation slot 18.

While preferred embodiments have been shown and described, various modifications and substitutions may be made thereinto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitation.

What is claimed:

1. A full bore selective location and orientation system comprising:
   a nipple installable in a tubular string and having internal location and orientation features of known configuration;
   and
   a locating device runable within the tubular string and having location and orientation features engageable with said internal features of said nipple.
2. A full bore selective location and orientation system as claimed in claim 1 wherein said internal features comprise at least one groove arrangement and at least one recess.
3. A full bore selective location and orientation system as claimed in claim 2 wherein said at least one groove arrangement is at least one collet groove.
4. A full bore selective location and orientation system as claimed in claim 2 wherein said at least one groove arrangement is a plurality of collet grooves.
5. A full bore selective location and orientation system as claimed in claim 1 wherein said nipple is connectable into a tubular string as a portion of that string.
6. A full bore selective location and orientation system as claimed in claim 5 wherein said nipple is threadably connectable into said string.
7. A full bore selective location and orientation system as claimed in claim 2 wherein said at least one recess is at least one slot.
8. A full bore selective location and orientation system as claimed in claim 1 wherein said system further includes a wiper plug subsystem to protect said features from contamination.
9. A full bore selective location and orientation system as claimed in claim 2 wherein said system includes a plurality of nipples having unique features.
10. A full bore selective location and orientation system as claimed in claim 2 wherein said at least one recess is located uphole of said at least one groove arrangement.
11. A full bore selective location and orientation system as claimed in claim 2 wherein said at least one recess is located downhole of said at least one groove arrangement.
12. A full bore selective location and orientation system as claimed in claim 2 wherein said at least one recess is located within said at least one groove arrangement.
13. A full bore selective location and orientation system as claimed in claim 1 wherein said orientation features include at least one reverse cut.
14. A method of locating and orientating a downhole tool comprising:
   installing a tubular nipple having a particular inside dimensions configuration in a tubular string;
   running a locating device having a complementary outside dimensions configuration to engage with said inside dimensions configuration; and
   rotating said locating device to a position where a biased member extends from said locating device into a recess in said tubular member.

15. A method of locating and orientating a downhole tool as claimed in claim 14 wherein said engaging said complementary configuration prevents further downhole progress of said locating device.

16. A method of locating and orientating a downhole tool as claimed in claim 14 wherein said method further comprises installing a wiper plug subsystem in said nipple.

17. A method of locating and orientating a downhole tool as claimed in claim 16 wherein said installation is before said nipple is installed.

18. A method of locating and orientating a downhole tool as claimed in claim 16 wherein said installation is after said nipple is installed.

19. A method of locating and orientating a downhole tool as claimed in claim 14 wherein said installing comprises installing one or more tubular nipples, each nipple having a unique inside dimension configuration.

20. A method of locating and orientating a downhole tool as claimed in claim 16 wherein said wiper plug is a straddling wiper plug.

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