(54) Title: TOP DRIVE APPARATUS

(57) Abstract: A method and apparatus for transferring fluid from a rotor (140) of a top drive apparatus to a non-rotating conduit, (101, 102) such as a gooseneck, the rotor (140) rotating at a working speed, characterised in that a seal (109) is arranged between said rotor (140) and a speed reducer apparatus (160) and a further seal (107) arranged between the speed reducer apparatus (160) and the non-rotating conduit (101, 102), the method comprising the step of the speed reducer apparatus (160) rotating at a speed slower than the working speed, such that the seal (109) and further, seal (107) each rotate at slower speed than the working speed.
This invention relates to a top drive apparatus and a method for transferring fluid from a rotor of a top drive apparatus to a non-rotating conduit, such as a gooseneck.

A top drive system for drilling wellbores, such as oil and gas wells, is one of two common types of system, the other being a rotary table system. A top drive system generally comprises a main body which houses a motor for rotating a sub which has a rotor connected to a sub connectable to a single, stand or string of tubulars. The tubulars may be any of: drill pipe, casing, liner, premium tubular or any other such tubular used in the construction, maintenance and repair of wellbores, such as oil and gas wells. A top drive system is generally arranged on a substantially vertical track on a derrick of a rig. The top drive system is lifted and lowered on the track with a line over a crown block on a travelling block connected to the top drive system. The line is reeled in and let out using a winch commonly known as a drawworks. The top drive system can thus be used to trip tubulars in and out of the wellbore; turn the drill string to facilitate drilling the wellbore; and turn a single or stand of tubulars in relation to a string of tubulars hung in the wellbore to threadedly connect or disconnect tubulars from a string of tubulars in the drill string to length or shorten the string of tubulars. An elevator generally depends on links attached to the top drive to facilitate handling of tubulars and alignment with the sub for connection and disconnection therewith. A top drive system may also be used in conjunction with a passive or active spider and/or with
rotary tongs to facilitate connection and disconnection of tubulars from the string of tubulars. A casing running tool can be used to allow a top drive to connect a joint of casing to a string of casing held in a spider in the floor of a drilling rig. The casing running tool may have external slips or internal slips to allow the joint of casing to be gripped and rotated by the top drive relative to the static casing string held in the spider. The casing running tool may comprise a fluid connection so that circulation of drilling mud can continue whilst the joint of casing, once connected to the string, can be lowered into the well. The casing running tool may also comprise a blow out preventer for inhibiting a blow out during tripping of the casing string.

Drilling fluids are transmitted to drilling swivels, used in rotary table systems and top drive drilling apparatus through a high-pressure swivel apparatus known as a "washpipe" with a seal known as a "washpipe packing" assembly. This packing assembly consists of a tubular component which is held stationary, and through which the drilling fluid flows under high pressure. A rotating seal assembly of contact lip seals is mechanically fixed to and rotates with the main shaft of the top drive or swivel, and forms a dynamic seal against the outer surface of the tubular washpipe as the main shaft rotates while drilling. Due to the high pressures and surface speeds involved in this arrangement, service life of the washpipe packing is limited. Drilling fluid leaks are therefore common on many drilling rigs, causing contamination and damage to associated components and environmental disruption.

The prior art discloses a variety of top drive apparatus; for example, and not by way of limitation, the
following U.S. Patents present exemplary top drive apparatus and sealing assemblies: 4,458,768; 4,807,890; 4,984,641; 5,433,279; 6,276,450; 4,813,493; 6,705,405; 4,800,968; 4,878,546; 4,872,577; 4,753,300; 6,007,105; 6,536,520; 6,679,333; 6,923,254.

In top drives and rotary drilling the wash pipe typically sealingly engages a set of circumferential seals contained within a seal housing. Often, the wash pipe remains stationary while the seals and the seal housing rotate. Such seal assemblies have conventionally included a series of reinforced, elastomeric, chevron type seals interspersed with a series of reinforcing back up rings. In certain prior art apparatus, one seal is exposed to full hydraulic pressure on one side, and atmospheric pressure on the opposite side. Full differential pressure of the drilling mud acts on one seal until that seal fails and the next seal in the assembly then acts as the primary seal. Some prior art swivel designs have sought to compensate for potential run out and offset problems by allowing the wash pipe and the seal housing to articulate.

