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(54) **KNUCKLE-SWIVEL FOR DRILLING WELLS**

KNIEHEBEL-DREHKOPF ZUM BOHREN VON BOHRLÖCHERN

TETE ARTICULEE TOURNANTE POUR FORAGE DE PUITS

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(56) References cited:
WO-A-00/52296 US-A- 2 544 584
US-A- 2 893 222 US-A- 3 733 853
US-A- 4 128 127 US-A- 4 154 544
US-A- 4 904 228 US-A- 5 037 354
US-A- 5 651 737 US-A- 6 010 272

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Description

[0001] The invention refers to a knuckle-swivel usual in combination with servicing equipment as mentioned in the generic portion of claim 1.

[0002] Such a knuckle-swivel is generally known by the US-Patent 4, 128, 127

BACKGROUND OF THE INVENTION

[0003] Many conventional drilling rigs use a top-drive for pulling pipe and/or tools from a well bore. Powerful motors are used to pull and wind wire rope, cable or strand about a drum located above the derrick floor. Swivels are used in-line with helical wound members such as rope, cable or strand for allowing rotation about a longitudinal axis thereof under tension for minimizing or avoiding straightening of the helical windings in order to protect the strength and integrity of the rope, cable or strand by compensating for the torsional force induced by large axial forces on the helical member. Typical forces can be on the order of several tons, or more.

[0004] In one typical operation referred to as a "wireline strip over operation", a sinker bar is used in-line with the wire rope. Sinker bars have in the past been comprised of a rigid member which may be in the form of a solid bar on the order of 4,6-6,1 M. (15 to 20 feet) in length. Use of such a sinker bar with a top drive creates interference between the sinker bar and rig equipment located vertically above the drill pipe; heretofore, it has been necessary to move and relocate the top drive unit out of the way. This is a time consuming operation that is best to be avoided.

[0005] Object of the invention is to provide a knuckle-swivel as mentioned in the generic portion of the claim 1 which avoid disadvantages of the prior art mentioned in the introduction part of the description and also in the description for preferred embodiments of the invention with references to the figures of the enclosed drawing.

SUMMARY OF THE INVENTION

[0006] The invention relates to the use of a unique implement which is now referred to as a "knuckle-swivel" and which provides for the multiple function of introducing a 360 degree swivel capability for minimizing and/or precluding the above referred torsional forces on the rope, cable or strand and, in addition, provides for a knuckle function to allow angular displacement for minimizing or precluding bending loads transmitted into the swivel during withdrawal of sinker bars from the well bore or other tools and the like being pulled around an obstacle.

[0007] The present invention is particularly useful for well drilling operations including but not limited to those utilizing a top drive winding drum for pulling items from the well bore and, more particularly, the invention is intended to be used with "Flexible Sinker Bar Assemblies" which are the subject of my United States Letters Patent

6,227,292 B1, granted on May 8, 2001.

[0008] An important feature of the present invention resides in the combination of the instant knuckle-swivel and a sinker bar, either a rigid sinker bar or ideally a flexible sinker bar, in order to minimise or preclude the heretofore requirement of moving the top drive unit during pulling operations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a longitudinal, sectional view of a knuckle-swivel in accordance with the invention.

FIG. 2 is a side elevational view of the knuckle-swivel showing the extent of side rotation.

FIG. 3 is a schematic representation of the knuckle-swivel connected to a helical wound wire rope, cable or strand which comprises part of a sinker bar.

FIG. 4 is a schematic view showing a helical wound rope, cable or strand being diverted around rig equipment with the knuckle-swivel located at the mouth of the well.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] knuckle-swivel body member, generally indicated by the numeral 10, includes a bottom sub 14 having threads 16 at one end thereof and receiving a bearing pin 18 in its opposite hollow end 20 and being connected thereto by a slotted spring pin 22.

[0011] An upper sub 24 includes a first threaded end 26 and a second threaded end 28, the latter being connected to the knuckle-swivel body member 10 in alignment with bottom sub 14. Body member 10 contains a pair of bearing cones 30, 30, a pair of bearing cups 32, 32 and a pair of bearing races 34, 34 which are mounted upon cylindrical posts 36, 36 disposed on opposite sides of bearing pin 18. A flat wire compression spring 40, of a type known as a crest-to-crest spring, is located between one bearing cup 32 and the adjacent end of upper sub 24 for applying a constant force against the cup 32 for stabilizing a plurality of ball bearings 42 between the bearing cones 30, 30 and the bearing races 34, 34. A grease fitting 44 is provided for passing lubricant through a passage 46, it being understood that the lubricant can pass through spring 40 and protect the various bearing components.

