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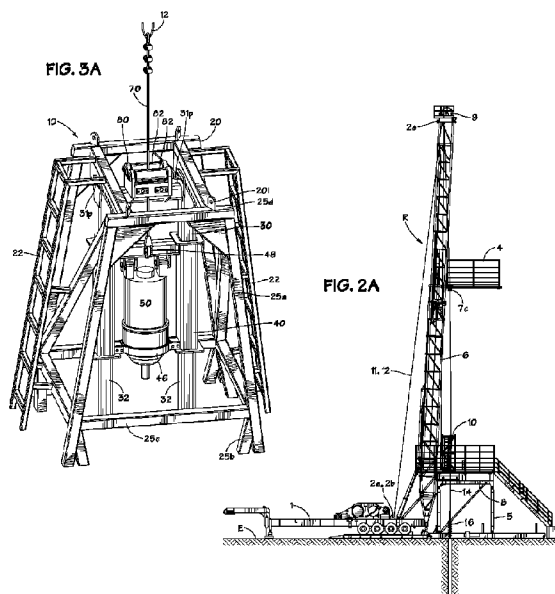
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(57) Abstract: A method for drilling an auxiliary hole, such as a conductor hole, a mousehole or a rathole, useful in wellbore drilling operations, the method comprising the steps of installing an auger drive unit (10) on a drill floor (8) of a drilling rig (R), the auger drive unit (10) comprising a drive (50) having a rotor (51), and a structure (20) for supporting the drive (50), the drive (50) movable in a substantially vertical plane in relation to said structure (20), the method further comprising the steps of connecting an auger (16) to said rotor (51) and rotating said auger (16) to drill said auxiliary hole.

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METHOD AND APPARATUS FOR DRILLING AUXILIARY HOLES

The present invention relates to a method and apparatus for drilling auxiliary holes such as conductor holes, ratholes, and mouseholes.

5 The prior art discloses a variety of methods and systems for drilling operations; for example, and not by way of limitation, those disclosed in U.S. Patents 2,810,550; 3,340,938; 3,719,238; 3,807,109; 3,922,825; 3,942,593; 4,269,395; 4,290,495; 4,368,602; 4,421,179; 10 4,442,904; 4,489,526; 4,569,168; 4,809,788; 4,837,992; 4,875,530; 5,038,871; 5,199,507; 5,351,767; 5,468,121; 5,544,978; 6,209,851; 6,634,436; 6,523,319 and the references cited in these patents - all these patents incorporated fully herein for all purposes. The 15 formation of auxiliary holes such as conductor holes, ratholes, and mouseholes and the use of such holes is common in such drilling operations. Figure 1 illustrates a prior art drilling system.

20 In many drilling operations, prior to drilling a main wellbore, auxiliary holes such as a conductor hole, rathole, or mousehole are drilled near the location of the main wellbore. This is a large diameter hole, lined with pipe, also called a starter hole, varies in depth down of tens of feet to a few hundred feet depending on 25 the local geology. A mousehole is a shallow bore hole under or to one side of the rig floor, usually lined with pipe, in which joints of drill pipe are temporarily placed. A rathole may be used to store a kelly, consisting of an opening in the rig floor fitted with a 30 piece of casing with an internal diameter larger than the outside diameter of the kelly, but less than that of the upper kelly valve so that the kelly may be lowered into the rathole until the upper kelly valve rests on the top

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of the piece of casing.

Typically, an auxiliary hole is drilled by a relatively small portable rig rather than by the drilling system that will be used to drill a main wellbore. Once
5 the auxiliary hole has been drilled, the portable rig is removed. A variety of problems are associated with the use of such rigs; often including difficulties in transporting such rigs to remote locations where the main wellbore is to be drilled. Often, if auxiliary hole
10 drillers are not available or cannot reach the drill site, some drillers use a kelly to drill these holes. Using the kelly to drill these holes can be dangerous to employees and personnel, since the workers have to pull the kelly over by hand or with winches to these holes and
15 the resistance and weight of this equipment can make it difficult to maintain a precise drilling angle. This can lead to inaccurate angles for these holes which is undesirable. Guiding the drilling of an auxiliary hole with a kelly can be extremely difficult. The drill bit
20 can move in any direction and precision can be lost. Also for kelly drilling, a rig mud system must be operational.