According to the present invention, there is provided a top drive apparatus for wellbore operations, the top drive apparatus comprising a rotor with a bore for the passage of fluid therethrough, drive apparatus for rotating the rotor at a working speed, and a non-rotating conduit in fluid communication with the rotor characterised in that the top drive apparatus further comprises a speed reducer apparatus connected between the rotor and the conduit, a seal arranged between the rotor and the speed reducer apparatus and a further seal arranged between the speed reducer apparatus and the conduit. The seal may be any known seal, including
dynamic seals, rubber seals, elastomeric seals, seals with one fin or a plurality of fins, or metal to metal seals.

Preferably, the speed reducer apparatus comprises a wash pipe, the seal arranged between the rotor and the wash pipe and a further seal arranged between the wash pipe and the conduit.

Advantageously, the speed reducer apparatus further comprises a gear system. Preferably, the gear system comprises a planetary gear system. Advantageously, the planetary gear system comprises a primary gear wheel substantially concentric with the wash pipe and may be fixed to the rotor or rotationally fixed to the rotor. Preferably, the planetary gear system comprises at least one satellite gear wheel which meshes with the primary gear wheel. Advantageously, the at least one satellite gear wheel rotates a secondary gear wheel rotationally fixed to the wash pipe. Preferably, the wash pipe comprise splines to mesh with a gear of the gear system.

Advantageously, the seal is arranged in a seal holder. Preferably, the seal holder is fixed to the rotor. Advantageously, the seal is rotationally fixed in the seal holder. Alternatively, the seal is allowed rotate within the seal holder. Preferably, the further seal is arranged in a further seal holder. Advantageously, the further seal holder is fixed to the conduit. Preferably, the further seal is rotationally fixed in the seal holder. Alternatively, the seal is allowed rotate within the seal holder.

Preferably, the conduit comprises a gooseneck (12,102), which may be rigid or flexible. The conduit can comprise a straight piece of rigid pipe or flexible hose. Preferably, the speed reducer apparatus reduces the
rotational speed to at least 25% less than the rotor rotational speed. Advantageously, the speed reducer apparatus reduces the rotational speed to about 50% of the rotor rotational speed.

Preferably, the speed reducer apparatus has a ring housing, and a torque arrester. Preferably, the ring housing allows rotation of the washpipe and the gear system within the ring housing, advantageously on bearings. Preferably, the torque arrester is in a fixed relation to the conduit, and preferably, fixed to the further seal holder. Advantageously, the torque arrester comprises a bar. Preferably, the bar is substantially parallel to the washpipe.

The present invention also provides a method for transferring fluid from a rotor of a top drive apparatus to a non-rotating conduit, the rotor rotating at a working speed, characterised in that a seal is arranged between said rotor and a speed reducer apparatus and a further seal arranged between the speed reducer apparatus and the non-rotating conduit, the method comprising the step of the speed reducer apparatus rotating at a speed slower than the working speed, such that the seal and further seal each rotate at slower speed than the working speed.

The present invention, in certain aspects, provides a shaft sealing assembly in which an auxiliary shaft rotated by a rotating main shaft is connected to and rotates with the shaft via a speed reducer, for example, a gear drive apparatus, between the main shaft and the auxiliary shaft so that the auxiliary shaft rotates at a reduced speed compared to the speed of the main shaft, for example about one-half the main shaft speed, thus exposing seals dynamically sealing against the auxiliary
shaft to a surface which is moving at the reduced speed, thus enhancing seal life.

In one particular aspect the main shaft is the main drive shaft of a top drive used in wellbore operations, for example drilling operations, and the auxiliary shaft is in fluid communication with a washpipe through which drilling fluid or mud flows to and through the top drive apparatus.

The present invention discloses, in certain embodiments, a top drive apparatus with a drive motor; a drive quill or main shaft; a gear apparatus coupled to the drive motor; a top drive support apparatus for supporting various items; and a washpipe shaft in accordance with the present invention connected with the top drive main shaft via a speed reducer for rotation at a speed less than that of the main shaft to enhance the life of seal assemblies, for example with packings used to seal against the washpipe shaft.

Accordingly, the present invention includes features and advantages which are believed to enable it to advance top drive shaft sealing technology. Characteristics and advantages of the present invention described above and additional features and benefits will be readily apparent to those skilled in the art upon consideration of the following detailed description of preferred embodiments and referring to the accompanying drawings.

