APPARATUS AND METHOD FOR MAKING UP AND BREAKING OUT THREADED CONNECTIONS OF DRILL BITS AND BOTTOMHOLE COMPONENTS

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ABSTRACT
An apparatus and method for making up and breaking out the threaded connection of a drill bit and bottomhole assembly away from a drilling rig wellbore. The apparatus includes a housing structure adapted for reassemble securing a drill bit and thereby preventing rotation of the drill bit during make up or break out of the drill bit and a bottomhole component. A back up wrench positions and grips the housing structure having the drill bit reassemble secured therein and a torque wrench applies torque to the bottomhole component to make up or break out the connection therebetween.
APPARATUS AND METHOD FOR MAKING UP AND BREAKING OUT THREADED CONNECTIONS OF DRILL BITS AND BOTTOMHOLE COMPONENTS

FIELD OF INVENTION

[0001] The present application relates generally to an apparatus and method for connecting or disconnecting a drill bit and a bottomhole component using a bit breaker. The apparatus is adapted for use with conventional bit breakers. The method and apparatus is adapted to make up and break out drill bits oriented in a horizontal mode away from the drilling rig without the usual need for a rotary table of a conventional drilling rig designed for make up and break out of drill bits oriented in a vertical mode over a drilling rig wellbore. By eliminating the need for a rig rotary table in order to perform drill bit make up and break out operations, drilling rig equipment and rig personnel can be used for other more cost-effective purposes.

RELATED APPLICATION

[0002] The present application includes structure that relates to another patent application by Applicant entitled “Apparatus and Method for Assembling and Disassembling Downhole Components in a Horizontal Mode.”

BACKGROUND OF THE INVENTION

[0003] It is well known in the oil and gas industry to use a conventional drilling rig with a rotary table, in conjunction with a bit breaker, to make up or break out a drill bit and bottomhole component such as a drill collar or the like. With conventional drilling systems, drill bit joints are typically made up or broken out by first detachably mounting a bit breaker around the bit. A bit breaker typically has a specially contoured opening for receiving the bit and securing it in place.

[0004] Bit breakers are generally designed for use with two types of drill bits as shown in FIGS. 5 and 7: roller-cone bits 30 and fixed-cutter bits 31. Of course, other types of bit breakers may also be available in the industry (e.g., for drag bits). Drill bits vary in size and configuration and bit breakers are sized accordingly to securely a given drill bit within the bit breaker as necessary. Bit breakers 38 used with roller-cone bits typically have a box-shaped configuration as shown in FIG. 6. The bit breaker generally includes a latch or gate 39 to fixedly hold the drill bit 30 within the bit breaker 38. For example, FIG. 6 shows a roller-cone bit 30 detachably mounted within a bit breaker 38 with the gate 39 closed to secure the bit for make up or breakout operations. FIGS. 7 and 8 show a fixed-cutter 31 and bit breaker plate 40 which may be used to secure shank slots 70, 72, 74, 76 on the fixed-cutter bit to prevent it from rotating when torque is applied.

[0005] During conventional make up and break out operations, a suitable bit breaker is chosen and inserted into an opening in the drilling rig rotary table. The drill bit is inserted into and secured within the bit breaker. The rotary table secures the bit breaker and keeps it (and the drill bit) from rotating when torque is applied to the collar.

[0006] Conventional methods and devices require that the bit breaker be inserted into the rotary table such that the bit breaker lies flat. In this way, the central axis of the drill bit is positioned vertically for subsequent mating with the drill collar suspended vertically above the rotary table.

[0007] Due to extremely high torque (e.g., up to 60,000 ft-lbs) needed to properly make up or break out a bit and collar, various on-site drilling rig equipment and numerous rig personnel are required. To accomplish this, a number of workers must operate various rig systems including the elevator, top drive, power tongs, rotary table, etc. When using conventional drilling rig equipment, make up and break out operations are accomplished in a vertical mode above or near the wellbore. That is, the drill collar, which is typically very heavy, must be handled using the drilling rig and power tongs—while the heavy-duty the collar is suspended above the rotary table.

[0008] When making up or breaking out the drill collar and bit, power tongs are used to carefully support and manipulate the heavy drill collar above the drill bit pin to align and mate, or break out, the threaded box of the collar and the threaded pin of the drill bit.

[0009] Clearly, the use of drilling rig equipment and the rotary table for these tasks can be time consuming and reduce the cost effectiveness of the overall drilling operation. In addition, using rig equipment to apply torques of up to 60,000 ft-lbs for make up and break out operations can not only wear down and cause breakage of the equipment but also create potentially dangerous situations.

[0010] There have been various devices adapted for make up and break out of a bit and collar in a vertical mode using rig equipment. Several examples are listed below:


[0012] U.S. Pat. No. 4,924,954 to Mead, entitled “Bit Breakout System”

[0013] U.S. Pat. No. 4,352,399 to Davis, entitled “Bit Breaker and Handle”

[0014] U.S. Pat. No. 4,495,840 to Freitag et al. entitled “Bit Breaker”

[0015] There also have been devices adapted for make up and break out in a horizontal orientation. Several examples include:


[0017] However, conventional devices used for making up or breaking out operations in a horizontal mode do not include heavy-duty bit adapters configured for high-torque applications. Also, special structures are needed to secure the various types of roller-cone and fixed-cove bit breakers when oriented vertically so as to orient the bit axis horizontally as opposed to lying flat in a rotary table. That is, in a horizontal mode, the drill bit needs to be fixedly secured in a vertically oriented bit breaker such that the central axis of the bit extends horizontally to enable proper make up or breakout with a horizontally oriented drill collar.
The oil and gas drill industry has a continuing need for an apparatus and method of more cost-effectively making up and breaking out drill bits and bottomhole components such as collars in such a way as to minimize or eliminate the need for on-site drilling rig equipment and rig personnel to engage in time consuming and potentially hazardous drill bit assembly and disassembly operations.

