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(54) **DUAL TOP DRIVE SYSTEMS AND METHODS**

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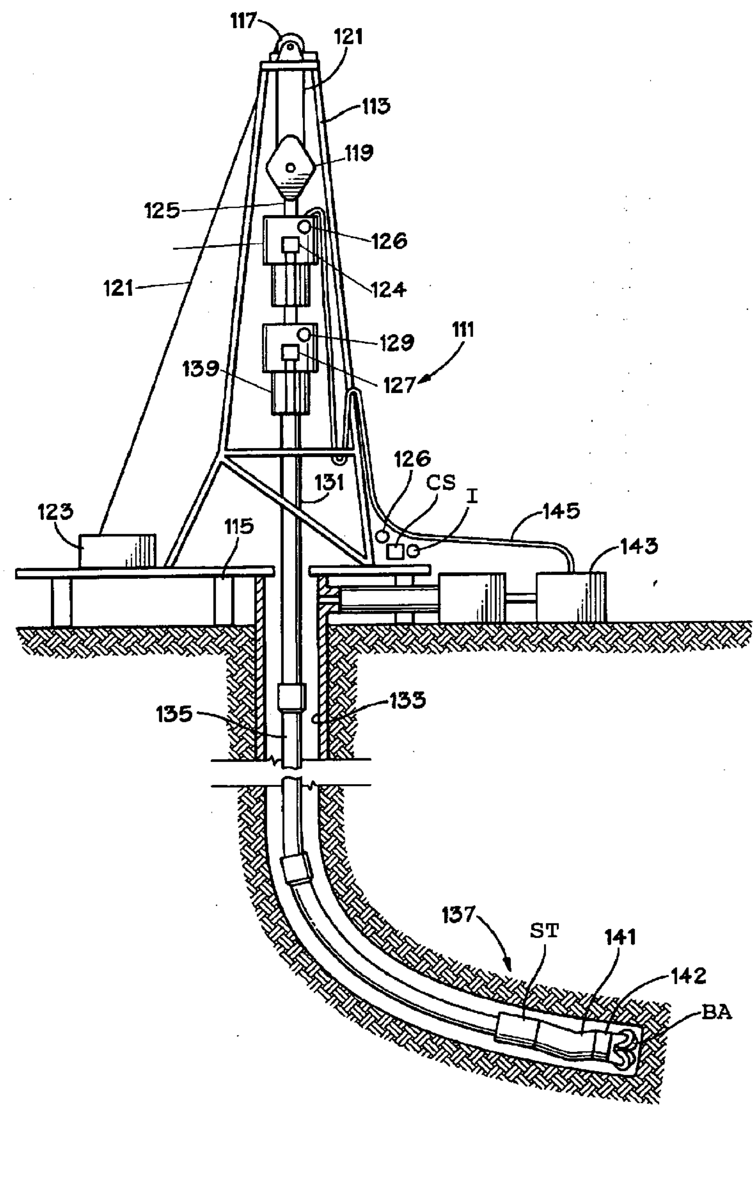
(57) **ABSTRACT**

Systems and methods for wellbore operations using a dual top drive system with two top drives; the top drives positioned with one above the other; the two top drives in certain aspects movable separately or in unison; in one aspect the top drives operational to counter each other's reactive torque; and in other aspects the wellbore operation being one of drilling, casing, casing while drilling, casing drilling, reaming, under-reaming, joint make-up, joint breakout, milling, managed pressure drilling, underbalanced drilling, tubular running, tubular running with continuous circulation, controlling bit face orientation during operations with a bit, conducting well operations based on mechanical specific energy considerations, and automatic drilling.