The present inventors have recognized the problems associated with the rotation of a shaft with respect to packing or seals and have realized that effective reduction of the speed of shaft rotation can enhance seal life and reduce seal wear.

By reducing the surface speed at which the seals effectively operate, the present invention extends the
service life of washpipe packing. Instead of the packing rotating at main shaft speed against a stationary washpipe, the present invention provides a speed reducing mechanism (for example, a gear drive apparatus) which rotates a washpipe shaft at, for example, one-half the speed of the main shaft, thus the washpipe packing is not subjected to the full speed of the main shaft. In one embodiment of the present invention, a similar dynamic sealing assembly is, optionally, added at the upper, formerly stationary, end of the washpipe. By rotating the washpipe shaft with the main shaft, but at a lower speed than the main shaft, for example at one-half main shaft speed, the or each of the sealing assemblies are only subjected to one-half the original surface speed (thus one half the original contact with a rotating surface), increasing the overall service life of the packing and washpipe assembly. Rotation of the washpipe shaft is driven by the main shaft through a speed reducing mechanism.
For a better understanding of the present invention, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a schematic view of a prior art drilling rig comprising a top drive drilling apparatus;

Figure 2 is a front view of a top drive apparatus comprising a washpipe apparatus in accordance with the present invention;

Figure 3 is a cross-section view of part of the apparatus shown in Figure 2;

Figure 4 is a cross-section of part of the apparatus shown in Figure 2;

Figure 4A is a schematic side cross-section view of part of the apparatus in accordance with the present invention; and

Figure 5 is an enlarged cross-section view of part of the apparatus shown in Figure 4.

Figure 1 shows a typical prior art drilling rig with a derrick DK supporting a top drive TD which rotates drill pipe DP. The top drive TD is supported from a travelling block TB beneath a crown block CB. A drawworks DS, on a rig floor RF raises and lowers the top drive on a line L. The top drive moves on a guide track GT.

Figure 2 shows a apparatus S in accordance with the present invention with a top drive 1 with a drive motor 2; a gear apparatus 3 coupled to the top drive 1 with a bearing support 4 and support links 4a; a washpipe apparatus 10 with a washpipe shaft in accordance with the present invention; an elevator load ring 5; a mud saver apparatus 9; a lower internal blowout preventer 6; a saver sub 7; a gooseneck 24; and a pipe gripper 8 with supports 8A connected to the elevator load ring 5.
As shown in Figure 3 a washpipe apparatus 10 in accordance with the present invention has a main washpipe body 12 disposed above and in fluid communication with a main shaft M of the top drive apparatus S. A washpipe shaft 70 projects into an upper packing assembly 16 and rotates with the main shaft M (but is connected to the main shaft only via a gear apparatus described below). Upper and lower packing assemblies 16 and 18 respectively, have seals which seal against the washpipe shaft 70.

Drilling mud flows through a channel 22 of the gooseneck 24 into an interior 70a of the washpipe shaft 70 and from there down a channel C through the main shaft M into the drill pipe.

Packing 15 of the upper packing assembly 16 does not rotate with the washpipe shaft 70. The outer surface of the washpipe shaft 70 rotates against the packing 15. Preferably, the packing is in a rotationally fixed relation to the gooseneck 24. The gooseneck 24 is connected to gooseneck support 25 with bolts 26. For assembly purposes a support 28 is connected to the upper packing assembly 16 with a bolt (or bolts) 32 connected to a housing 34. A bolt (or bolts) 36 connect the lower packing assembly 18 adjacent the main shaft M. Following assembly, the support 28 and the bolts 32, 36 may be removed.

A primary gear 40 is secured to and rotates with the main shaft within the housing 34. Teeth 40a on the primary gear 40 mesh with teeth 42a on planetary gears 42 which are mounted on shafts 44 of a gear carrier 46. Ball bearings 48 in a lower part 52 of the housing 34 and ball bearings 49 under an upper part 54 of the housing 34 isolate the housing 34 from the rotation of the main
shaft M, rotation of the primary gear 40, and rotation of
the planetary gears 42. A shield 62 shields items below
it from falling drilling mud and inhibits the leakage or
flow of mud from going into apparatuses below the shield
62, for example a top drive gear box.