**BRIEF DESCRIPTION OF DRAWINGS**

For a further understanding of the nature of the present disclosure, reference should be had to the following brief description of the drawings, wherein:

**FIG. 1** is a perspective, isometric view of an apparatus according to the disclosure for make up and break out of a horizontally oriented drill bit and bottomhole component;

**FIG. 2** is a perspective, isometric view of a bit housing of the apparatus according to FIG. 1;

**FIG. 3** is an elevated side view, partially cut away, of a back up wrench and control panel of the apparatus according to FIG. 1;

**FIG. 4** is a fragmentary isometric, perspective view of the apparatus according to the disclosure, with a torque wrench partially cut away, and showing a made up drill bit and bottomhole component in position before break out of same;

**FIG. 5** is a perspective, isometric view of a roller-cone drill bit not yet connected to a bottomhole component;

**FIG. 6** is a perspective, isometric view of the roller-cone drill bit (shown in FIG. 5) releasably secured within a roller-cone bit breaker;

**FIG. 7** is a perspective, isometric of a view fixed-cutter drill bit not yet connected to a bottomhole component;

**FIG. 8** is a perspective, isometric view of a fixed-cutter bit breaker before a fixed-cutter bit is releasably secured in the fixed-cutter bit breaker;

**FIG. 9** is a fragmentary isometric, perspective view of the apparatus according to the disclosure, with a torque wrench partially cut away, and showing the bottomhole component broken out from the drill bit and moved away from the bit housing;

**FIG. 10** is an elevated side view of the bit housing having a roller-cone bit adapter of different sizes at either end;

**FIG. 11** is an elevated side view of the bit housing having a fixed-cutter bit adapter of different sizes at either end; and

**FIG. 12** is an elevated side view of a wrench cylinder of the torque wrench.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

Referring now to the drawings in more detail, FIGS. 1 and 2 illustrate an apparatus 10 configured for use in making up or breaking out a threaded connection of a drill bit and bottomhole component. The bottomhole component may be, for example, a drill collar or other drill string component.

The apparatus 10 is configured for heavy-duty make up and break out operations at a location which is away from the drilling rig wellbore without the need for a conventional rotary table which performs these operations in a vertical mode.

That is, due to the extremely high torque (e.g., ranging up to 60,000 ft-lbs) needed to properly make up and break out drill bits, drilling systems typically require use of the durably-built rotary table capable of withstanding high-torque drill bit assembly and disassembly applications. The rotary table requires these operations be performed in a vertical mode with the drill bit and bottomhole component oriented vertically over the rig rotary table and wellbore.

In the preferred embodiment, the apparatus 10 is ruggedly configured to handle heavy-duty drill bits and collars or other bottomhole components. The apparatus 10 is adapted for applying high torque to a threaded connection of a bit and collar to make up or break out same.

The apparatus 10 also preferably has a transportable configuration. With such a configuration, drill bit make out/break out operations can be performed using the apparatus 10 at a more convenient location thus avoiding the need for use of expensive onsite rig equipment and personnel. In this way, the rig crew is not burdened with the time consuming and potentially dangerous task of using the drilling rig equipment to engage in onsite operations requiring the use of high-torque equipment necessary for make up and break out operations.

In the preferred embodiment of the present disclosure, the apparatus 10 includes a movable back up wrench 12 and a torque wrench 14 (i.e., working wrench), both of which are mounted to a base frame 16. The apparatus 10 further preferably includes a housing structure 18 adapted to be supported by the movable back up wrench 12. The base frame 16 preferably has a plurality of adjustable members 22, 24, 26, 28 to foster leveling the apparatus 10.

As shown in FIG. 3, the apparatus 10 further includes a control panel 20 to operate the wrenches and apparatus 10 as necessary. The control panel 20 is configured with controls, gauges, and indicators as suitable for operation of the apparatus 10. The control panel 20 is preferably mounted to the base frame 16 but may be remotely located for ease of use. The control panel 20 also includes electrical and hydraulic circuitry as necessary for operation. The apparatus 10 requires suitable electrical and hydraulic power sources (not shown) for operation of the associated circuits and structures of the apparatus 10.

Referring now to FIG. 4, the apparatus 10 is configured for make up and break out operations of a drill bit 30 and bottomhole component 32 such as a collar, with the bit 30 and collar 32 having a preferably horizontal orientation as opposed to vertically oriented rotary table operations. In this way, the central axes 10a, 30a, 32a of the apparatus 10, bit 30, and collar 32, respectively, are not only oriented horizontally but also axially aligned. That is, the apparatus 10 is adapted for positioning and manipulating a tubular drill bit 30 and bottomhole component 32, each having a central axis 10a, 30a, such that they are coaxial with the central axis.
of the apparatus 10 during make up and break out operations with the central axis 10\(a\) preferably being oriented horizontally.