[0012] As is best shown in FIG. 1, body member 12 is provided with a frusto-conical surface 50 which limits bearing pin 18 to approximately 20 degrees of side-to-side rotation, the extent of rotation being best shown in FIG. 2. Thus, bearing pin 18 is capable of rotating 360 degrees about its longitudinal axis within body member 12 in addition to a side-to-side conical movement of 20 degrees.

[0013] Referring to FIGS. 3 and 4, it will be seen that the knuckle-swivel 10 is secured by a swaged end con-

connector 60 to a line 62, which may be a helical wound wire rope, or cable, or strand member. It is to be understood that helical wound line 62 is protected by knuckle-swivel 10 because of the capability of 360 degrees of axial rotation of bearing pin 18 minimizes or precludes torsional forces upon the line 62. In the absence of such protection, large axial loads would tend to straighten the helical windings and thereby severely weaken the strength of the line 62. End connector 60 is threaded onto sub 14, and sub 24 can be threadably connected to a pipe or tool 64.

[0014] It is to be understood that it is conventional in the well drilling industry to provide a top drive (not shown) in the form of a winding drum located at or near the top of a derrick or rig, for pulling pipe or tools from the well. It is not unusual for portions of the derrick or rig to be interposed between the well head and the winding drum. As a result, it has heretofore been necessary to mount the top drive so that it may be adjustably moved laterally to prevent interference between the pulling line and rig. As is best shown in FIG. 4, line 62, which may be a component of a flexible sinker bar as described in U.S. Patent 6,227,292, can be angularly displaced while under load because of the provision of knuckle-swivel 10. As a result, interference with rig equipment, generally indicated by the numeral 80, is avoided and it is unnecessary to move or relocate the top drive member. Line 62 can be trained over a guide roller (not shown) upwardly of or adjacent the rig equipment 80 for preventing contact during a wire-line strip over operation, or the like.

[0015] From the foregoing, the preferred construction of the invention will be obvious to those skilled in this art but it is to be understood that some changes in construction and operation are possible without departing from the scope of the invention as defined in the claimed subject matter appended hereto.

Claims

1. A knuckle-swivel (10) usable in combination with well servicing equipment including a pulling line (62) for removing equipment from a well comprising:
 - a bottom sub (14) and
 - an upper sub (24),
 - a bearing pin (18) connected between said pair of subs (14, 24),
 - a bearing member (30, 32, 34, 42) carried at the rear end of said bearing pin (18) and providing for 360 degree rotation about a longitudinal axis thereof,
 - a body member (12) at the front end of said upper sub (24) surrounding said bearing member (30, 32, 34, 42) and including a frusto-conical surface (50) at its front end providing angular movement of said bearing pin (18) from its longitudinal axis, **characterised in that** said bearing member is comprised of a pair of bearing

cones (30), a pair of bearing cups (32), and a pair of bearing races (34) connected to a pair of cylindrical posts (36) carried by said bearing pin (18).

2. A knuckle-swivel as defined in claim 1 including a spring (40) disposed between one of said bearing cups (32) and an end of said sub (24).
3. A knuckle-swivel as defined in claim 1 wherein a grease fitting (44) is disposed axially within one of said subs (14, 24) for providing lubricant to said bearing member.
4. A knuckle-swivel as defined in claims 1 and 4 wherein said frusto-conical surface (50) provides for 20 degree angular movement of said bearing pin (18) from its longitudinal axis.
5. A knuckle-swivel as defined in claim 1 wherein said pulling line (62) is a portion of a flexible sinker bar.

Patentansprüche

1. Kniehebel - Drehkopf (10), in Verbindung mit einer Bohreinrichtung, einschließlich eines Bohrseiles mit einem
 - Seilanschlußteil (14) und einem
 - Kniehebel-Kupplungsteil (24),
 - einem Lagerzapfen (18) zur Verbindung der Teile (14,24),
 - einem Lager (30, 32, 34, 42), am rückwärtigen Ende des Lagerzapfens (18) der um 360 Grad um seine Längsachse rotierbar ausgebildet ist,.
 - einem Körper (12) am vorderen Ende des Kniehebel-Kupplungsteiles (24), der das Lager (30, 32, 34, 42) umschließt und der an seinem vorderen Ende eine konische Fläche (50) aufweist, die eine Winkelbewegung des Lagerzapfens (18) zuläßt, **dadurch gekennzeichnet, dass** das Lagerteil paarweise jeweils aus Lagerschalen (34) und Lagerkonussen (32) zur Aufnahme einer Lagerkugel (42) besteht, wobei sich die Lager jeweils an Lagerschultern (30) abstützen und dass die Lager an gegenüberliegenden Flächen zweier Flansche (36) am hinteren Ende des Lagerzapfens anliegen.
2. Kniehebel - Drehkopf nach Anspruch 1 mit einer Feder (40) zwischen den Lagerkonussen (32) und dem Kniehebel-Kupplungsteil (24) angeordnet ist.
3. Kniehebel - Drehkopf nach Anspruch 1, wobei die Bohreinrichtung eine axiale Schmiervorrichtung (44) zur Schmierung der Lager vorgesehen ist.