Figures 4 and 5 show another embodiment of a
apparatus 100 in accordance with the present invention
useful as a washpipe apparatus in the apparatus S of
Figure 2. An s-pipe extension 101 is connected to a
gooseneck 102 (sometimes referred to as a washpipe
apparatus). Drilling mud flows through a channel 101a in
the s-pipe extension 101 into a channel 102a through the
gooseneck 102 down into a channel 121 of a washpipe shaft
120 and then to a channel 141 through a top drive shaft
140 driven by a top drive motor 105 (for example a
rotating shaft projecting from a top drive gear box 104
(shown in dotted line)). A connector 103 with seals 103a,
103b, connects the s-pipe extension 101 to the gooseneck
102.

An upper seal carrier 106 connected to the
gooseneck 102 houses seal assemblies 107 (which include
seal carriers and seals) which seal against an outer
surface of the washpipe shaft 120. The upper seal holder
106 maintains the top of the washpipe shaft 120 in place.

A lower seal holder 108 connected to the shaft 140 houses
seal assemblies 109 (which include seal carriers and a
seal) which seal against an outer surface of the washpipe
shaft 120. The lower seal carrier 108 maintains the
bottom of the washpipe shaft 120 in place.

A speed reducer 160 interconnected between the shaft
140 and the washpipe shaft 120 reduces the speed of the
washpipe shaft 120 as compared to the speed of the shaft
140. Thus the seals 107 and 109 seal against a shaft
(the washpipe shaft 120) rather than against the lower shaft (the top drive shaft 140) and the seals are, therefore, subjected to a shaft surface rotating at a speed less than (for example, in certain aspects, at least 25% less than, and, in other aspects about 50% less than) the speed of the lower shaft.

Ports 106p and 108p house bolts 106b, 108b, respectively, which maintain the seal assemblies 107, respectively, in place. Bolts 102b bolt the gooseneck to other structure. A torque arrester 112 is connected to the washpipe, for example to the upper seal holder 106 and to the speed reducer 160. This torque arrester 112 prevents the ring housing 164 of the speed reducer 160 from rotating with other parts of the speed reducer 160.

The ring housing 164 provides a housing for bearings and gears of the speed reducer 160. A splash shield 114 is connected to the shaft 140.

A sun gear 162 is connected to the lower seal holder 108 and rotates with the shaft 140. Planetary gears 166 (for example, but not limited to, four planetary gears) mounted on shafts 167 to a planetary gear carrier 168 mesh with and are driven by the sun gear 162. Splines 169 on the planetary gear carrier 168 mesh with corresponding splines 128 on the washpipe shaft 120 to rotatively drive the washpipe shaft 120.

The ring housing 164 houses a bearing assembly 170 with bearings 172 between the ring housing 164 and the sun gear 162. The ring housing 164 houses a bearing assembly 174 with bearings 176 between the ring gear and the planetary gear carrier 168. The sun gear and the planetary gears are sized, designed and configured to achieve a desired gear reduction to reduce the speed of the shaft 120 as compared to the speed of the shaft 140.
For example, in one particular aspect, the gears are designed so that the shaft 140 rotates twice as fast as the shaft 120. In certain prior apparatus seals (like the seals 109) were subjected to a shaft (like the shaft 140) rotating at its operational speed and seals (like the seals 107) were held stationary. The seals (like two seals 107; and the seals 109) in apparatus in accordance with the present invention are now subjected to a shaft rotating at a much lower speed.

Figure 4A shows schematically a apparatus 200 in accordance with the present invention in which a washpipe shaft 202 connected to a washpipe 204 is interconnected via a speed reduction device 206 to a rotatable top drive shaft 208. Seals 211, 212 seal against the washpipe shaft 202. Both seals are subjected to a surface of the washpipe shaft 202 against which they seal that is rotating at a speed less than the rotational speed of the top drive shaft 208. The seals 211 are in a seal holder 218 connected to the washpipe 204. Although the seals 212 are connected to a lower seal holder 214 that is connected to the top drive shaft 208, the seals 212 only "see" a surface speed of the washpipe shaft 202 which is less than that of the top drive shaft 208 since the washpipe shaft 202 and the top drive shaft 208 are rotating in the same direction. The speed reduction device 206 may be any suitable speed reducer, including, but not limited to, a gear apparatus.