[0040] The housing structure 18, referred to hereinafter as the bit housing 18, is adapted to releasably secure a drill bit 30 such that rotation of the drill bit 30 is prevented when torque is applied to the bottomhole component 32 by the torque wrench 14 during bit make up or break out operations. That is, the torque wrench 14 is configured for gripping a collar 32 (or other bottomhole component) and applying torque thereto to make up or break out a threaded connection of the drill bit 30 and collar 32.

[0041] The bit housing 18 has at least one and preferably two functional ends configured to releasably secure a drill bit 30 with the bit housing 18 being positioned in a suitable orientation by the back up wrench 12. In this way, the drill bit 30, having a central axis 30\(a\), is insertable into a selected functional end such that the drill bit 30 is also secured in the selected suitable orientation—which is preferably horizontal.

[0042] In the preferred embodiment of the present disclosure, the first functional end 34 of the bit housing 18 is adapted to detachably mount a first bit breaker 38, and the second functional end 36 is adapted to detachably mount a second bit breaker 40, whereby a drill bit 30 insertable into a selected bit breaker is releasably secured in a horizontal mode and is prevented from rotating such that the threaded connection of the drill bit 30 and bottomhole component 32 may be made up or broken out when torque is applied to the bottomhole component 32 by the torque wrench 14.

[0043] The dual-ended bit housing 18 preferably has a first functional end 34 configured to releasably secure a roller-cone drill bit 30 and a second functional end 36 configured to releasably secure a fixed-cutter drill bit 30. FIGS. 5 and 7 show a typical roller-cone drill bit 30 and fixed-cutter drill bit 31, respectively. It should be appreciated that the functional ends 34, 36 may vary in size, shape, and configuration to correspondingly accommodate drill bits of various sizes, shapes, configurations or types as suitable. Of course, a person of ordinary skill in the art would understand that the functional ends could be adapted to detachably mount any other type of bit such as drag bits, etc.

[0044] Referring again to FIGS. 2 and 4, the bit housing 18 is sized and configured to releasably secure a variety of drill bits (e.g., rock drill bits, diamond drill bits, drag bits, etc.). The bit housing 18 is preferably modular and is comprised of a roller-cone bit adapter 34, fixed-cutter bit adapter 36, an intermediate sleeve 42, and first and second spacers 44, 46. The intermediate sleeve 42 and spacers 44, 46 are configured for connecting together in a spaced relationship the roller-cone bit adapter 34 and the fixed-cutter bit adapter 36 with the adaptors 34, 36 preferably being disposed at opposite ends of the intermediate sleeve 42. In this way, the bit housing 18 has dual-ended configuration which fosters readily switching between operations requiring use of a roller-cone bit adapter 34 to operations requiring use of a fixed-cutter bit adapter 36—or between operations using the same types of bit but of different sizes.

[0045] In the preferred embodiment of the present disclosure, the first functional end 34, or roller-cone bit adapter 34, is adapted to detachably mount a first bit breaker 38 as shown in FIG. 4. The second functional end 36, or fixed-cutter bit adapter 36, is adapted to detachably mount a second bit breaker 40 (See FIGS. 4 and 8). With this configuration, a drill bit insertable into a selected bit breaker may be releasably secured in a horizontal mode and prevented from rotating such that the threaded connection of the drill bit 30 and a bottomhole component 32 may be made up or broken out when torque is applied by the torque wrench 14 to the bottomhole component 32.

[0046] The roller-cone bit adapter 34 preferably comprises a bit box 52 fixedly attached to a cylindrical chamber 48. The adapter 34 is configured to receive a roller-cone bit breaker 38. Again, FIG. 5 shows a roller-cone drill bit 30. FIG. 6 shows the roller-cone bit releasably secured in a bit breaker 38. The bit breaker 38 includes a latchable gate 39.

[0047] The bit box 52 shown in FIG. 4 is ideally configured to detachably mount a roller-cone bit breaker 38 with the bit breaker 38 releasably securing the roller-cone bit 30 to prevent rotation thereof during make up or break out operations. The bit box 52 preferably has latching structures 56, 58, 60, 62 for detachably mounting the bit breaker via the handles 64, 66. The adapter chamber 48 is preferably hollow and configured to receive at least a portion of the roller-cone bit 30 releasably secured within the roller-cone bit breaker 38. The roller-cone bit adapter 34 ideally further comprises a first spacer 44 fixedly attached to the intermediate sleeve 42.

[0048] Looking now to the second functional end, the fixed-cutter bit adapter 36 preferably comprises a bit plate 54 fixedly attached to an elongated cylindrical chamber 50 (See FIGS. 7 and 8). The adapter 36 is configured to receive a fixed-cutter bit breaker 40. FIG. 7 shows a fixed-cutter bit 31. FIG. 8 shows a fixed-cutter bit 40 adapted to releasably secure a fixed-cutter bit 31. The fixed-cutter bit breaker 40 preferably has a latchable gate 68 configured to secure the fixed-cutter bit 31 with the bit breaker 40 by the shank slots 70, 72, 74, 76 (FIGS. 4, 7, and 8). The shank slots 70, 72, 74, 76 are arranged to engage the interior of the fixed-cutter bit breaker 40. The bit breaker 40 has four pins 78, 80, 82, 84 which mate into four corresponding holes 80\(a\), 82\(a\), 84\(a\) in the bit plate 54.