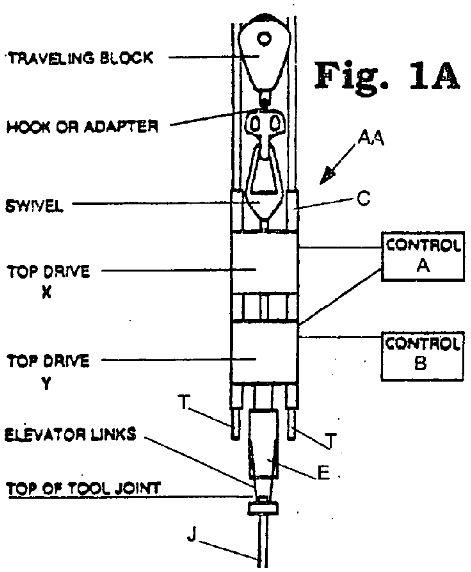


Fig. 1A

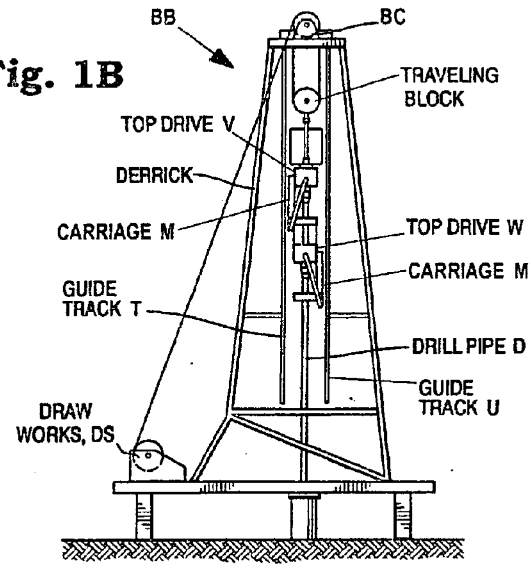


Fig. 1B

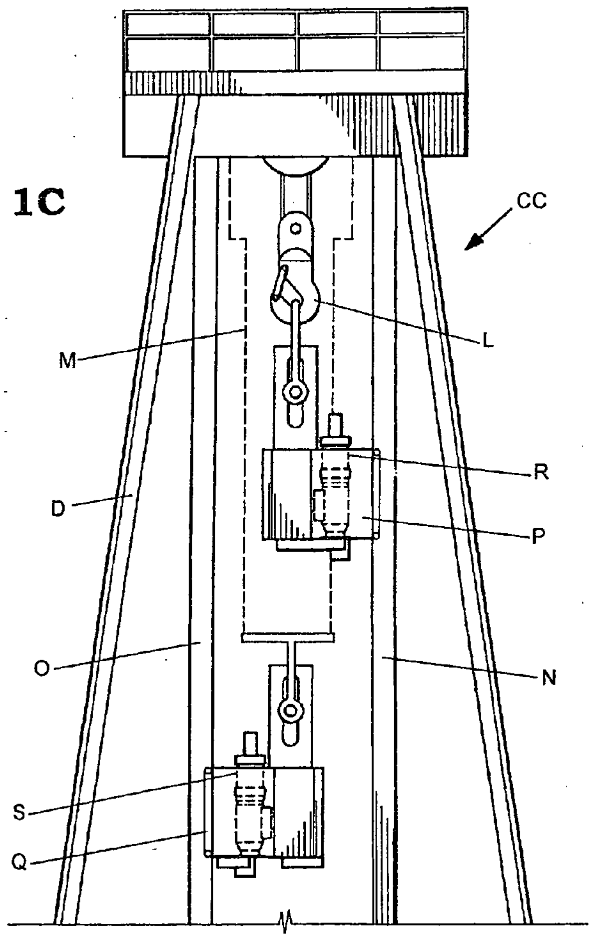


Fig. 1C

Fig. 2

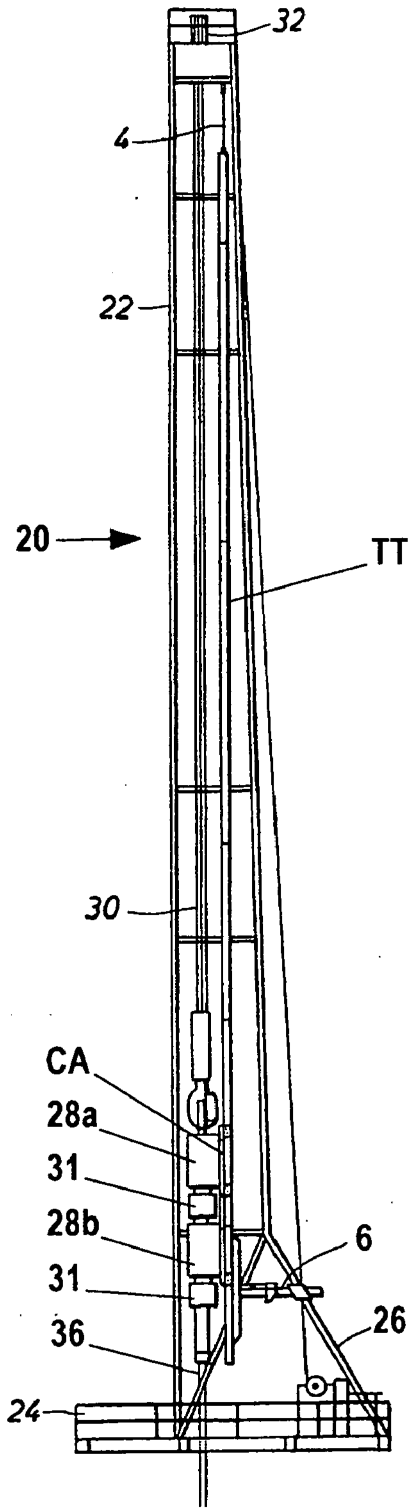
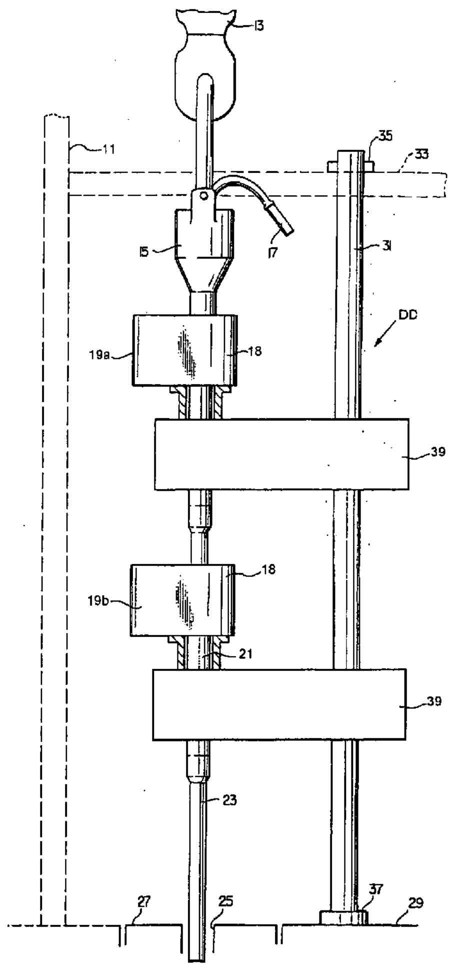


Fig. 3


13
11
35
33
15
17
31
DD
19a
18
39
18
19b
21
39
23
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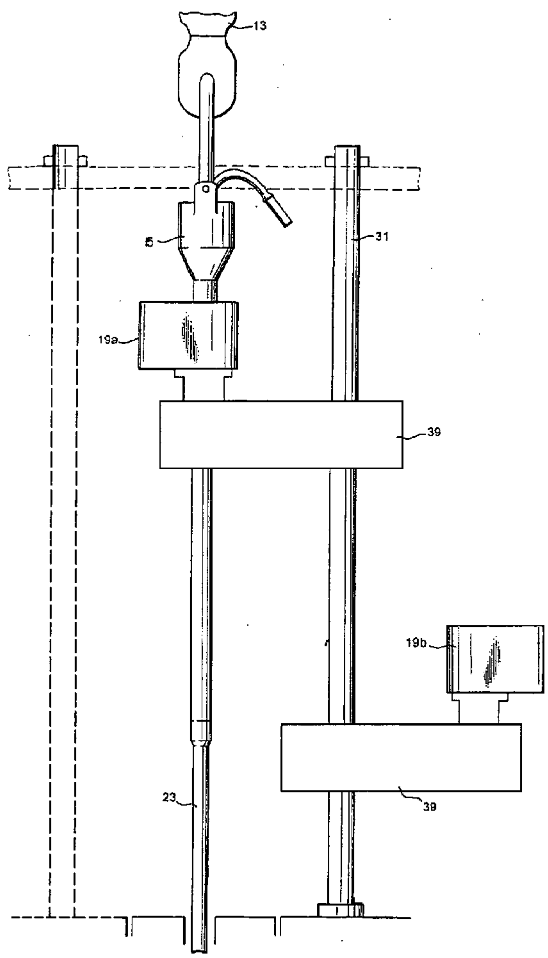
25
37
29

Fig. 3A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19a
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19b
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23
39