4. Kniehebel - Drehkopf nach Ansprüchen 1 und 4, wobei die konische Fläche (50) eine Schwenkbewegung des Lagerzapfens (18) um 20 Grad aus der Längsachse der Bohrvorrichtung ermöglicht.

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5. Kniehebel - Drehkopf nach Anspruch 1, wobei das Bohrseil (62) ein Teil eines flexiblen Stabes ist.

Revendications

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1. Tête articulée tournante (10) utilisable en association avec un équipement d'entretien d'un puits comprenant un câble d'entraînement (62) destinée à enlever un équipement d'un puits comprenant :

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- un élément de raccord inférieur (14) et
- un élément de raccord supérieur (24),
- une broche de palier (18) reliée entre lesdits deux éléments de raccord (14, 24),
- un élément de palier (30, 32, 34, 42) maintenu à l'extrémité arrière de ladite broche de palier (18) et permettant une rotation à 360 degrés autour d'un axe longitudinal de celle-ci,
- un élément de corps (12) à l'extrémité avant dudit élément de raccord supérieur (24) entourant ledit élément de palier (30, 32, 34, 42) et comprenant une surface frustoconique (50) à son extrémité avant permettant le moment angulaire de ladite broche de palier (18) depuis son axe longitudinal, **caractérisée en ce que** ledit élément de palier est constitué de deux cônes de roulement (30), de deux cuvettes de roulement (32), et de deux bagues de roulement (34) reliées à deux montants cylindriques (36) maintenus par ladite broche de palier (18).

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2. Tête articulée tournante selon la revendication 1, comprenant un ressort (40) disposé entre l'une desdites cuvettes de roulement (32) et une extrémité dudit élément de raccord (24).
3. Tête articulée tournante selon la revendication 1, dans laquelle un raccord de graissage (44) est disposé axialement à l'intérieur de l'un desdits éléments de raccord (14, 24) pour fournir un lubrifiant pour ledit élément de palier.
4. Tête articulée tournante selon les revendications 1 et 4, dans laquelle ladite surface frustoconique (50) permet un mouvement angulaire de 20 degrés de ladite broche de palier (18) depuis son axe longitudinal.
5. Tête articulée tournante selon la revendication 1, dans laquelle ledit câble d'entraînement (62) est une partie d'une barre de charge flexible.

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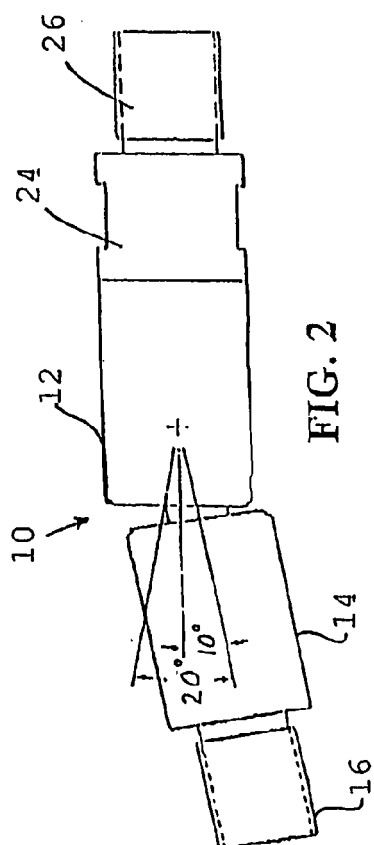


