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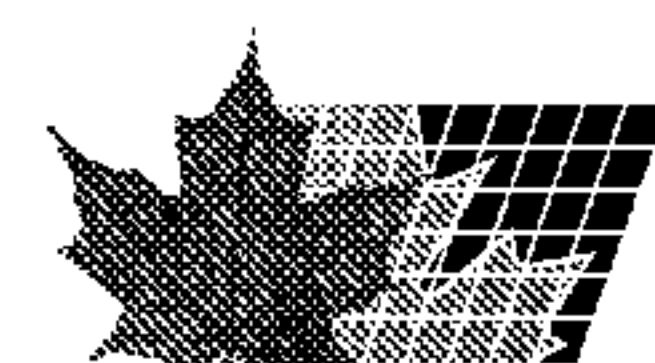
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(54) Titre : DISPOSITIF D'ANCRAGE DE COUPLE

(54) Title: TORQUE ANCHOR

(57) **Abrégé/Abstract:**

The invention describes a torque anchor for use with progressive cavity pumps (PC Pumps) for preventing rotation of the PC Pumps and any related tool string and tubing within a wellbore. The torque anchor includes at least one fixed rigid slip and one pivotable slip that in combination enhance the ability of the torque anchor to remain centered within wellbore casing and provide space between the torque anchor and wellbore casing for other tubing and/or other cabling or instruments to be run within the well and/or facilitate the passage of sand and other substances indigenous to many well formations past the torque anchor.



ABSTRACT

The invention describes a torque anchor for use with progressive cavity pumps (PC Pumps) for preventing rotation of the PC Pumps and any related tool string and tubing within a wellbore. The torque anchor includes at least one fixed rigid slip and one pivotable slip that in combination enhance the ability of the torque anchor to remain centered within wellbore casing and provide space between the torque anchor and wellbore casing for other tubing and/or other cabling or instruments to be run within the well and/or facilitate the passage of sand and other substances indigenous to many well formations past the torque anchor.

TORQUE ANCHOR

FIELD OF THE INVENTION

The invention describes a torque anchor for use with progressive cavity pumps (PC pumps) for preventing rotation of the PC pumps and any related tool string and tubing within a wellbore. The torque anchor includes at least one fixed rigid slip and one pivotable slip that in combination enhance the ability of the torque anchor to remain centered within wellbore casing and provide space between the torque anchor and wellbore casing for other tubing and/or other cabling or instruments to be run within the well and/or facilitate the passage of sand and other substances indigenous to many well formations past the torque anchor.

BACKGROUND OF THE INVENTION

During oil-well production, in-line pumps such as progressive cavity pumps are used to pump oil from the well bore to the surface. A progressive cavity pump system includes a surface driven rotor mounted within a downhole stator that is rotationally secured to production casing so as to prevent rotation of the stator in response to the rotation of the rotor. The stator is secured to the production tubing by a torque anchor that permits the stator to be positioned in the well at a desired location wherein upon clockwise rotation of the tubing string and connected tool string, the torque anchor will lock against the wellbore casing and thereby secure the stator to prevent right-hand rotation of the tubing string within the well casing so as to enable operation of the progressive cavity pump.

Within a wellbore, it is often desired that in addition to enabling the operation of the progressive cavity pump, that one or more lengths of coiled tubing and/or cabling also be run within the wellbore to regions below the pump for various purposes such as to deliver hot oil or diluent to break up sand or heavy oil within the formation and/or to communicate with one or more instruments beneath the progressive cavity pump. That is, as operators seek to collect more information from a well during production and/or seek to concurrently perform other operations within the well using additional systems, auxiliary lengths of coiled tubing or cable may be run past the torque anchor.

In addition, in deviated wells in particular, it is desirable to maintain the progressive cavity pump in a centralized position to enable coiled tubing and/or cable to

be readily run past the progressive cavity pump without binding or wedging of this auxiliary tubing or cabling between the torque anchor and casing or wellbore.

As a result, there has been a need for a torque anchor that, in addition to performing as an effective torque anchor, improves the ability of the operator to perform other operations within the well. Further, as progressive cavity pumps are often used in wells containing sand or other heavy substances it is desirable for the torque anchor to utilize a housing with as much flow-through space as possible, achievable by utilizing a housing with a smaller diameter and relatively larger slips.