Fig. 4

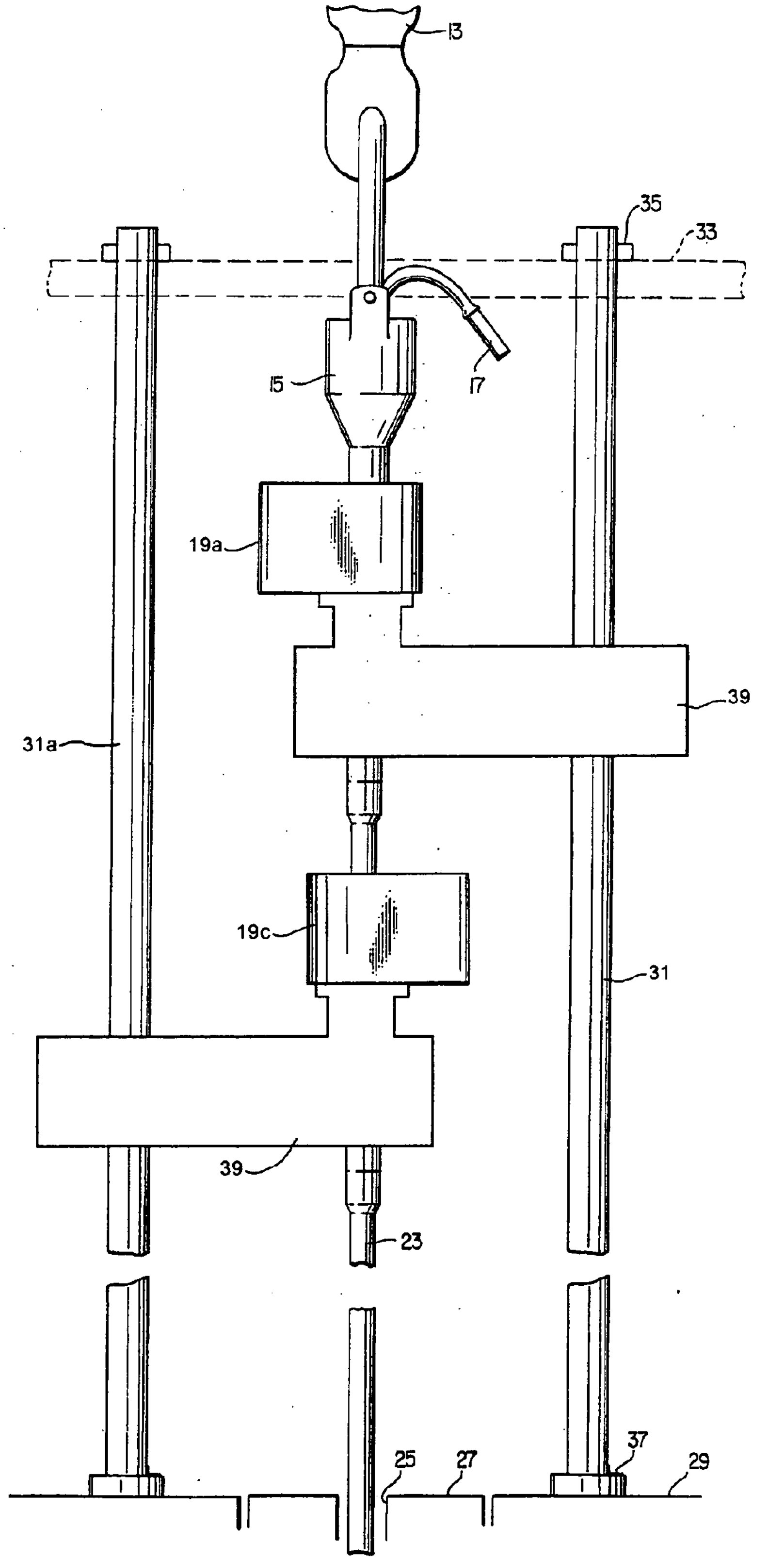


Fig. 5

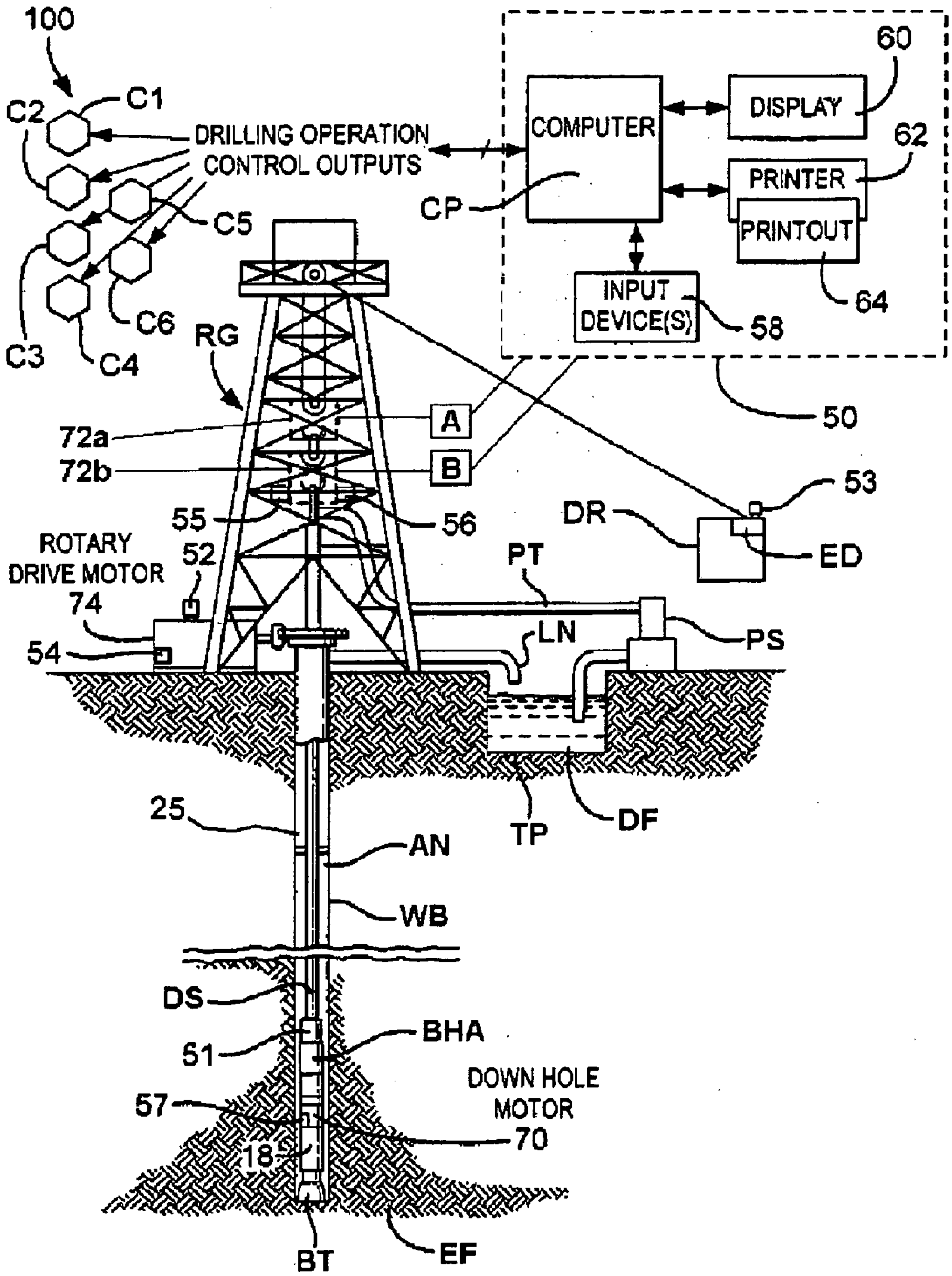
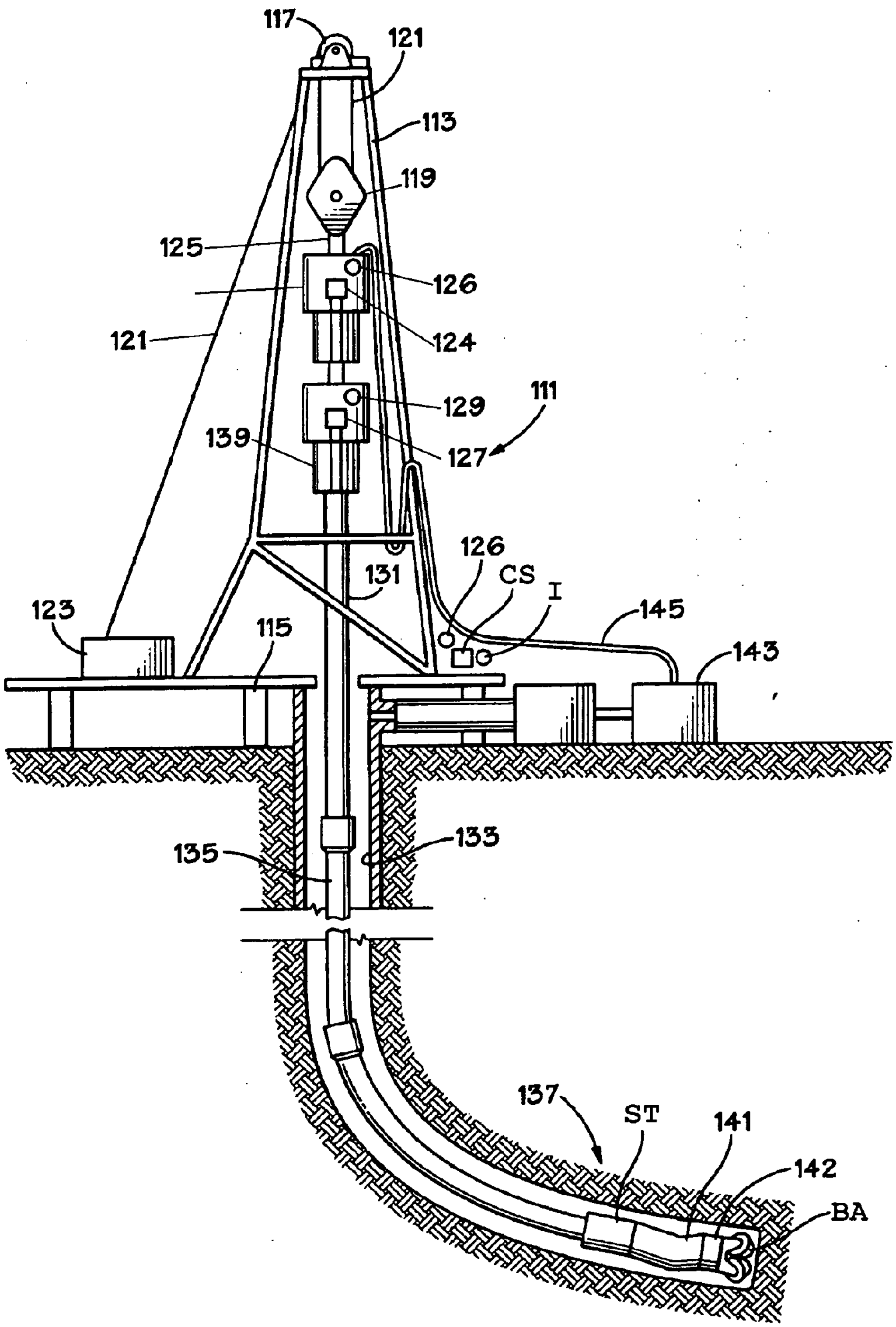

100
C1
C2
C3
C4
C5
C6
DRILLING OPERATION
CONTROL OUTPUTS
COMPUTER
CP
DISPLAY
60
PRINTER
62
PRINTOUT
64
INPUT
DEVICE(S)
58
50
RG
72a
72b
A
B
53
DR
ED
55
56
ROTARY
DRIVE MOTOR
74
52
54
PT
LN
PS
TP
DF
25
AN
WB
DS
BHA
51
DOWN HOLE
MOTOR
70
57
18
BT
EF

Fig. 6


117
121
113
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124
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111
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141
142
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Fig. 7B