FIG. 2

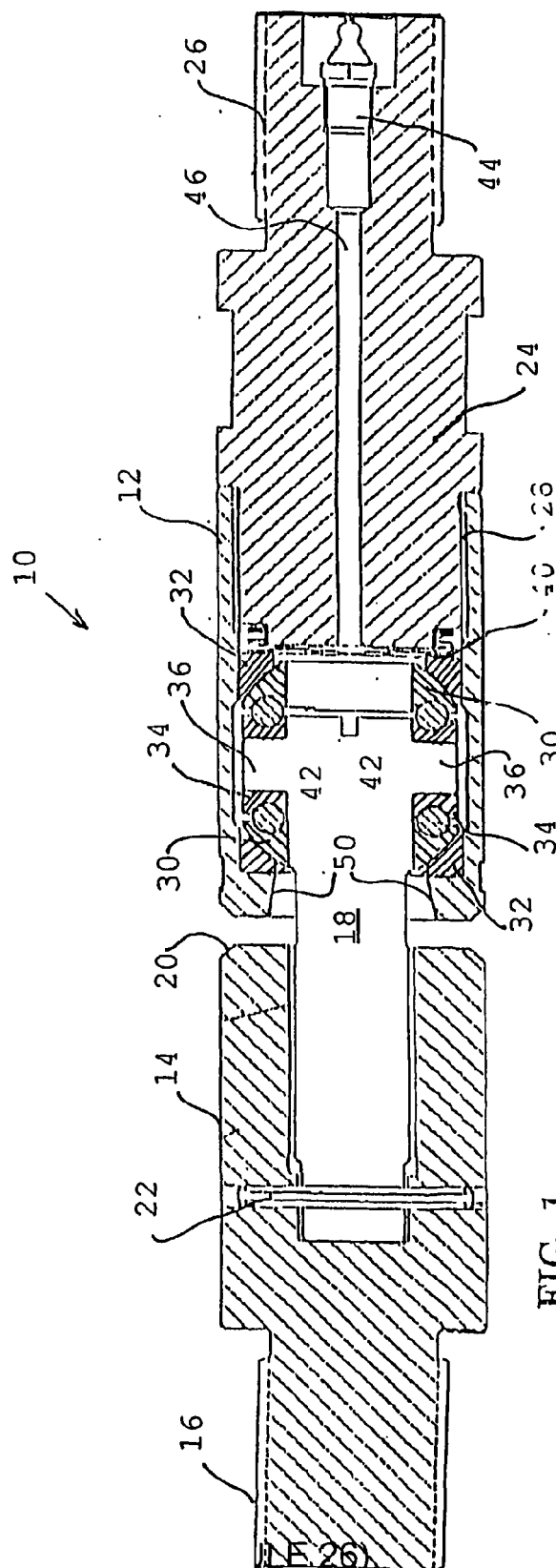


FIG. 1

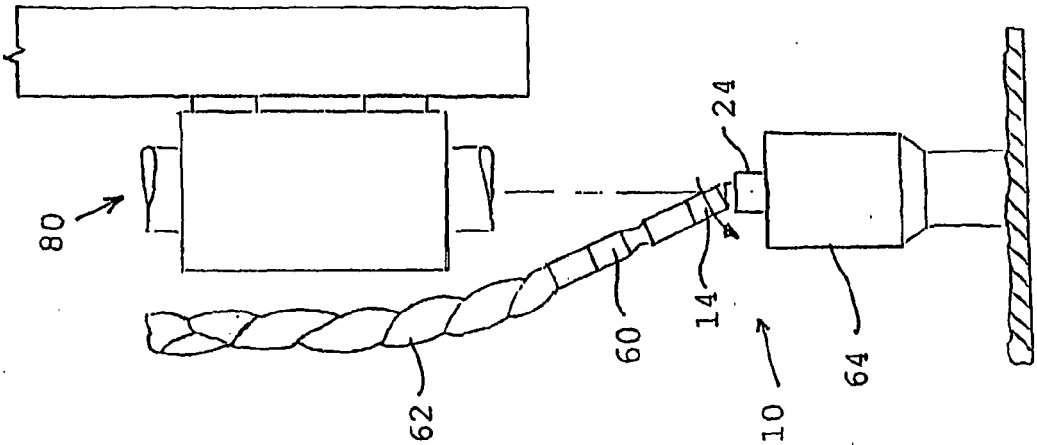


FIG. 4

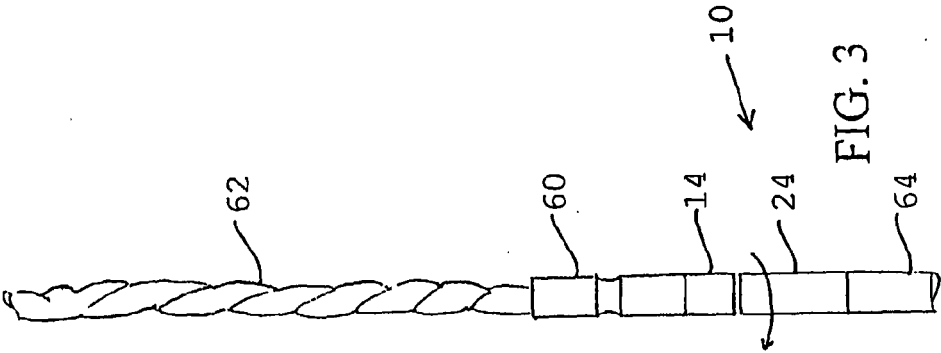


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4128127 A [0002]
- US 6227292 B1 [0007]
- US 6227292 B [0014]