[0049] The bit plate 54 is ideally configured to detachably mount a fixed-cutter bit breaker 40 with the bit breaker releasably securing the fixed-cutter bit 31 to prevent rotation thereof during make up or break out operations. As shown in FIGS. 2 and 4, the bit plate 54 preferably has latching structures 86, 88, 90, 92 for detachably mounting the bit breaker 40 via the handles 94, 96. (See FIG. 8). The elongated cylindrical chamber 50 is preferably hollow and configured to receive at least a portion of the fixed-cutter bit 31 releasably secured within the fixed-cutter bit breaker 40. As with the adapter 34, the fixed-cutter bit adapter 36 ideally also further comprises a second spacer 46 fixedly attached to the intermediate sleeve 42.

[0050] In the preferred embodiment, the bit housing 18 is modular in that the roller-cone bit adapter 34, fixed-cutter bit adapter 36, and intermediate sleeve 42, are preferably threadably coupled with each other and thus separable. The first and second spacers 44, 46 are ideally fixedly attached to their respective adaptors 34, 36.
In an alternate embodiment, the spacers 44, 46 may be threadably coupled to their respective adapters 34, 36 as well as the sleeve 42 to further foster modularity as well as interchangeability. The intermediate sleeve 42 is preferably configured for use in suspending or supporting the bit housing 18. A hoisting member 43 is ideally fixedly attached to the intermediate sleeve 42. The hoisting member 43 is preferably centrally positioned on the intermediate sleeve 42. In this way, the hoisting member 43 and sleeve 42 combination are configured together such that the bit housing 18 is generally counterbalanced in a horizontal orientation when suspended using the hoisting member 43 or alternately supported using the intermediate sleeve 42. In view of the need for a heavy-duty bit housing capable of withstanding high-torque make up/break out applications, the bit housing 18 preferably is variously configurable to have a sufficient size to accommodate large and hefty drill bits. That is, as shown in FIG. 10, larger drill bit adapters can be attached to the intermediate sleeve 42 to accommodate larger drill bits. Also, the sleeve 42 can be configured in various sizes for light or heavy duty applications. In addition, the modular dual-ended design fosters handling, transporting, suspending, positioning, and/or supporting a larger bit housing. That is, with the preferable dual-ended configuration, the bit housing 18 can generally be more easily counterbalanced to facilitate hoisting and positioning the bit housing 18 in the back up wrench 12 for make up/break out operations.

In another alternative embodiment, the spacers 44, 46 may have varying lengths, strengths, and weights. Spacers having a specified length and weight may be used as necessary to help assemble a more counterbalanced bit housing 18 to further improve handling.

It should also be appreciated, that the bit housing 18 can be modularly and/or interchangeably configured with a suitable size and height to help resist rotation when torque is applied to a threaded connection of the bottom hole component 32 and drill bit 30.

In the alternate embodiment, as shown in FIGS. 10 and 11, the bit housing 18 has variously configured ends such that the first end 34, 36 is adapted to receive a drill bit of one size or configuration and the second end 34', 36' is adapted to receive a drill bit of a different size or configuration from the first end 34, 36. For example, the first end may be adapted to accommodate a bit breaker sized for a rock bit with a 4.5-inch pin size while the second end may be adapted to accommodate a bit breaker sized for a rock bit with a 7.875-inch pin size. As explained before, the spacers 44, 44', 45, 45' used at either end may also be selected as suitable to compensate for the differing weights of the bit breakers mounted at either end so as to maintain a generally counterbalanced bit housing 18 to foster ease of handling.

Referring now to FIGS. 1, 3, 4, and 9, the back up wrench 12 preferably has a throat 13 with a central axis 12c oriented in a horizontal mode. The back up wrench 12 is configured to grip and position the bit housing 18 with the back up wrench 12 gripping the bit housing 18 coaxially such that a drill bit 30, releasably secured in the bit housing 18, is also oriented in a horizontal mode. In this way, the back up wrench 12 fixedly holds the bit housing 18 with a first grip pressure such that the bit housing 18 is prevented from rotating about its axis 18a when torque is applied.

As shown in FIGS. 3 and 4, the back up wrench 12 also preferably includes a plurality of gripping assemblies 98, 100, 102 adapted to move inwardly and outwardly for gripping and releasing the bit housing 18. The gripping assemblies 98, 100, 102 are ideally arranged circumferentially around and are equidistant from the central axis 12a of the throat 13.

Referring now to FIGS. 1, 4 and 12, the torque wrench 14 also preferably has a throat 15 with a central axis 14a oriented in a horizontal mode and includes a wrench cylinder 112 and wrench frame 114. The torque wrench 14 is configured to grip and apply torque to the bottom hole component 32 such that the bottom hole component 32 is gripped with a second grip pressure by the torque wrench 14. In this way, the drill bit 30, which is in turn fixedly held in the bit housing 18, has a central axis 30a which is axially aligned—preferably in a horizontal mode—with the bit housing 18, bottom hole component 32, and torque wrench 14. With this configuration, the torque wrench 14 can be actuated to properly apply sufficient torque to make up or break out the threaded connection of the bottom hole component 32 and drill bit 30.

The torque wrench 14 also preferably includes a plurality of gripping assemblies 104, 106, 108 adapted to move inwardly and outwardly for gripping and releasing the bottom hole component 32. The gripping assemblies 104, 106, 108 are ideally arranged circumferentially around and are equidistant from the central axis 14a of the torque wrench throat 15.