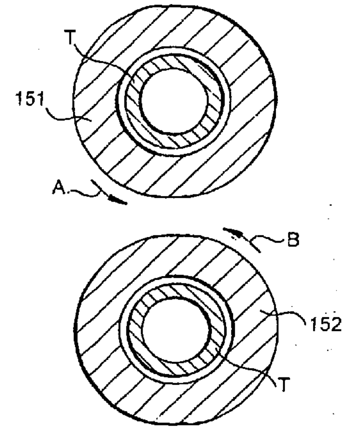
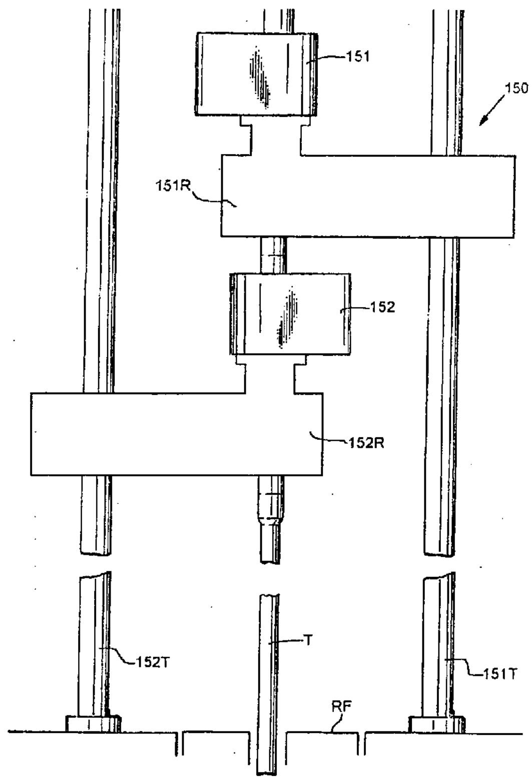


Fig. 7A



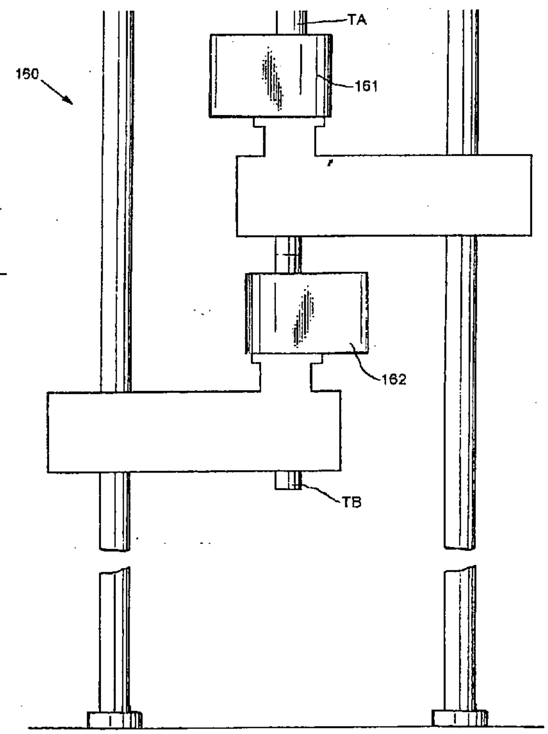


Fig. 8

Fig. 9

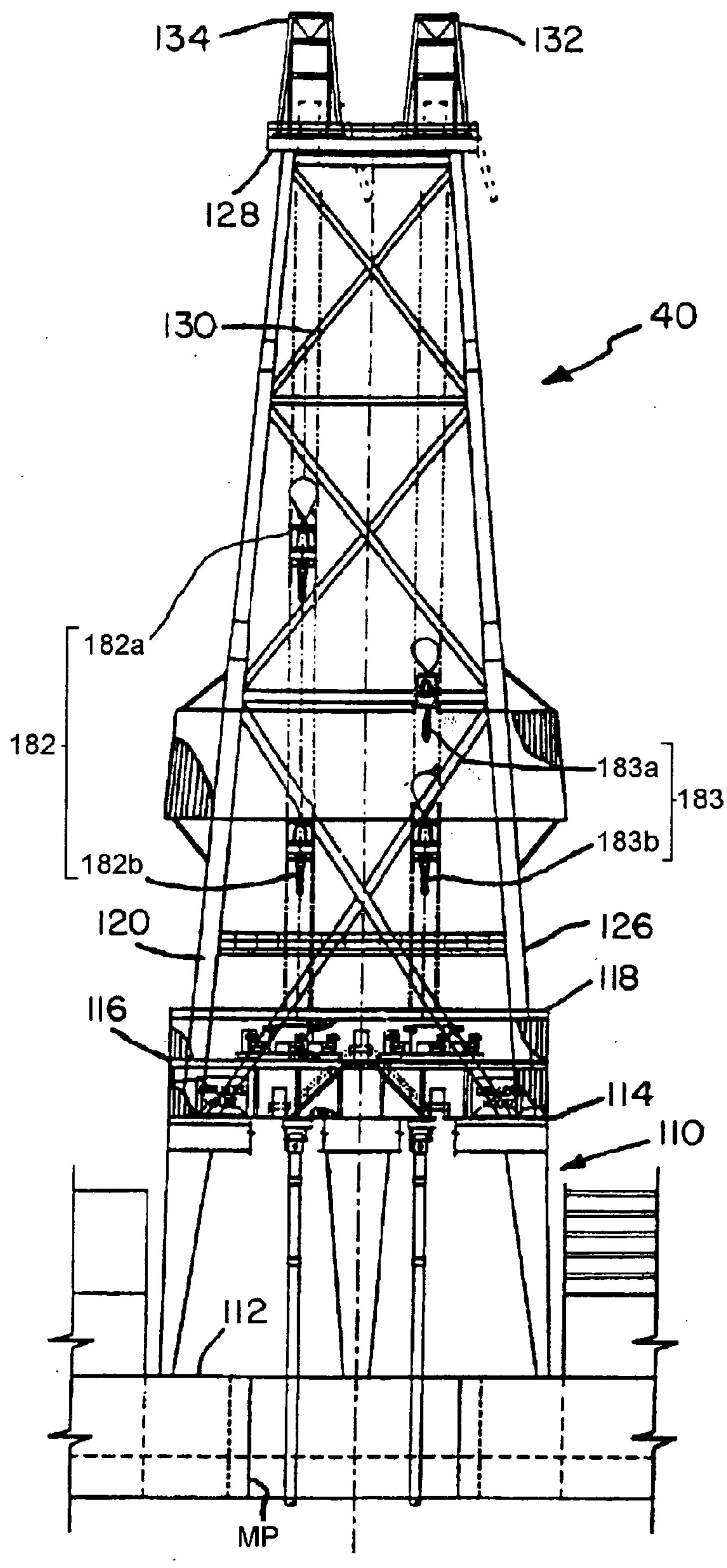
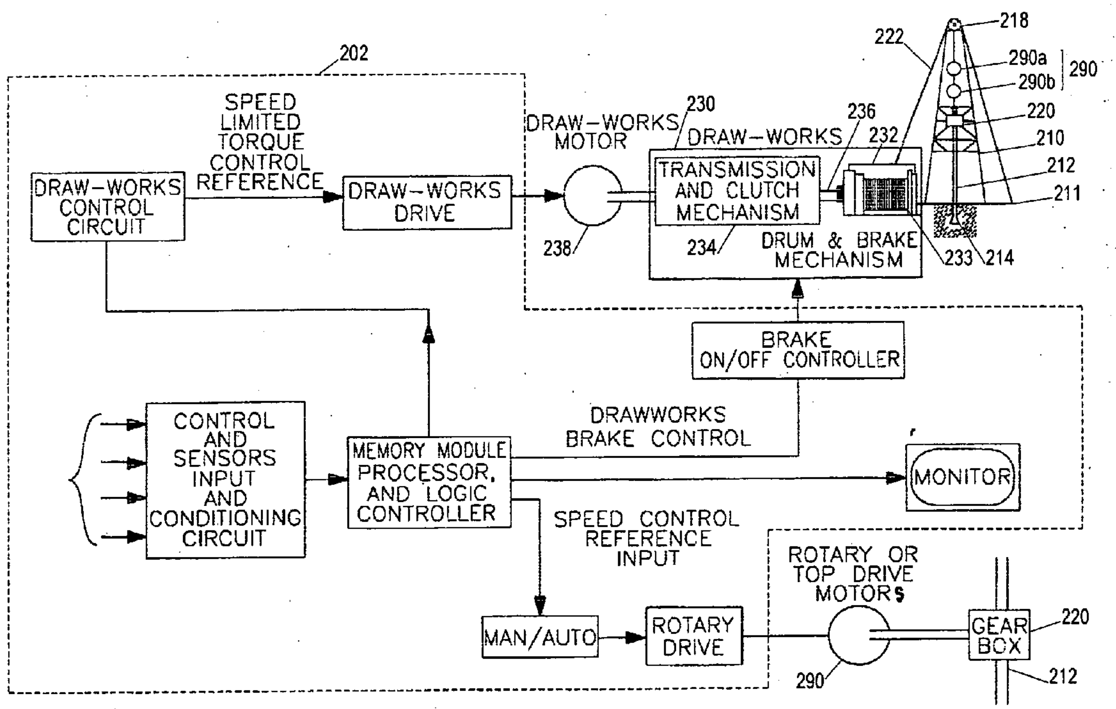