A review of the prior art indicates that a number of different anti-rotation systems have been developed in the past that utilize a variety of concepts to provide different functionalities to an anti-rotation system or torque anchor.

For example, Advantage Products Inc. (Calgary, Alberta) produces a torque anchor that utilizes a single pivotable slip for deployment against well casing. In this system, the single slip extends from the main body of the torque anchor upon clockwise rotation of the tubing string such that when the slip engages with the well casing, the main body of the torque anchor is forced to move across the casing to the opposite side of the casing. This system can provide a pinch point that can damage tubing running adjacent to the torque anchor. In addition, this system by virtue of the main body of the torque anchor engaging with the well casing will similarly cause tools such as the stator of a PC pump to be biased against the well casing causing extra wear on such tools.

Canadian Patent 2,159,659 and US Patent 5,636,690 describe a torque anchor having pivotable slips for engagement with the well casing. In a horizontal and some deviated operations which make up a significant portion of all applications, a single slip engages and the main body of the torque anchor is pressed against the opposite side of the casing to the engaged slip.

Canadian Patent 2,220,392 describes a torque anchor having a plurality of drag slips that emerge from a slip cage and do not define a fixed volume of space between the slips.

Canadian Patent 2,238,910 describes a torque anchor to prevent right-hand rotation of tubing string within a stationary well casing. The system includes a fixed slip, two floating slips and a means for rotating the slips about the housing to create varying diameters of overall tool.

Canadian Patent 1,274,470 describes a no-turn tool having three movable slips that do not define a fixed volume between the slips.

Otatco Inc. (Calgary, Alberta) produces a torque anchor having a one piece body with integral slips and a collar to prevent right-hand rotation of a tubing string within a stationary well casing. The system includes a no-spring system having collars mounting passive dogs that provide anti-rotation when the collars are counter-rotated with respect to one another.

SUMMARY OF THE INVENTION

In accordance with the invention, there is provided a torque anchor that overcomes many of the disadvantages of prior art systems.

More specifically, the invention provides a torque anchor to prevent rotation of a tubing string within well casing so as to enable operation of a progressive cavity pump and to provide a definable volume of space between the torque anchor and well casing. In a first embodiment, the torque anchor comprises: a body for attachment to a tubing string, the body supporting at least one rigid slip for operative contact with wellbore casing; and, an outwardly biased pivotable slip on the body circumferentially spaced from the at least one rigid slip wherein the pivotable slip is dimensioned to engage with downhole casing when the tubing string is rotated in the first direction.

In one embodiment the at least one rigid slip is two rigid slips circumferentially spaced from one another and that may be detachable from the body. In other embodiments, the two or more rigid slips are spaced at 75-120° to one another on the body. Each rigid slip may include a second rigid slip longitudinally displaced from a corresponding rigid slip. Similarly, the pivotable slip may include a second pivotable slip longitudinally displaced from the pivotable slip and/or a recess for receiving the pivotable slip when the pivotable slip is biased against the body. The pivotable slip may also be a pin driven pivotable slip.

In a more specific embodiment, the invention provides a torque anchor comprising: a body for operative attachment to a tubing string, the body supporting two rigid slips circumferentially spaced from one another at 90-120° to one another on the body for engagement with downhole casing or a well bore; and, an outwardly biased pivotable slip on the body circumferentially spaced from the at least two rigid slips wherein the pivotable slip is dimensioned to engage with downhole casing when the tubing string is rotated in the first direction, the body including a recess for receiving the pivotable slip when the pivotable slip is biased against the body.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described by the following detailed description and drawings wherein:

Figure 1 is a side view of a torque anchor within casing in accordance with one embodiment of the invention;

Figure 2 is a perspective view of a torque anchor within casing in accordance with one embodiment of the invention;

Figure 3 is a schematic cross-sectional view of a torque anchor within casing as viewed from below in accordance with one embodiment of the invention;

Figure 3A is a schematic side view of a pivotable slip of a torque anchor in accordance with one embodiment of the invention;

Figure 3B is a schematic end view of a mounting system for a pivotable slip of a torque anchor in accordance with one embodiment of the invention;

Figure 4 is a schematic cross-sectional view of a torque anchor centered within casing and showing auxiliary tubing as viewed from above in accordance with one embodiment of the invention; and,

Figure 5 is a schematic cross-sectional view of a torque anchor within casing and showing auxiliary tubing as viewed from above in accordance with one embodiment of the invention.