As shown in FIGS. 1 and 4, the wrench cylinder 112 is preferably rotatably mounted to the wrench frame 114 which is in turn preferably fixedly mounted to the base frame 16. The wrench frame 114 also includes a hydraulic control member 116. The control member 116 preferably includes a hydraulic piston/cylinder combination 118 used to rotate the wrench cylinder 112 with respect to the wrench frame 114 to apply torque to a bottom hole component 32, as gripped by the gripping assemblies 104, 106, 108 during make up and break out. The wrench frame 114 preferably includes a plurality of bearing members 120, 122, 124, 126 spaced circumferentially around the frame 114 to foster respective rotation of the wrench cylinder 112.

As shown in FIG. 12, the wrench cylinder 112 includes preferably two apertures 128, 130 and a pin 132. With the control member 116 in the proper position, the pin 132 is inserted into the make up aperture 128 to configure the torque wrench 14 for make up torque and into the break out aperture 130 for break out torque.

The back up wrench 12 is ideally movably mounted with respect to the torque wrench 14 and includes a carriage structure 140. Referring again to FIGS. 3 and 4, the back up wrench 12 preferably has first and second side walls 142, 144 with a plurality of gears 146, 148, 150 rotatably mounted to the first wall 142 and a plurality of gears 152, 154, 156 rotatably mounted to second side wall 144. The carriage structure 140 is mounted to the base frame 16 and preferably has two horizontally extending tracks 158, 160 such that the plurality of gears 146, 148, 150 and 152, 154, 156 are positioned to rotatably engage the tracks 158, 160, respectively.

The back up wrench 12 also preferably includes a control structure 134 having a control wheel 136 and gear 138 also adapted to rotatably engage the track 160.
In this way, the back up wrench 12 may be translated axially with respect to the torque wrench 14 to foster detachable mounting of a selected bit adapter with, for example, a drill bit breaker 38 having a drill bit 30 releasably secured therein prior to actual make up or break out.

It should also be recognized that the apparatus 10 may be used to assemble or disassemble the preferably modularly configured bit housing 18 to re-config the bit housing 18 as suitable with functional ends as desired. That is, with the sleeve 42 and spacers 44, 46 being threadably connectable, the back up wrench 12 may be used to grip the sleeve 42, and the torque wrench 14 may be used to grip the spacer portion of a selected bit adapter in such a way that the sleeve 42 and spacer of the bit adapter may be made up or broken out.

In addition, the preferred embodiment of the present disclosure further includes a circuit (not shown) to control and actuate the back up wrench 12 so as to selectively grip, with a first grip pressure, the bit housing 18. The circuit also controls the torque wrench 14 so as to selectively grip, with a second grip pressure, the bottomhole component 32 and apply torque thereto to make up or break out the threaded connection of the bottomhole component 32 and drill bit 30.

Moreover, as illustrated in FIG. 1, the back up wrench 12 and torque wrench 14 both preferably include hydraulic conduits (e.g., items 162, 163, 164) and structures as necessary to actuate, via hydraulic pressure, the gripping assemblies 98, 100, 102 and 104, 106, 108. The torque wrench 14 ideally includes a hydraulic piston/cylinder combination 118 to actuate the control arm used for make up or break out operations.

In addition, one of ordinary skill in the art would understand that in an alternate embodiment, the apparatus 10 could be oriented or inclined at an angle, in a non-horizontal mode, to foster ease of bit and component axial translation or the like by using jack systems, ramps, tilting mechanisms or other means for orienting the apparatus 10. Moreover, the leveling members 22, 24, 26, 28 could be further modified such that they could be used to incline apparatus 10 to a selected suitable orientation.

In another alternate embodiment, the apparatus 10 further comprises at least one conventional spinner, as would be known to a person of ordinary skill in the art, with the spinner configured for being aligned with the central axis 32a of the bottomhole component 32 and/or torque wrench central axis 14a. The spinner preferably has at least two cylindrical members adapted to selectively rotate the bottomhole component 32 with respect to the drill bit 30 to foster more efficient making up or breaking out of the threaded connection. In addition, the apparatus 10 also preferably further comprises at least one conventional support platform to support at least one bottomhole component 32 to facilitate supporting the bottomhole component 32 or alignment thereof with the torque wrench central axis 14a during make up or breakout operations. This is especially advantageous during a break out operation to help support the broken out bottomhole component 32 and move it away from the broken out drill bit 30 still captured within the bit breaker.

The spinner and support platform, of the alternate embodiment, both preferably include a hydraulic piston/cylinder combination and a plurality of hydraulic lines as necessary to actuate, via hydraulic pressure, at the control panel 20 the spinner and support platform for alignment and proper support of the bottomhole component 32 or connected components. Of course, a person of ordinary skill in the art would understand that a plurality of spinners and/or support platforms may be included as part of the apparatus 10 to foster make up/break out operations of a multi-sectioned stand of bottomhole components such as for example drill collars, stabilizers, subs, etc.

Moreover, with the alternate embodiment described above, a person of ordinary skill in the art would understand that the apparatus 10 further includes a spinner circuit (not shown) to produce a spin control signal with the spin control signal being used to selectively rotate the bottomhole component 32 during making up and breaking out operations as well as necessary support platform circuits and controls. The control circuits are preferably activated using controls as required located on the control panel 20.