The present invention, therefore, provides in at least certain embodiments, a top drive apparatus for wellbore operations, the top drive apparatus having: a main shaft with a main shaft channel therethrough; drive apparatus for rotating the main shaft at a main shaft speed; a speed reducer apparatus connected to the main
shaft; a washpipe shaft connected to the speed reducer apparatus so that the washpipe shaft is rotatable by the speed reducer apparatus at a washpipe shaft speed less than the main shaft speed; the washpipe shaft having a top end and a bottom end, and a washpipe shaft channel therethrough; a washpipe having a washpipe channel therethrough, the washpipe shaft channel in fluid communication with the washpipe channel; the washpipe shaft channel in fluid communication with the main shaft channel; a first seal holder connected to the washpipe and holding first seal assemblies for sealing against the top end of the washpipe shaft; and a second seal holder connected to the main shaft and holding second seal assemblies for sealing against the second end of the washpipe. Such a apparatus may have one or some, in any possible combination, of the following: the speed reducer apparatus reducing the washpipe shaft speed to at least 25% less than the main shaft speed; the speed reducer apparatus reducing the washpipe shaft speed to about 50% of the main shaft speed; the speed reducer apparatus is a gear apparatus including first gear apparatus connected to the main shaft and second gear apparatus connected to the washpipe shaft, the first gear apparatus for driving the second gear apparatus; the first gear apparatus includes a first gear, the second gear apparatus includes a plurality of second gears, and the first gear drives the plurality of second gears to rotate the washpipe shaft; the speed reducer apparatus having a ring housing, and a torque arrester connected to the ring housing and to the washpipe; wherein the torque arrester is connected to the first seal holder which is connected to the washpipe; and/or wherein the drive apparatus includes a top drive motor and a top drive gear apparatus driven by
The present invention, therefore, provides in at least certain embodiments, a top drive apparatus for wellbore operations, the top drive apparatus having: a main shaft with a main shaft channel therethrough; drive apparatus for rotating the main shaft at a main shaft speed; a speed reducer apparatus connected to the main shaft; a washpipe shaft connected to the speed reducer apparatus so that the washpipe shaft is rotatable by the speed reducer apparatus at a washpipe shaft speed less than the main shaft speed; the washpipe shaft having a top end and a bottom end, and a washpipe shaft channel therethrough; a washpipe having a washpipe channel therethrough, the washpipe shaft channel in fluid communication with the washpipe channel; the washpipe shaft channel in fluid communication with the main shaft channel; a first seal holder connected to the washpipe and holding first seal assemblies for sealing against the top end of the washpipe shaft; a second seal holder connected to the main shaft and holding second seal assemblies for sealing against the second end of the washpipe; the speed reducer apparatus reduces the washpipe shaft speed to about 50% of the main shaft speed; the speed reducer apparatus is a gear apparatus including first gear apparatus connected to the main shaft and second gear apparatus connected to the washpipe shaft; the first gear apparatus for driving the second gear apparatus; and the drive apparatus includes a top drive motor and a top drive gear apparatus driven by the top drive motor.

The present invention, therefore, provides in at least certain embodiments, a method for dynamically sealing a drive shaft of a top drive apparatus, the top
drive apparatus suitable for wellbore operations, the
method including: rotating a washpipe shaft of a top
drive apparatus; sealing against a top end and a bottom
end of the washpipe shaft, the washpipe shaft being part
of the top drive apparatus, the top drive apparatus
having a main shaft with a main shaft channel
therethrough, drive apparatus for rotating the main shaft
at a main shaft speed, a speed reducer apparatus
connected to the main shaft, a washpipe shaft connected
to the speed reducer apparatus so that the washpipe shaft
is rotatable by the speed reducer apparatus at a washpipe
shaft speed less than the main shaft speed, the washpipe
shaft having a top end and a bottom end, and a washpipe
shaft channel therethrough, a washpipe having a washpipe
channel therethrough, the washpipe shaft channel in fluid
communication with the washpipe channel, the washpipe
shaft channel in fluid communication with the main shaft
channel, a first seal holder connected to the washpipe
and holding first seal assemblies for dynamically sealing
against the top end of the washpipe shaft, a second seal
holder connected to the main shaft and holding second
seal assemblies for dynamically sealing against the
second end of the washpipe, and rotating the washpipe
shaft at a speed less than the speed of the main shaft;
wherein the washpipe shaft speed is at least 25% less
than the main shaft speed; wherein the washpipe shaft
speed is about 50% of the main shaft speed; wherein the
speed reducer apparatus is a gear apparatus including
first gear apparatus connected to the main shaft and
second gear apparatus connected to the washpipe shaft,
and the first gear apparatus for driving the second gear
apparatus, the method further including: driving the
second gear apparatus with the first gear apparatus;
wherein the first gear apparatus includes a first gear, the second gear apparatus includes a plurality of second gears, and the first gear is for driving the plurality of second gears to rotate the washpipe shaft, the method further including: driving the plurality of second gears with the first gear to rotate the washpipe apparatus; wherein the speed reducer apparatus has a ring housing, and a torque arrester connected to the ring housing and to the washpipe; wherein the drive apparatus includes a top drive motor and a top drive gear apparatus driven by the top drive motor, the method further including driving the top drive gear apparatus with the top drive motor, and driving the main shaft with the top drive gear apparatus.