134
132
128
130
40
182a
182
183a
183
183b
182b
120
126
118
116
114
110
112
MP

Fig. 10



202
SPEED LIMITED TORQUE CONTROL REFERENCE
DRAW-WORKS CONTROL CIRCUIT
DRAW-WORKS DRIVE
DRAW-WORKS MOTOR
230
DRAW-WORKS
TRANSMISSION AND CLUTCH MECHANISM
236
232
222
218
290a
290b
290
220
210
212
211
238
234
DRUM & BRAKE MECHANISM
233
214
BRAKE ON/OFF CONTROLLER
DRAWWORKS BRAKE CONTROL
CONTROL AND SENSORS INPUT AND CONDITIONING CIRCUIT
MEMORY MODULE PROCESSOR, AND LOGIC CONTROLLER
MONITOR
SPEED CONTROL REFERENCE INPUT
ROTARY OR TOP DRIVE MOTORS
MAN/AUTO
ROTARY DRIVE
GEAR BOX
220
290
212

DUAL TOP DRIVE SYSTEMS AND METHODS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention is directed to top drives and to welbore operations and methods involving top drives.

[0003] 2. Description of Related Art

[0004] There are a wide variety of known top drives and known methods employing a top drive.

BRIEF SUMMARY OF THE INVENTION

[0005] The present invention, in certain and various aspects, discloses systems with dual top drives and wellbore operations and methods which use dual top drives.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0006] FIG. **1**A is a front view of a system according to the present invention.

[0007] FIG. **1**B is a front view of a system according to the present invention.

[0008] FIG. **1**C is a side view of a system according to the present invention.

[0009] FIG. **2** is a side view of a system according to the present invention.

[0010] FIG. **3** is a side view of a system according to the present invention.

[0011] FIG. **3**A is a side view of a system according to the present invention.

[0012] FIG. **4** is a side view of a system according to the present invention.

[0013] FIG. **5** is a schematic view of a system according to the present invention.

[0014] FIG. **6** is a schematic view of a system according to the present invention.

[0015] FIG. **7**A is a schematic view of a system according to the present invention.

[0016] FIG. **7**B is a partial cross-section view of the system of FIG. **7**A.

[0017] FIG. **8** is a schematic view of a system according to the present invention.

[0018] FIG. **9** is a schematic view of a system according to the present invention.

[0019] FIG. **10** is a schematic view of a system according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] FIG. **1**A shows a system AA according to the present invention which has two top drives X and Y on a carriage C which is movably connected to tracks T on a derrick (not shown). A typical traveling block, hook or adapter, and swivel support the top drives in their movement on the carriage. An elevator system E with elevator links supports a tool joint J.

[0021] A control system A controls the top drive X and/or top drive Y. A control system B controls the top drive Y (when it is not controlled by the control system A). Optionally, the control system B controls the top drive X or both top drives X and Y. These control systems may include any known control system used in wellbore operations and, without limitation, may be any control system referred to herein; disclosed in a patent or application incorporated herein; and/or disclosed herein. Any top drive in any system according to the present invention may have any of these control systems; and any system herein may have one or two top drive control systems.

[0022] The two top drives X and Y move in unison on the carriage C. Optionally, the two top drives may be spaced apart as desired any desired space or distance on the carriage C.

[0023] FIG. **1**B shows a system BB according to the present invention which has two top drives V and W each on its own dedicated movable support M (e.g., carriage, dolly, etc.). The top drives V and W are diametrically opposed to each other and torque from each is reacted to its own dedicated carriage, to its own dedicated guide track (T for top drive V; U for top drive W), and to a derrick structure. A traveling block and crown block arrangement BC supports the top drives and a drawworks system D raises and lowers the block and the top drives.

[0024] The top drives V, W are connected together, move in unison, and either singly or in unison rotate a drill pipe D. Optionally, the top drives are not connected together and may or may not move in unison.

[0025] FIG. **1**C shows a system CC according to the present invention which has two top drives R, S each on its own carriage P, Q, respectively, which are movably mounted to a torque track N, O, respectively on a derrick D. A support system L supports the top drive R and with movement apparatus (not shown; e.g. like any herein) provides for movement of the top drive R up and down in the derrick D. A support system M (shown schematically in dotted line; like any support system herein) supports the top drive S and with a movement apparatus (not shown) provides for the movement of the top drive S up and down in the derrick D. The system M is positioned and configured so it does not interfere with and is operable independently of the system L.

[0026] The top drives R, S may be moved in unison or they may be moved independently of each other. Optionally one or both top drives R, S are pivotably mounted to their respective tracks or to the derrick for movement out of alignment with and/or out of the way of the other top drive and/or away from a well center.

[0027] The present invention provides improvements to the subject matter of U.S. Pat. No. 5,501,386. Referring to FIG. **2**, a drilling rig or derrick **20** is shown having a mast **22**, substructure and an A-frame **26** which supports and stabilizes mast **22** on substructure **24**. Top drive drilling units **28***a* and **28***b* are suspended from a cable arrangement **30**, a portion of which loops around crown block **32**, and in turn is tensioned for upward movement by a motor (not shown) supported at the rig floor. A drill string **36** is suspended by the top drive drilling units. The top drive units include a power swivel **31** to rotate drill string **36**. Drill string **36** passes through substructure **24** into the ground.

[0028] The top drive units are on a carriage assembly CA which moves along a torque track TT. Torque track TT can be comprised of a series of track segments. At its upper end, the torque track TT is suspended by a cable **4** which is attached to the structural framework of mast **22**. At its lower end, the torque track TT is attached by member **6** to A-frame **26**. The combination of member **6** is occasionally referred to as a strong back. In this manner, any torsional load which is introduced into the torque track TT as a result of the rotation of top drive drilling units is resisted by the strong back frame arrangement which transfers most of the torsional loads and forces into substructure **24** rather than mast **22**. One possible configuration and assembly for a torque track TT is disclosed in further detail in U.S. patent application Ser. No. 217,689, filed Mar. 24, 1994.

[0029] The present invention provides improvements to the subject matter of U.S. Pat. No. 4,865,135. Referring to FIG. **3**, a system DD according to the present invention has a derrick **11** shown schematically by dotted lines. The derrick **11** supports a block arrangement **13** which moves up and down the derrick. The block arrangement supports a swivel **15**, which is connected to a mud hose **17**. The mud hose **17** will be connected to a source of drilling fluid.

[0030] Top drive units **19***a* and **19***b* are also supported by the blocks below the swivel **15** in the embodiment shown. Each top drive unit contains an electrical motor within a housing **18** which is supplied with electrical power from the drilling rig. The housings **18** also contain a drive mechanism connected to the electrical motor for rotating a drive stem **21**. The drive stem **21** is adapted to be connected to the upper end of the string of drill pipe **23** and rotates relative to housings **18**.

[0031] The drill pipe **23** extends through a hole **25** in a rotary table **27**. The rotary table **27** is rotatably mounted to the rig floor **29**. In one aspect, the rotary table **27** does not apply torque to the drill pipe **23** while the top drive units (or one of them) are operating.

[0032] Torque shaft **31** is vertically mounted in the derrick **11** at its upper end to a brace **33** in the derrick **11**. A nut **35** or other means applies tension to the torque shaft **31** to increase its rigidity. The lower end of the torque shaft **31** is held by a coupling **37**. When a top drive unit is operating, coupling **37** will prevent any rotation of the torque shaft **31** relative to the rig floor **29**.

[0033] Each top drive is connected to the torque shaft **31** by a torque connection apparatus **38** carried in the derrick **11** below each housing **18**. Reactive torque on the housings **18** is applied to the apparatuses **39** (e.g. see those disclosed in U.S. Pat. No. 4,865,135).

[0034] In operation, the top drive units rotate the drive stem **21**. Assuming that the rotation is to the right, looking downward, this will create a reaction torque in the housings **18** in the opposite direction. The rotational force on the housings **18** will be applied to the torque connection apparatuses **39** which transmit the rotational force to the torque shaft **31**. The torque shaft **31** will transmit the rotational force to the rig floor **29**. The coupling **37** prevents the torque shaft **31** from rotating, and thus prevents the housing **18** from rotating. There will be little or no lateral forces imposed on the torque shaft **31** by the reaction torques of the top drive units. As the top drive units move downward during drilling, apparatuses **39** move with them on the torque shaft **31**. If the drive stem **21** is rotated in the reverse direction, such as during breakout, then the opposite will apply.