In use, the apparatus 10 is first set up for make up or break out of a drill bit 30 and bottomhole component 32 as desired. It should be emphasized that appropriate safety measures and conduct must be followed when personnel are engaged in any activity related to the use of the apparatus 10.

For make up, initially the back up wrench 12 is preferably positioned as far away from the torque wrench 14 as possible using the control wheel 136 (See FIGS. 4, 9, and 12). Then, the location of the make up/break out pin 132 is confirmed, and if necessary, the torque wrench 14 is hydraulically configured so that the pin 132 can be inserted into the make up aperture 128 on the wrench cylinder 112.

For example, when making up a roller-cone bit 30, a bit housing 18 having an appropriate size and configuration is selected and, using the hoisting member 43, is transported into the throat 13 of the back up wrench 12. All operations are performed using the appropriate controls, gauges, and indicators of the control panel 20 as necessary (See FIG. 3).

The backup wrench gripping assemblies 98, 100, 102 are actuated using the control panel 20 to grip the bit housing 18 in the desired orientation which is preferably horizontal. The drill bit 30 is releasably secured within a selected bit breaker 38 and the bit breaker is placed in the roller-cone bit adapter 34 of the bit housing 18. The bit breaker 38 is detachably mounted to the adapter 34 carefully using the latches 56, 58, 60, 62 to properly mount the bit breaker 38.

Next, a desired bottomhole component 32 is hoisted and positioned into the throat 15 of the torque wrench 14 (See FIG. 9). The torque wrench gripping assemblies 104, 106, 108 are actuated to grip the bottomhole component 32.

Then, the back up wrench 12 is moved towards the bottomhole component 32 to align the pin threads of the bit with the box threads of the bottomhole component 32. The bit and component are repositioned and adjusted as necessary to ensure proper alignment of the threads for make up. Conventional leveling methods and structures may be used for alignment and making prior to the application of final make up torque by the torque wrench 14 (See FIG. 4).
It should be appreciated that the apparatus 10 is configured to foster ease of alignment. That is, both the back up wrench 12 and torque wrench 14 are ideally mounted to the base frame 16 in such a way that the central axes of the back up wrench 12 and torque wrench 14 respectively are coaxially aligned. (See FIGS. 1, 4, and 9). Moreover, after conventional alignment of the bit and component axes 30a, 32a, the back up wrench gripping assemblies 98, 100, 102 are actuated to grip the intermediate sleeve 42 and the torque wrench gripping assemblies 104, 106, 108 are actuated to grip the bottomhole component 32 threaded connection to the drill bit 30, such that the central axis 32a of the component is coaxial with the central axis 14a of the torque wrench 14 throat. The central axis 30a of the drill bit 30 secured within the bit breaker 38 is coaxial with the back up wrench 12 throat central axis 12a. With this configuration, all the central axes 18a, 12a, 30a, 14a, 32a are aligned axially for proper make up (as well as proper break out described hereinafter).

After proper alignment and confirmation that the intermediate sleeve 42 and bottomhole component 32 are properly gripped by the back up and torque wrenches 12, 14, respectively, sufficient torque is then applied to the bottomhole component 32 to properly make up the threaded connection of the bottomhole component 32 and drill bit 30. The latches 56, 58, 60, 62 detachably mounting the bit breaker 38 are detached. The back up wrench 12 and bit housing 18 are then moved away from the bit breaker 38 still releasably secured to the drill bit 30 now broken out from the bottomhole component 32. (See FIG. 9).

The bit breaker 38, still releasably securing the broken out drill bit 30, is positioned on a stable flat surface as necessary so that the bit breaker 38 can be carefully released from the drill bit 30 so that the bit 30 can be moved away from the bit breaker 38. The bit 30 and bit breaker 38 can then be transported to a desired location.

The intermediate sleeve 42 and bottomhole component 32 are properly gripped by the back up wrench 12 and torque wrench 14, respectively, sufficient torque is then applied to the bottomhole component 32 to properly make up the threaded connection of the bottomhole component 32 and drill bit 30. The latches 56, 58, 60, 62 detachably mounting the bit breaker 38 are detached. The back up wrench 12 and bit housing 18 are then moved away from the bit breaker 38 which is still releasably secured to the drill bit 30 now connected to the bottomhole component 32.

The bit breaker 38 is positioned as necessary so that it can be carefully and safely released from the drill bit 30 and moved away from the bit. The bottomhole component 32 and drill bit 30 are properly secured with a hoist. The torque wrench gripping assemblies 104, 106, 108 are then deactivated as necessary to release the bottomhole component 32 now made up to the drill bit 30 and component. The joined component 32 and bit 30 are then transported to a desired location.

For break out, the back up wrench 12 is preferably positioned with respect to the torque wrench 14 using the control wheel 136 to properly locate the bit housing 18. The location of the make up/break out pin 132 is confirmed and if necessary the torque wrench 14 is hydraulically configured so that the pin 132 can be inserted into the break out aperture 130 on the wrench cylinder 112 (See FIGS. 4 and 12).

The appropriate bit housing 18 is selected and positioned in the back up wrench 12 as explained above.

The drill bit 30 and threaded connection bottomhole component 32 are hoisted and positioned as necessary to ensure proper alignment with the central axis 18a of the bit housing 18 and torque wrench 14. Conventional leveling methods and structures may be used for alignment.