The present invention, therefore, provides in at least certain embodiments, a top drive shaft apparatus including: a main shaft with a main shaft channel therethrough; drive apparatus for rotating the main shaft at a main shaft speed; a speed reducer apparatus connected to the main shaft; a washpipe shaft connected to the speed reducer so that the washpipe shaft is rotatable by the speed reducer apparatus at a washpipe shaft speed less than the main shaft speed; the washpipe shaft having a top end and a bottom end, and a washpipe shaft channel therethrough; a washpipe having a washpipe channel therethrough, the washpipe shaft channel in fluid communication with the washpipe channel; and the washpipe shaft channel in fluid communication with the main shaft channel. Such a apparatus may have one or some, in any possible combination, of the following: a first seal holder connected to the washpipe and holding first seal assemblies for sealing against the top end of the washpipe shaft, and a second seal holder connected to the
main shaft and holding second seal assemblies for sealing against the second end of the washpipe; wherein the speed reducer apparatus reduces the washpipe shaft speed to at least 25% less than the main shaft speed; and/or wherein the speed reducer apparatus reduces the washpipe shaft speed to about 50% of the main shaft speed; and/or the speed reducer apparatus having a ring housing, and a torque arrester connected to the ring housing and to the washpipe.

The present invention, therefore, provides in at least certain embodiments, a drive shaft apparatus including: a main shaft with a main shaft channel therethrough; drive apparatus for rotating the main shaft at a main shaft speed; a speed reducer apparatus connected to the main shaft; a secondary shaft connected to the speed reducer apparatus so that the secondary shaft is rotatable by the speed reducer apparatus at a secondary shaft speed less than the main shaft speed; the secondary shaft having a top end and a bottom end, and a secondary shaft channel therethrough; a pipe having a pipe channel therethrough, the secondary shaft channel in fluid communication with the pipe channel; the secondary shaft channel in fluid communication with the main shaft channel; first sealing apparatus for sealingly contacting the secondary shaft for sealing a main-shaft secondary-shaft interface; and second sealing apparatus for sealingly contacting a secondary-shaft-pipe interface.

In this document, the word "comprising" is used in its non-limiting sense to mean that items following the word are including, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the
context clearly requires that there be one and only one of the elements.
1. A top drive apparatus for wellbore operations, the top drive apparatus comprising a rotor (M, 140) with a bore (C, 141) for the passage of fluid therethrough, drive apparatus for rotating the rotor (M, 140) at a working speed, and a non-rotating conduit (12, 101, 102) in fluid communication with the rotor characterised in that the top drive apparatus further comprises a speed reducer apparatus (10, 160) connected between said rotor (M, 140) and said conduit (12, 101, 102), a seal (19, 109) arranged between the rotor (M, 140) and the speed reducer apparatus (10, 160) and a further seal (15, 107) arranged between the speed reducer apparatus (10, 160) and the conduit (12, 101, 102).

2. A top drive apparatus as claimed in Claim 1, wherein said speed reducer apparatus (10, 160) comprises a wash pipe (70, 120), said seal (19, 109) arranged between said wash pipe (70, 120) and a further seal (15, 107) arranged between said wash pipe (70, 120) and said conduit (12, 101, 102).