[0035] As shown in FIG. **3**A, the top drive unit **19***b*, in one aspect, is selectively movable on the torque shaft **31** out of the way of the top drive unit **19***a*.

[0036] As shown in FIG. **4** in a system according to the present invention (like the system of FIG. **3**—like numerals indicate like parts) a top drive unit **19***c* is connected via a torque connection apparatus to a torque shaft **31***a* (like the torque shaft **31**). It is within the scope of the present invention for the top drive unit **19***c* to be supported by and moved by the same apparatus associated with the top drive unit **19***a*; or the top drive unit **19***c* may have its own dedicated support and movement structure situated and configured so they do not interfere with those of the top drive unit **19***a* and which permit the top drive unit **19***c* to move with or independently of the top drive unit **19***a*. The top drive unit **19***c* may be moved out of the way of the top drive unit **19***a* (as may the top drive unit **19***a* be moved out of the way of the top drive unit **19***c*—e.g. see FIG. **3**A for one method of such movement).

[0037] The present invention presents improvements to the subject matter of U.S. Pat. No. 7,243,735. In certain embodiments of systems and methods according to the present invention (e.g., as in FIG. **5**) fluid is pumped down a well by pumps and cuttings flow up an annulus with fluid pumped out of a bit rotated by a system according to the present invention, any disclosed herein, with two top drives. Sensors provide signals indicative of various parameters, including, e.g., WOB, ROP, torque, bit rotation speed, and bit cross-section area. WOB, ROP, and/or torque can be measured by sensor(s) at the surface and/or downhole. Bit rotational speed (zero at the surface, by definition) is measured downhole. The sensors are in communication with a control system(e.g. a computer system or systems, PLC's, and/or DSP's). This system controls the operation and the top drives and may calculate differentiated mechanical specific energies; e.g. three different mechanical specific energies—drillstring, bit, and surface. Any suitable known downhole sensors can be used (for the system and method of FIG. **5** and/or for any system and method disclosed herein), including, but not limited to, those disclosed in U.S. Pat. Nos. 6,839,000; 6,564,883; 6,429,784; 6,247,542; and in the references cited therein, all incorporated fully herein for all purposes.

[0038] In one scenario a driller views a display (screen and/or strip chart) which indicates in real time the value of any significant change in operational parameters, e.g. in drillstring mechanical specific energy, bit mechanical specific energy, and surface mechanical specific energy. The system may provide and the display may also display results post-event, not in real time.

[0039] The CONTROL system can be used to control various aspects of a wellbore operation. The system can be programmed to control any drilling parameter or set of parameters (e.g. one or some in any combination, of WOB, ROP, torque and/or bit speed). The computer is programmed to perform one, some, or all of the following actions: control the top drives; provide warnings to the driller and to others on site and/or remote from the rig, e.g. in a remote facility (by any known type of communication) e.g. warnings of increased energy consumption per volume drilled which can lead to a determination of bit failure, bit tooth breakage, bearing failure, bottom hole balling, drillstring vibration, bit whirl, and bit vibration execute control with controls of appropriate equipment and apparatuses to maintain parameters at or below target or not-to-exceed values, e.g. controlling WOB; and controls on the pumps to control fluid flow, conduct diagnostic tests of apparatuses and equipment (and of the wellbore itself) to locate source of a problem and, in one aspect, to choose and/or display possible courses of corrective action, e.g., simultaneously optimizing ROP and mechanical specific energy to optimize drilling performance (optionally) execute control to effect a higher-level strategy, e.g., simultaneously minimizing ROP and mechanical specific energy to optimize drilling.

[0040] FIG. **5** illustrates a system **100** according to the present invention and method according to the present invention which has sensors **51**-**57** for providing data for calculating WOB, ROP, bit speed and torque. As shown, the system

100 has top drives **72***a* and **72***b* (shown schematically; may be any suitable dual top drive system disclosed herein as is true for any system herein), a rotary drive **74** and a downhole motor **70** to indicate that any of these drive systems may be used with systems and methods according to the present invention. A drillstring DS extending down from a rig RG into a wellbore WB in an earth formation EF has a bit BT on a bottom hole assembly BHA at the wellbore bottom. Drilling fluid DF flows from a tank or pit TP pumped by a pump system PS through a piping system PT down the drillstring DS and returning up an annulus **25** flowing in a line LN back to the tank TP.

[0041] A control system **50** includes a computer CP with a display **60**, a printer **62** and a printout **64**. Input devices **58** receive data signals from the sensors **51**-**57** which are in communication with the computer via wire, cable and/or wireless communication. For example, sensors may provide signals indicative of the following: top drive operation, WOB, at the surface from a sensor or a drill line anchor or downhole from a sensor **51** of an MWD unit; torque, at the surface from a sensor **52** of the rotary drive **74** or from a sensor **55** of the top drive or drives, or downhole from the sensor **51**; ROP, at the surface from a sensor **53** on an encoder ED of a drawworks DR (shown schematically) or from the sensor **51**; and bit rotational speed at the surface from a sensor **55** in a top drive or drives or from a sensor **54** in the rotary drive or downhole from the sensor **51**; or from a sensor **57** in the motor **70**. The computer CP calculates various parameters and then decides whether to provide alarms and/or to execute control programs to control various aspects of top drives and/or of the drilling process.

[0042] The drilling operation control outputs from the computer CP are provided to various controllers and control systems C**1**-C**6** which control drill line payout (brake control and/or drawworks motors control); a rotary table (control bit speed); top drives (control bit speed) mud pumps (pump rate control) downhole drilling systems, and/or rotary steerable systems.

[0043] In one particular method of use of the system **100**, a new bit is tripped into the wellbore and the drillstring is run down to the wellbore bottom. The driller enters into the computer CP target ROP, bit rotational speed, drilling fluid pump rate, and WOB. The control system **50** then prepares to collect data related to all the drilling parameters to be measured and monitored and calculates and displays the three mechanical specific energies. The system **50** proceeds to determine a background mechanical specific energy level with drilling at "safest" conditions and determines that the entire allowable operating range for WOB, RPM, torque and ROP is within safe limits. In one aspect WOB and bit RPM are directly controlled by the driller. Torque and ROP are resultants of this control, but can also be controlled, for example, by adjusting WOB and/or rotational speed to alter the resultant torque and ROP's. The driller then starts drilling with the target ROP, WOB, RPM, and pump rate. The system **50** informs the driller that the drilling process in progress is acceptable. In one particular scenario, the system **50** then detects an increase in bit mechanical specific energy, informs the driller that an abnormal event is occurring, and begins a diagnostic process. The system **50** moves all control parameters to a safe (or safest) value (e.g. to values at which bit balling will not occur), e.g. minimum WOB, maximum RPM, and maximum drilling fluid pump rate. The system **50** controls equipment directly or sends set points to individual devices' controllers. In this case, the bit mechanical specific energy then returns to an acceptable or baseline value and the system **50** concludes that bit balling had been occurring when the drilling operation was at the original target values the driller had been using. The system **50** then informs personnel, e.g. the driller and/or the company man, that bit balling has been detected and the system **50** offers two possible course of action: 1. replace the bit; 2. let the system **50** attempt to find a maximum ROP at which balling will not occur. In the event option **2**. is chosen, the rig personnel can decide if the calculated ROP is acceptable for further drilling. In the event option **2**. is chosen, the control system resumes drilling at the determined safe values of the drilling parameters (e.g. those at which bit balling is least likely to occur) and then manipulates ROP, RPM, WOB and pump rate to achieve maximum ROP while seeing that bit mechanical specific energy is maintained at or below "no balling" values.

[0044] Systems and methods according to the present invention with dual top drives may be used with casing drilling systems and methods disclosed in U.S. Pat. Nos. 5,197,553; 5,271,472; 5,472,057; 6,443,247; 6,640,903; 6,705,413; 6,722,451; 6,725,919; 6,739,392; 6,758,278; and in references cited in these patents—all incorporated fully herein for all purposes. The methods of the present invention with dual top drives are useful in milling procedures and in milling/drilling or milling-and-drill procedures, e.g., in the systems and methods of U.S. Pat. Nos. 5,474,126; 5,522,461; 5,531,271; 5,544,704; 5,551,509; 5,584,350; 5,620,051; 5,657,820; 5,725,060; 5,727,629; 5,735,350; 5,887,655; 5,887,668; 6,202,752; 6,612,383; and in the references cited in these patents—all of which are incorporated fully herein for all purposes.