The drill bit 30 is then releasably secured in an appropriately sized and configured bit breaker and after proper conventional alignment, the bit breaker is placed in the roller-cone bit adapter 34 of the bit housing 18. The bit breaker 38 is detachably mounted to the adapter carefully using the latches 56, 58, 60, 62 to properly mount the bit breaker 38.
made without departing from the spirit of the invention. As well, the drawings are intended to describe the concepts of the invention so that the presently preferred embodiments of the invention will be plainly disclosed to one of skill in the art but are not intended to be manufacturing level drawings or renditions of final products and may include simplified conceptual views as desired for easier and quicker understanding or explanation of the invention. As well, the relative size and arrangement of the elements of the invention may be greatly different from that shown and still operate well within the spirit of the invention as described hereinbefore and in the appended claims. It will be seen that various changes and alternatives may be used that are contained within the spirit of the invention. Moreover, it will be understood that various references to directions, locations, positions and the like are made only with respect to easier explanation in conjunction with the drawings and that the elements may be oriented differently, for instance, during transportation and manufacturing as well as operation. Because many varying and different embodiments may be made within the scope of the inventive concept(s) herein taught, and because many modifications may be made in the embodiment herein detailed in accordance with the descriptive requirements of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An apparatus for applying torque to a threaded connection of a drill bit and bottomhole component to make up or break out same away from a drilling rig wellbore, comprising:
   a housing structure having at least one functional end configured to releaseably secure a drill bit, wherein said housing structure is positioned in a selected orientation, whereby a drill bit having a central axis is insertable into said at least one functional end with the drill bit being releaseably secured in said selected orientation, and wherein torque is applied to a threaded connection of the drill bit and bottomhole component to make up or break out same.

2. An apparatus for applying torque to a threaded connection of a drill bit and bottomhole component to make up or break out same away from a drilling rig wellbore, comprising:
   a housing structure having two functional ends, with a first end being configured to releaseably secure a first drill bit and a second end being configured to releaseably secure a second drill bit, whereby a drill bit is insertable into a selected functional end of said housing structure with the drill bit being releaseably secured in said selected functional end, wherein torque is applied to a threaded connection of the drill bit and bottomhole component to selectively make up or break out same.

3. The apparatus of claim 2, further comprising:
   an intermediate sleeve disposed between said first and second functional ends of said housing structure, said intermediate sleeve being configured for use in suspending or supporting said housing structure.

4. The apparatus of claim 3, further comprising:
   a hoisting member fixedly attached to said intermediate sleeve, said hoisting member and sleeve being configured in such a way that said housing structure is generally counterbalanced in a horizontal orientation when suspended using said hoisting member or supported using said intermediate sleeve.

5. The apparatus of claim 2, wherein said housing structure having two functional ends is configured such that said first end is adapted to receive a drill bit of one size or configuration and said second end is adapted to receive a drill bit of a different size or configuration from said first end.

6. The apparatus of claim 2, wherein said housing structure having two functional ends is configured such that said first end is adapted to releaseably secure a roller-cone bit and said second end is adapted to releaseably secure a fixed-cutter bit.

7. The apparatus of claim 2, wherein said housing structure is sized and configured to resist rotation when torque is applied to a threaded connection of the bottomhole component and drill bit releaseably secured by said housing structure to selectively make up or break out the bottomhole component and drill bit.

8. An apparatus for applying torque to a threaded connection of a drill bit and bottomhole component to make up or break out same away from a drilling rig wellbore, comprising:
   a bit housing having a first functional end and a second functional end, said first functional end being adapted to releaseably secure a roller-cone bit, and said second functional end being adapted to releaseably secure a fixed-cutter bit, wherein said bit housing has a central axis, said bit housing being configured to releaseably secure a selected drill bit configured for threaded connection with a bottomhole component;
   a back up wrench having a throat with a central axis oriented in a horizontal mode, said back up wrench being configured to grip and position said bit housing, said back up wrench gripping said bit housing coaxially such that a drill bit releaseably secured in said bit housing is oriented in a horizontal mode, wherein said back up wrench fixedly holds said bit housing with a first grip pressure such that said bit housing is prevented from rotating about its axis;
   a torque wrench to grip and apply torque to the threaded connection of a bottomhole component and drill bit, the bottomhole component being gripped with a second grip pressure by said torque wrench, and the drill bit fixedly held in said bit housing being gripped with said first grip pressure by said back up wrench, whereby the central axes of the bottomhole component and drill bit are coaxial with said bit housing, and whereby said torque wrench is configured to selectively apply sufficient torque to make up or break out the threaded connection of the bottomhole component and drill bit;
   and
   a circuit to control said back up wrench to selectively grip with a first grip pressure said bit housing securing the drill bit, wherein said circuit controls said torque wrench to selectively grip with a second grip pressure and apply torque to the bottomhole component to make up or break out the threaded connection of the bottomhole component and drill bit.
9. The apparatus of claim 8, wherein said first functional end is adapted to detachably mount a first bit breaker, and wherein said second functional end is adapted to detachably mount a second bit breaker, whereby a drill bit insertable into a selected bit breaker is releasably secured in a horizontal mode and is prevented from rotating such that the threaded connection of the drill bit and a bottomhole component may be made up or broken out when torque is applied by said torque wrench to said bottomhole component.