3. A top drive apparatus as claimed in Claim 2, wherein said speed reducer apparatus (10, 160) further comprises a gear system (40, 42, 42a, 162, 166).

4. A top drive as claimed in Claim 3, wherein said gear system (40, 42, 42a, 162, 166) comprises a planetary gear system (40, 42, 42a, 162, 166).

5. A top drive apparatus as claimed in Claim 4, wherein said planetary gear system (40, 42, 42a, 162, 166) comprises a primary gear wheel (40, 162) substantially concentric with said wash pipe (70, 120).

6. A top drive apparatus as claimed in Claim 5, wherein said planetary gear system (40, 42) comprises at least one satellite gear wheel (42a, 166) which meshes
with said primary gear wheel.

7. A top drive apparatus as claimed in Claim 6, wherein said at least one satellite gear wheel \((M,140)\) rotates a secondary gear wheel \((46)\) rotationally fixed to said washpipe \((70,120)\).

8. A top drive apparatus as claimed in any one of Claims 3 to 7, wherein said wash pipe \((70,120)\) comprise splines \((128)\) to mesh with a gear of said gear system \((40,42,42a,162,166)\).

9. A top drive apparatus as claimed in any preceding claim, wherein said seal \((19,109)\) is arranged in a seal holder \((52,108)\).

10. A top drive apparatus as claimed in Claim 9, wherein said seal holder \((52,108)\) is fixed to said rotor \((M,140)\).

11. A top drive apparatus as claimed in Claim 10, wherein said seal is rotationally fixed in said seal holder \((52,108)\).

12. A top drive apparatus as claimed in any preceding claim, wherein said further seal \((15,107)\) is arranged in a further seal holder \((16,106)\).

13. A top drive apparatus as claimed in Claim 12, wherein said further seal holder \((16,106)\) is fixed to said conduit \((12,101,102)\).

14. A top drive apparatus as claimed in Claim 13, wherein said further seal \((15,107)\) is rotationally fixed in said seal holder \((16,106)\).

15. A top drive apparatus as claimed in any preceding claim, wherein said conduit \((12,101,102)\) comprises a gooseneck \((12,102)\).

16. A top drive apparatus as claimed in any preceding claim, wherein the speed reducer apparatus \((10,160)\) reduces the rotational speed to at least 25% less than the rotor rotational speed.
17. A top drive apparatus as claimed in any preceding claim, wherein the speed reducer apparatus (10,160) reduces the rotational speed to about 50% of the rotor rotational speed.

18. A top drive apparatus as claimed in any preceding claim, wherein the speed reducer apparatus (10,160) having a ring housing (52,164), and a torque arrester (28).

19. A method for transferring fluid from a rotor (M,140) of a top drive apparatus to a non-rotating conduit (12,101,102), the rotor (M,140) rotating at a working speed, characterised in that a seal (19,109) is arranged between said rotor (M,140) and a speed reducer apparatus (10,160) and a further seal (15,107) arranged between the speed reducer apparatus (10) and the non-rotating conduit (12,101,102), the method comprising the step of the speed reducer apparatus (10,160) rotating at a speed slower than the working speed, such that the seal (19,109) and further seal (15,107) each rotate at slower speed than the working speed.

20. A method in accordance with Claim 19, wherein said speed reducer apparatus (10) comprises a washpipe (70,120) and a gear system (40,42,42a,162,166).
**INTERNATIONAL SEARCH REPORT**

**PCT/GB2008/050112**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. E21B3/02

According to International Patent Classification (IPC) onto both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>US 4 984 641 A (PRYOR DALE H [US]) 15 January 1991 (1991-01-15) column 5, lines 28-36; claims 10,16; figures 1-6 the whole document</td>
<td>1-20</td>
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<td>A</td>
<td>EP 1 752 607 A (VARCO INT [US]) 14 February 2007 (2007-02-14) figures 8,10</td>
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<td>WO 2005/121493 A (VARCO INT [US]; FOLK ROBERT ALDEN [CA]; FOLK STEVEN LORNE [CA]; LUCAS) 22 December 2005 (2005-12-22) figures 4,15,34</td>
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**Date of the actual completion of the International search**
24 June 2008

**Date of mailing of the international search report**
01/07/2008

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