DETAILED DESCRIPTION

In accordance with the invention and with reference to the figures, embodiments of a torque anchor 10 are described.

With reference to Figures 1-5, embodiments of a torque anchor 10 are shown in two perspective views (Figures 1 and 2) and cross-sectional views (Figures 3, 4 and 5). The torque anchor generally includes a body 12 on which at least one rigid stabilizing slip, (preferably two) 14 and one outwardly biased and pivotable slip 16 are mounted. The body 12 includes appropriate male 18 and female 20 connectors to allow the torque anchor to be connected to a progressive cavity (PC) pump stator or tubing string (not shown) as known to those skilled in the art.

When mounted to a PC pump stator or tubing string, counter-clockwise rotation (as viewed from above) of the tubing string will permit counter-clockwise rotation of the torque anchor, PC pump and tubing string within well casing 20 (or well bore). Clockwise rotation of the tubing string (as viewed from above) will cause the pivotable slip 16 to engage with the well casing 20 such that the pivotable slip 16 and each of the rigid slips 14 are biased against the well casing 20 (Figures 3, 4 and 5). As clockwise torque is maintained on the tubing string, the combination of the rigid slips 14 and pivotable slip 16 prevent clockwise rotation of the torque anchor within the well casing.

As shown in Figures 3, 4 and 5, the rigid slips 14 and pivotable slip 16 create three distinct volumes A, B and C between the body and casing. Importantly, volume A is a fixed volume determined by the lateral dimensions and spacing of the fixed slips 14 whereas volumes B and C may vary depending on the inside dimensions of the well casing and outside diameter of the body of the torque anchor. Preferably, each of the rigid slips 14 and pivotable slip 16 are dimensioned so as to center the torque anchor body within the casing. Figure 4 shows an embodiment where the slips 14 and 16 are dimensioned to center the tool whereas Figure 5 shows an embodiment where the body is not centered, but rather positioned to provide even larger volumes A, B and C.

As shown in Figure 4, where the body is centered, there is a greater capacity to run tubing or cable past the torque anchor within relatively symmetrical volumes B and C. As shown in Figure 5, where the body is not centered as a result of a smaller lateral dimension of the pivotable slip relative to the lateral dimension of the rigid slips, volumes B and C are not symmetrical and, hence, may be able to accommodate different auxiliary tubing strings/cables compared to the system shown in Figure 4.

Also, as shown in Figure 4, volume A may be utilized to rigidly attach an auxiliary cable to the housing through a clamp system 30. Alternatively, the same volume A may be utilized to loosely retain one or more auxiliary tubing strings as shown in Figure 5.

As shown to varying degrees in Figures 3, 4 and 5, the housing diameter may be different relative to the lateral dimension of the slip (as seen in cross-section) and/or the well casing thereby providing different volumes A, B, C for flow of well fluid, sand or other material past the torque anchor.

In a preferred embodiment, the rigid slips 14 are mounted on the body 12 parallel to the longitudinal axis of the body at approximately 90 degrees to one another as shown in Figure 3. This angle may, however, be varied to approximately 75-120 degrees depending on the desired volume A. The rigid slips are attached to the body through an appropriate connection system. It is preferred that the rigid slips are attached using bolts to enable rigid slips of different dimensions to be attached to the body so as to enable an operator to select the most appropriate dimensions for a given casing and in order to create a desired fixed volume A. The rigid slips may be set within a trough 32a (Figure 1) within the body to improve the structural strength of the torque anchor. Alternatively, the rigid slips may be permanently fixed to the body by welding. The rigid slips may be a single slip at each circumferential position on the body or may be separate pairs of slips longitudinally separated from one another (not shown). Each rigid slip may be tapered along its upper 32 and lower edge 34 to facilitate vertical movement through the casing in either direction.

The outer surface 36 of the rigid slip may be provided with an appropriate gripping surface to prevent slippage of the torque anchor with respect to the casing when the rigid slips are engaged against the casing, such as a plurality of pointed and hardened ridges. As shown in Figures 3, 4 and 5, the pivotable slip may also include a hardened pointed tip 16g (preferably tungsten carbide) to enhance the ability of the pivotable slip to grip against casing.