[0045] The present invention provides a method for selectively orienting a bit at the end of a drillstring, the method including moving a control member of a system to orient the bit, the system including motive apparatus with two top drives according to the present invention for rotating a drillstring and a bit.

[0046] As shown in FIG. **6** a drilling rig **111** is depicted schematically as a land rig, but other rigs (e.g., offshore rigs, jack-up rigs, semisubmersibles, drill ships, and the like) are within the scope of the present invention (as is true for all embodiments herein). In conjunction with an operator interface, e.g. an interface I, a control system CS as described below controls certain operations of the rig. The rig **111** includes a derrick **113** that is supported on the ground above a rig floor **115**. The rig **111** includes lifting gear, which includes a crown block **117** mounted to derrick **113** and a traveling block **119**. A crown block **117** and a traveling block **119** are interconnected by a cable **121** that is driven by drawworks **123** to control the upward and downward movement of the traveling block **119**. Traveling block **119** carries a hook **125** from which is suspended a top drive system **127** which includes a variable frequency drive controller **126**, a motor (or motors) **124** and a drive shaft **129**. Top drive systems **127** (either or both) (may be any suitable dual top drive system disclosed herein according to the present invention) rotate a drillstring **131** to which the drive shaft **129** is connected in a wellbore **133**. The top drives **127** can be operated to rotate the drillstring **131** in either direction. According to an embodiment of the present invention, the drillstring **131** is coupled to the top drives **127** through an instrumented sub **139** which includes sensors that provide information, e.g., drillstring torque information.

[0047] The drillstring **131** may be any typical drillstring and, in one aspect, includes a plurality of interconnected sections of drill pipe **135** a bottom hole assembly (BHA) **137**, which includes stabilizers, drill collars, and/or an apparatus or device, in one aspect, a suite of measurement while drilling (MWD) instruments including a steering tool ST to provide bit face angle information. Optionally a bent sub **141** is used with a downhole or mud motor **142** and a bit BA, connected to the BHA **137**. As is well known, the face angle of the bit is controlled in azimuth and pitch during drilling.

[0048] Drilling fluid is delivered to the drillstring **131** by mud pumps **143** through a mud hose **145**. During rotary drilling, drillstring **131** is rotated within bore hole **133** by the top drive(s) which, in one aspect, are slidingly mounted on parallel vertically extending rails (not shown) to resist rotation as torque is applied to the drillstring **131**. During sliding drilling, the drillstring **131** is held in place by the top drives while the bit is rotated by the mud motor **142**, which is supplied with drilling fluid by the mud pumps **143**. The driller can operate the top drives to change the face angle of the bit **156**. The cuttings produced as the bit drills into the earth are carried out of bore hole **133** by drilling mud supplied by the mud pumps **143**.

[0049] Control software in a programmable medium of the control system CS, e.g., but not limited to, one, two, three or more on-site, or remote computers, PLC's, single board computer(s), CPU(s), finite state machine(s), microcontroller(s), controls the movement of the main shafts in response to the movement of an adjustable apparatus (e.g. at a driller's console) so that the main shaft is not moved too quickly and so that it and the drillstring and the bit connected thereto are moved smoothly with a smoothly decreasing declaration as a movement end point is approached. "On-site" may include e.g., but is not limited to, in a driller's cabin and/or in a control room or building adjacent a rig.

[0050] A motor of the top drives—ONE OR BOTH—rotates the main shaft (which are connected to the drillstring) with the drill bit at its end. A VFD controller controls the motors. A position encoder (located adjacent the top drive motor) sends a signal indicative of the actual position of the main shaft to the VFD controller and to the control system CS where it is an input value for the control software in the system CS.

[0051] From the operator interface I, pre-selected limiting values for main shaft speed ("speed limit"); main shaft torque ("torque limit"); and a desired bit position or "Position Set Point" are input to the control system's control software. The control system CS provides status data to the operator interface I which includes speed, torque, shaft orientation, and position of the apparatuses. The control software sends commands to the VFD controllers which include speed commands and torque commands (torque limit). The VFD controllers provide feedback to the control software which includes values for actual speed of the main shaft and the actual torque (the torque applied to the drillstring by the top drives).

[0052] The control system CS can adjust the speed of the top drive motors. Singly or together, and controls the torque applied to the drillstring by the top drive(s) so that the main shaft stops at a desired point. The control system conveys to the control software data values (e.g. fifty per second) for the amount of torque actually applied to the string by either or both top drives; and, regarding actual speed, the amount of actual rotation of the string (in degrees or radians). The position encoder has provided position information and velocity information to the VFD controller. The control software receives information regarding position from the encoder and/or from the VFD controllers, optionally, through a direct input/output apparatus (e.g. an I/O device in communication with the encoder) controlled by the software. The VFD controllers constantly use the position from the encoder to control outputs of the top drives to achieve the desired commanded speed and to maintain torque within the torque limit imposed by the control software. The operator using the operator controls on the control interface inputs to the VFD controllers a limitation on the torque that is to be applied to the string ("Torque Limit") and a limitation on the speed at which the main shaft of the top drives is to be rotated ("Speed Limit").

[0053] FIG. **7**A illustrates schematically a dual top drive system **150** according to the present invention which has an upper top drive **151** above a lower top drive **152**. As shown to the right of the upper top drive **151**, when this top drive is rotating a tubular T to the right, clockwise as seen in FIG. **26**B, a reaction torque is as indicated by the arrow A. The generated rotational force is applied to the tubular T. A torque reactor **151**R reacts the reaction torque through the torque shaft **151**T to a rig floor RF.

[0054] As shown to the right of the lower top drive **152**, when this top drive is rotating the tubular T to the right, clockwise as seen in FIG. **26**B, a reaction torque is as indicated by the arrow B. The generated rotational force is applied to the tubular T. A torque reactor **152**R reacts the reaction torque through the torque shaft **152**T to the rig floor RF.

[0055] As shown in FIG. **7**B, the reaction torques generated by the two top drives are opposite to each other and reduce or eliminate the reaction torque total effect. Such reduction or elimination occurs with or without the torque reactors **151**R, **152**R (which is within the scope of the present invention). A balanced or relatively more balanced application of rotative force to the tubular T—achievable with such a system according to the present invention—stabilizes a member or members being rotated by the top drives and/or reduces stress and strain to the member(s), to the rig, to rig components, and to equipment.

[0056] FIG. **8** illustrates a dual top drive system **160** according to the present invention for making-up a joint of two tubulars TA and TB (or for breaking out the joint). An upper top drive **161** rotates the tubular TA in one direction while a lower top drive **162** either holds the tubular TB or rotates it in an opposite direction to that of the rotation of the tubular TA. Although FIG. **27** shows the two top drives opposed to each other, any two top drives of any system according to the present invention may be used to make-up joints or to break out joints. Also, such operations according to the present invention may be at well center or away from it, according to the present invention.

[0057] In certain aspects, the present invention includes an offshore drillship (e.g., see U.S. Pat. No. 6,056,071) which is a multi-activity drillship with a tanker-type hull which is fabricated with a large moon pool between the bow and stern. A multi-activity derrick (see derrick **40**, FIG. **9**) is mounted upon the drillship substructure above a moon pool and operable to conduct primary tubular operations and simultaneously operations auxiliary to primary tubular operations from a single derrick through the moon pool. In this patent application the term "tubular" is used as a generic expression for conduits used in the drilling industry and includes relative large riser conduits, casing, strings, and drillstrings of various diameters.

[0058] The derrick **40** includes a base **110** which is joined to the drillship substructure **112** symmetrically above the moon pool MP. The base **110** is preferably square and extends upwardly to a drill floor level **114**. Above the drill floor level is a drawworks platform **116** and a drawworks platform roof **118**. Derrick legs **120**,**126** (other legs not shown) are composed of graduated tubular conduits and project upwardly and slope inwardly from the drill floor **114**. The derrick terminates into a generally rectangular derrick top structure or deck **128**. The legs are spatially fixed by a network of struts **130** to form a rigid drilling derrick for heavy duty tubular handling and multi-activity functions in accordance with the subject invention. The derrick top **128** serves to carry a first mini-derrick **132** and a second mini-derrick **134** which guide sheave and hydraulic motion compensation system.

[0059] Tubulars are rotatable by a first dual top drive system **182** (with top drives **182***a*, **182***b*) and a second dual top drive system **183** (with top drives **183***a*, **183***b*). Each top drive may be the same or they may be different (as is true for any system according to the present invention). The top drive systems are connected to traveling blocks and are, optionally, balanced by hydraulic balancing cylinders and a guide dolly supports a power train which drives a tubular handling assembly above drill floor **114** (e.g., as in U.S. Pat. No. 6,056,071).