10. The apparatus of claim 8, further comprises a roller-cone bit adapter, fixed-cutter bit adapter, and an intermediate sleeve, said intermediate sleeve being configured for fixedly connecting together in a spaced relationship said roller-cone bit adapter and said fixed-cutter bit adapter with said adapters being disposed at opposite ends of said intermediate sleeve, whereby said bit housing has a dual function.

11. The apparatus of claim 10, wherein said roller-cone bit adapter comprises a bit box and roller-cone bit breaker, said bit box being configured to detachably mount said bit breaker, and wherein said bit breaker is adapted to releasably secure a roller-cone bit to prevent rotation thereof during make up or break out operations, and wherein said roller-cone bit adapter further comprises a chamber configured to receive a portion of the roller-cone bit releasably secured within said roller-cone bit breaker, and wherein said roller-cone bit adapter further comprises a first spacer fixedly attached to said intermediate sleeve connecting said adapters.

12. The apparatus of claim 10, wherein said fixed-cutter bit adapter comprises a bit plate and fixed-cutter bit breaker, said bit plate being configured to detachably mount said fixed-cutter bit breaker, and wherein said bit breaker is adapted to releasably secure a fixed-cutter bit to prevent rotation thereof during make up or break out operations, and wherein said fixed-cutter bit adapter further comprises an elongated chamber configured to receive a portion of the fixed-cutter bit releasably secured within said fixed-cutter bit breaker, and wherein said roller-cone bit adapter further comprises a second spacer fixedly attached to said intermediate sleeve connecting said adapters.

13. The apparatus of claim 8, further comprising:

an intermediate sleeve disposed between said first and second ends of said bit housing, said intermediate sleeve being configured for use in suspending or supporting said bit housing.

14. The apparatus of claim 13, further comprising:

a hoisting member mounted to said intermediate sleeve, said hoisting member being centrally positioned on said intermediate sleeve, wherein said hoisting member and sleeve are configured in such a way that said bit housing is generally counterbalanced in a horizontal orientation when suspended using said hoisting member or alternately supported using said intermediate sleeve.

15. The apparatus of claim 8, wherein said bit housing has two functional ends configured such that said first end is adapted to receive a drill bit of one size or configuration and said second end is adapted to receive a drill bit of a different size or configuration from said first end.

16. The apparatus of claim 8, wherein said bit housing having two functional ends is configured such that said first end is adapted to releasably secure a rock drill bit and said second end is adapted to releasably secure diamond bit.

17. The apparatus of claim 8, wherein said bit housing is sized and configured to resist rotation when torque is applied to a threaded connection of the bottomhole component and drill bit releasably secured to said bit housing to selectively make up or break out the bottomhole component and drill bit.

18. The apparatus of claim 8, wherein said back up wrench is movably mounted with respect to said torque wrench.

19. The apparatus of claim 18, wherein said back up wrench has first and second side walls with a plurality of gears being rotatably mounted to said first and second side walls, and wherein said apparatus further comprises a base frame, said frame having two horizontally extending tracks, said plurality of gears being positioned to rotatably engage said tracks, whereby said back up wrench may be translated axially with respect to said torque wrench to foster detachable mounting of a selected bit adapter with a drill bit breaker having a drill bit releasably secured therein during make up or break out operations.

20. The apparatus of claim 8, further comprising:

a frame for mounting said back up wrench and said torque wrench.

21. The apparatus of claim 8, further comprising:

a spinner configured for being aligned with the central axis of the bottomhole component, wherein said spinner has at least two cylindrical members adapted to selectively rotate the bottomhole component with respect to the drill bit, said spinner being adapted for use during making up or breaking out of the threaded connection.

22. The apparatus of claim 21 further comprising:

a spinner circuit to produce a spin control signal, wherein said spin control signal is used to selectively rotate the bottomhole component during making up and breaking out operations.

23. The apparatus of claim 8 further comprising:

a movable platform for supporting at least one bottomhole component to facilitate alignment of said bottomhole component with said torque wrench central axis during make up or breakout operations.

24. An method for applying torque to a threaded connection of a drill bit and bottomhole component to make up or break out same away from a drilling rig wellbore, comprising:

providing a bit housing having a first functional end and a second functional end, said first functional end being adapted to releasably secure a first drill bit, and said second functional end being adapted to releasably secure a second drill bit, wherein said bit housing has a central axis, said bit housing being configured to releasably secure a selected drill bit configured for threaded connection with a bottomhole component;

positioning a back up wrench having throat with a central axis oriented in a horizontal mode, said back up wrench being configured to grip and position said bit housing adapted for releasably securing the first and/or second drill bit, said back up wrench gripping said bit housing coaxially such that said first and/or second drill bit is
releaseably secured in a horizontal mode, whereby said back up wrench fixedly holds said bit housing with a first grip pressure such that said bit housing is prevented from rotating about its axis;

using a torque wrench to grip and apply torque to the threaded connection of a bottomhole component and a selected drill bit, with the bottomhole component being gripped by said torque wrench and the selected drill bit being gripped by said back up wrench, whereby the central axes of the bottomhole component and the selected drill bit are coaxial with said bit housing, whereby said torque wrench is configured to apply sufficient torque to make up or break out the threaded connection of the downhole component and the selected drill bit; and

providing a circuit to control said back up wrench and said torque wrench to selectively grip said bit housing securing the selected drill bit and to selectively grip and apply torque to the bottomhole component to alternating make up or break out the threaded connection of the bottomhole component and the selected drill bit.

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