The pivotable slip 16 is pivotally mounted on the housing and is outwardly biased to ensure engagement of the pivotable slip against the casing during clockwise rotation of the torque anchor. In the preferred embodiment, the pivotable slip includes two mounting rods 16a, 16b (Figure 3A) that are operatively retained within a corresponding mounting system such as lug 16c (Figure 3B). The mounting system or lug includes a bore 16d for receiving a mounting rod 16a, 16b. The mounting system or lug is attached to the body with appropriate bolts within bolt sleeves 16e. As shown in Figure 2, a torque

anchor may include two separate pivotable slips longitudinally displaced relative to one another. The pivotable slips may be also tapered along their upper and lower edges to facilitate vertical movement through the casing in either direction.

The pivotable slip may be further attached in the manner as described in Canadian Patent 2,159,659 referred to therein as a pin-actuated slip.

The pivotable slip may be further attached by a collar positioned circumferentially around and attached to the housing (not shown).

In other embodiments, the pivotable slip may be pivotally retained within the body by other means such as but not limited to wedging or camming surfaces, and/or systems utilizing centrifugal force as known to those skilled in the art.

The body 12 may be further provided with a recess 50 to receive the pivotable slip in a fully retracted position.

The pivotable slip is also provided with at least one biasing spring to outwardly bias the pivotable slip. The biasing spring is preferably a coil spring 60 having a first end for operative contact with the body and a second end for operative contact with the pivotable slip. The mounting system may include appropriate recesses such that the coil spring is not exposed to the outer surfaces of the tool 10.

The pivotable slip may also be removed and an alternate dimension slip attached to the body so as to enable an operator to select the most appropriate dimensions for a given casing and desired use.

Operation

In operation, the torque anchor 10 is threaded on a PC pump stator or on a tubing string above or below a PC pump. The pump and torque anchor are run to the setting depth and torque is applied to the tubing string (right hand direction). The torque anchor is released by rotation in the opposite direction (left hand direction). The torque anchor can either be moved to a different location or pulled from the well.

The torque anchor is an improvement over past torque anchors by providing superior centering capabilities of the PC pump and torque anchor over past torque anchors. As a result, and in combination with the operator's ability to attach rigid slips and pivotable slips of a particular dimension, a known volume of space can be created in a predictable location in a well of any orientation so as to enable auxiliary tubing and/or cabling to be run adjacent to the torque anchor. Further, the torque anchor provides a

generous amount of space for flow of well fluid materials such as sand, than other torque anchors do.

In addition, as contrasted with past torque anchors, the body of the torque anchor can be made smaller than the PC pump stator as only the slips and not the body contact the well casing. Also, the operation of the torque anchor does not result in the biasing of the adjacent tubing and tool string against the well bore which can result in extra wear to certain tools such as a PC pump.

Although the present invention has been described and illustrated with respect to preferred embodiments and preferred uses thereof, it is not to be so limited since modifications and changes can be made therein which are within the full, intended scope of the invention.

CLAIMS

1. A torque anchor to prevent rotation of a tubing string in a first direction while allowing rotation of the tubing string in an opposite second direction, the torque anchor comprising:
 - a body for attachment to a tubing string, the body supporting at least one rigid slip for operative contact with downhole casing; and,
 - an outwardly biased pivotable slip on the body circumferentially spaced from the at least one rigid slip wherein the pivotable slip is dimensioned to operatively contact with downhole casing when the tubing string is rotated in the first direction.
2. A torque anchor as in claim 1 wherein the at least one rigid slip are two rigid slips circumferentially spaced from one another.
3. A torque anchor as in claim 2 wherein the two rigid slips are detachable from the body.
4. A torque anchor as in claim 2 wherein the two rigid slips are spaced at 75-120° to one another on the body.
5. A torque anchor as in claim 2 wherein each rigid slip comprises at least two rigid slips longitudinally displaced from one another.
6. A torque anchor as in claim 2 wherein the pivotable slip comprises a second pivotable slip longitudinally displaced from the pivotable slip.
7. A torque anchor as in claim 6 wherein each rigid slip comprises at least two rigid slips longitudinally displaced from one another.
8. A torque anchor as in claim 1 wherein the body includes a recess for receiving the pivotable slip when the pivotable slip is biased against the body.
9. A torque anchor as in claim 1 wherein the pivotable slip includes a gripping surface for engagement with downhole casing.
10. A torque anchor as in claim 9 wherein the gripping surface is a hardened and pointed tip.
11. A torque anchor as in claim 1 wherein the pivotable slip is a pin driven pivotable slip.
12. A torque anchor to prevent rotation of a tubing string in a first direction while allowing rotation of the tubing string in an opposite second direction, the torque anchor comprising:

a body for attachment to a tubing string, the body supporting two rigid slips circumferentially spaced from one another at 75-120° to one another on the body for engagement with downhole casing or a well bore; and,
an outwardly biased pivotable slip on the body circumferentially spaced from the at least two rigid slips wherein the pivotable slip is dimensioned to engage with downhole casing when the tubing string is rotated in the first direction,
the body including a recess for receiving the pivotable slip when the pivotable slip is biased against the body.

13. A torque anchor as in claim 12 wherein each rigid slip includes a second rigid slip longitudinally displaced from one another.
14. A torque anchor as in claim 12 wherein the pivotable slip includes a second pivotable slip longitudinally displaced from the pivotable slip.
15. A torque anchor as in claim 12 wherein the rigid slips are detachable.

Application number / numéro de demande: 2611294

Figures: 1, 2, 3, 4, 5

Pages: _____

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FIGURE 3B

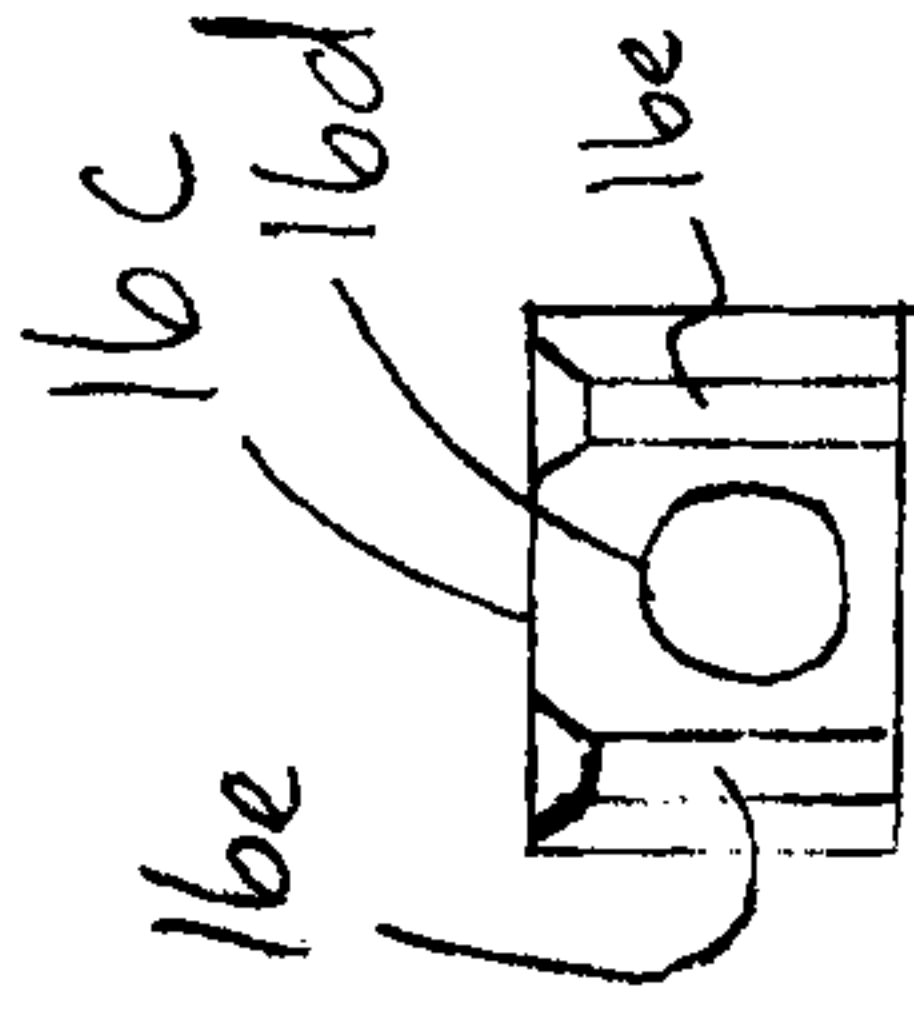


FIGURE 3A