[0060] It will be appreciated that the multi-activity derrick comprises two dual top drive systems, drawworks, motion compensation and traveling blocks positioned within a single, multi-purpose derrick.

[0061] As shown in FIG. **10**, a drilling system according to the present invention contains a support structure **210**, such as a derrick. A drill stem **212** having a drill bit **214** at its bottom end is coupled to a dual top drive system **290** which has two top drives **290***a*, **290***b* each connected via a gear box **220** for rotating the drill stem **212**. The system **290** in one aspect uses electric top drive motors. The electric motors may be a DC or an AC type motor. The system **290** is hereafter referred to as the "rotary system." The rotary system **290** is adapted to rotate the drill stem **212** in both the clock-wise and counter clock-wise directions.

[0062] The top end of the drill stem **212** is coupled to a cable or line **222** via a system of pulleys **218**. One end of the line **222** is anchored at a suitable place **211** on the support structure **210** while the other end of the cable **222** is wound on a drum **232** of a drawworks **230**. The drawworks **230** contains the drum **232**, which is coupled to a transmission and clutch mechanism **234** via a coupling member **236**, and a friction brake **233**. The transmission and clutch mechanism **234** contains different levels, wherein the lowest level defines the least rotational speed range for the drum **232** and the highest level defines the highest speed range for the drum **232**. The transmission and clutch mechanism **234** engages with the drum **232** via the coupling member **236**. During drilling, the clutch and transmission are set at the low clutch and low speed gears. If more than one DC motor is used to operate the drawworks, their armatures may be connected in series.

[0063] A prime mover **238** coupled to the transmission and clutch mechanism **234** is adapted to rotate the drum **232** in both the clock-wise and counter clock-wise directions when the clutch and transmission mechanism **234** is engaged with the drum **232**. An electric motor is preferably used as the prime mover **238**. The prime mover **238** is hereafter referred to as the "drawworks motor." When the clutch and the transmission mechanism **234** is disengaged from the drum **232**, the drawworks motor **238** has no affect on the drum **232**. When the brake **233** is fully engaged with the drum **232**, it prevents the drum **232** from rotating. When the drawworks motor **238** is disengaged from the drum **232** and the brake **232** is controllably released, the weight of the drill stem **212** (the hook load) causes the drum **232** to rotate to unwind the cable **222** from the drum, thus lowering the drill stem **212**. A control circuit controls the system of FIG. **10** and is, in one aspect, a control circuit **202** which is like the control circuit 100 of U.S. Pat. No. 5,713,422 (incorporated fully herein for all purposes).

[0064] It is to be understood that any dual top drive system according to the present invention shown schematically in each and any figure of the drawings herein may be any suitable dual top drive system according to the present invention disclosed herein; and that any system according to the present invention in any embodiment hereof may be used with any suitable control system disclosed herein. It is within the scope of the present invention to provide dual or two top drives (in any way or manner or as in any embodiment disclosed herein) in each system and/or method of the following U.S. patents and to employ the systems and/or methods of these patents, and/or their apparatuses and structures, using two top drives, with their systems, apparatuses, devices, and/or methods applied to one, either or both top drives: U.S. Pat. Nos. 7,882,902; 7,845,418; 7,845,408; 7,828,085; 7,810,556; 7,798,209; 7,793,719; 7,784,565; 7,784,535; 7,779,904; 7,775,579; 7,748,445; 7,743,853; 7,712,523; 7,681,646; 7,681,632; 7,665,531; 7,665,530; 7,617,866; 7,584,810; 7,533,720; 7,500,518; 7,493,970; 7,487,848; 7,472,762; 7,461,705; 7,461,698; 7,451,826; 7,419,012; 7,404,454; 7,401,664; 7,353,880; 7,320,374; 7,290,621; 7,270,189; 7,249,632; 7,231,969; 7,222,683; 7,219,744; 7,213,656; 7,199,497; 7,188,686; 7,178,788; 7,137,454; 7,128,161; 7,090,035; 7,090,021; 7,055,594; 6,443,241; 6,637,526; 6,691,801; 6,688,394; 6,779,599; 3,915,244; 6,588,509; 5,577,566; 6,315,051; 6,591,916; 6,527,493; 6,920,926; 4,878,546; 4,126,348; 4,458,768; 6,494,273; 5,713,422 6,073,699; 5,755,289; and 7,013,759, all incorporated fully herein, and the same with respect to these U.S. patent applications Ser. Nos. 12/600,576; 12/625,920; 12/284,022; 12/615,047; 12/813,981; 12/392,253; 12/218,211; and 09/865,089; and any top drive in any of these references may be used for one or both top drives in any embodiment of the present invention.

What is claimed is:

1.-**12**. (canceled)

13. A method for a wellbore operation using a first top drive and a second top drive.

14. The method of claim **13** wherein the wellbore operation is one of drilling, casing, casing while drilling, casing drilling, reaming, underreaming, joint make-up, joint breakout, milling, managed pressure drilling, underbalanced drilling, tubular rotation, tubular running, tubular running with continuous circulation, controlling bit face orientation during operations with a bit, conducting well operations based on mechanical specific energy considerations, automatic drilling and tubular rotation. and the tubular is one of casing, tubing, riser, tubular member, pipe, drill pipe, string of tubulars, drill string, quill, shaft, drive shaft and hollow shaft.

15. The method of claim **13** in which the two top drives operate in an operation mode, and the operation mode is one of the two top drives each simultaneously rotating a tubular and the two top drives each alternately rotating a tubular.

16. The method of claim **13** wherein the welbore operation is a tubular rotation operation and the tubular is a first tubular and the first top drive rotates the first tubular in a first direction and the second top drive rotates a second tubular in a second direction opposite to the first direction, the wellbore operation including one of joint make-up of the first tubular with the second tubular and joint breakout of the first tubular from the second tubular.

17. The method of claim **13** wherein the first top drive is on a first carriage movably connected to a derrick and the second top drive is on a second carriage movably connected to the derrick, and the relation to the derrick is one of a first relation and a second relation, in the first relation the first carriage on a first side of the derrick and the second carriage on the first side of the derrick, and in the second relation the first carriage is on a first side of the derrick and the second carriage is on a second side of the derrick opposite the first side.

18. The method of claim **13** further comprising using the two top drives, stabilizing a tubular during rotation thereof.

19. The method of claim **13** further comprising using the two top drives, counteracting a force applied to a tubular during the operation.

20. The method of claim **13** wherein the operation is a joint make-up operation for joining two tubulars and, using the two top drives, the first top drive rotates a first tubular member during joint make-up and the second top drive holds a second tubular member to be made up with the first tubular.

21. The method of claim **20** wherein the second top drive rotates the second tubular.

22. The method of claim **13** wherein the wellbore operation is a joint make-up operation, and first top drive makes up the joint to shouldering of the joint, and the second top drive then makes up the joint past shouldering.

23. The method of claim **13** wherein the wellbore operation is a joint make-up operation and the first top drive makes up the joint to a point near shouldering, and the second top drive then completes makes up of the joint.

24. The method of claim **13** wherein the operation is a tubular rotation operation and both of the top drives are operating in one of a first mode and a second mode, the first mode comprising upon sensing that less torque is sufficient, one of the top drives is selectively deactivated and the second mode comprising upon sensing a need for added torque in the rotation, the other top drive is selectively activated to provide additional torque for the rotation.

25. The method of claim **13** wherein the operation is one of a tubular rotation operation and a drilling operation, and during the operation the top drives are activated alternately.

26. The method of claim **13** wherein the position of the top drives with respect to each other is changable during the wellbore operation.

27. The method of claim **26** wherein the second top drive is moved out of the way of the first top drive as the top drives move down in a derrick.

28. The method of claim **13** wherein each top drive has a dedicated torque transfer apparatus for transferring torque therefrom, the method further comprising

transferring torque from each top drive.

29. The method of claim **13** wherein the first top drive is connected to a first torque transfer apparatus and the second tpp drive is connected to a second torque transfer apparatus, the method further comprising

transferring torque from the first top drive with the first torque transfer apparatus to a first structure, and

transferring torque from the second top drive with the second torque transfer apparatus to a second structure, the second structure opposite and spaced-apart from the first structure.

30. The method of claim **13** wherein the first top drive is on a derrick, the second top drive is on the derrick, and the derrick is on a drillship.

31. The method of claim **13** wherein each top drive is in driving relation to a drive stem, and the drive stem is rotated by both top drives during the well operation.

32. A dual top drive system for a wellbore operation, the dual top drive system comprising a first top drive above a second top drive.

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