U.S. Patent 3,719,238 discloses a compact, mobile, portable rotary drilling rig which enables the use of
25 pipe of a length slightly less than the height of the mast. The drilling rig has a power driven swivel or drilling head connectable to a drill pipe, which swivel may be pulled down by a hydraulic cylinder plunger arrangement, which cylinder is about one half the length
30 of the distance which the swivel is to be pulled down, and which cylinder is so constructed that no hoses are connected directly to the movable hydraulic cylinder. The hydraulic cylinder exerts tension on cables to

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perform the pull down action. Provision is made to mount the present compact, mobile, rotary drilling rig, including the mast, on a vehicle which may be enclosed in van like insulated structure. In certain aspects such a portable drilling rig has: a base; a prime mover mounted on the base; an upstanding mast mounted on said base; a fluid powered swivel mounted on the mast for movement longitudinally thereof in guided relation; a fluid pump connected in driven relation with the prime mover; a piston rod having two hollow portions, mounted longitudinally of and within the mast and having a fluid blockage therein between the hollow portions; a movable fluid cylinder mounted on the hollow piston rod and being longitudinally movable with respect thereto; packing sealing the ends of the cylinder with respect to the hollow piston rod; a piston mounted on the piston rod within the length of the fluid cylinder; cable sheaves mounted on each end of the fluid cylinder; further cable sheaves mounted near each end of the mast; at least two cables connected to the fluid powered swivel and extending in opposite directions over the sheaves at each end of the mast and over the sheaves at each end of the cylinder, with a portion of the cable being restrained against substantial movement at each end of the mast; pressure control apparatus for directing fluid under pressure into the cylinder through on the portion of the hollow piston rod at one end thereof on one side of the piston and directing fluid under pressure out of the fluid cylinder on the other end of the piston and on the other side of the blockage in the hollow piston rod into the other portion of the hollow piston rod to move the cylinder relative to the piston by fluid pressure so as to move the swivel longitudinally of the mast by means of

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the cables connected thereto.

U.S. Patent 4,421,179 discloses well drilling apparatus including a powered drilling unit connectable to the upper end of a drill string and adapted to rotate it to drill a well, and a vertically extending guide track structure which guides the drilling unit for movement along the axis of the well, with a portion of the guide track structure being mounted for swinging movement between a drilling position in which the drilling unit is aligned with the axis of the well and a slightly inclined position in which the track structure guides the drilling unit for movement along an inclined axis in alignment with a mousehole, and with the drilling unit also preferably being mounted for movement to a laterally retracted position at a side of the well in which it leaves an area along the axis of the well unobstructed for use of conventional hoisting equipment in making a round trip of the drill string out of and then back into the well. In one aspect such a well drilling apparatus includes: a mast or derrick; a drilling unit including an element adapted to be connected to the end of a drill string for rotation therewith about the axis of the string, and a motor operable to drive the element and the connected string rotatively about the axis; a pair of elongated first guide rails; a pair of shorter second guide rails forming lower extensions of the first rails; a carriage by which the drilling unit is carried and engaging the rails for movement therealong between an upper position of guided engagement with the first rails and a lower position of guided engagement with the second rails; pivotal connection means mounting the first rails near their upper ends for swinging movement of the first rails and

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the second rails and the carriage and carried drilling unit relative to the mast or derrick between drilling positions in which the carriage and drilling unit are guided by the first and second rails for movement along the axis of the drill string and inclined positions in which the first and second rails extend at an angle to the axis and guide the carriage and drilling unit for movement along an inclined path at an angle to the axis for access to a mousehole; and a connection mounting at least one of the second rails to a corresponding one of the first rails for movement therewith between the drilling and inclined positions, and for swinging movement relative thereto with the carriage and drilling unit to move the drilling unit from an active position of alignment with the axis to a retracted position at a side of the axis.

U.S. Patent 5,038,871 discloses drilling equipment including apparatus for laterally moving a direct drive drilling unit to a position offset from the centerline of a well. The drilling equipment includes a traveling block suspended for generally vertical travel within a derrick during drilling of a well, a direct drive drilling unit suspendable from the traveling block, means for guiding the drilling unit during drilling and apparatus connected to the derrick for moving the drilling unit laterally relative to the axis of the well to an offset position. The drilling unit includes a drill motor and a drive sleeve for threadably connecting the drill motor to a drill string in the well. The guide means includes a first pair of rails connected to the derrick and extending parallel to the axis of the well. The apparatus includes a second pair of rails and means for supporting the drilling unit. The second pair of

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rails is positionable below and in alignment with the first pair of rails when the support means is in the offset position. In one aspect such equipment includes: means for suspending equipment for generally vertical travel within the derrick; a power swivel suspendable from the suspension means, said power swivel including a drill motor for rotating a drill string in a well, means for guiding the power swivel during travel, the guide means including a first pair of rails connected to the derrick and extending parallel to the axis of the well, and apparatus connected to the derrick for moving the power swivel laterally relative to the axis of the well to an offset position, the apparatus including a second pair of rails and means for supporting the power swivel, the second pair of rails being positioned below and in alignment with the first rails when the support means is in the offset position whereby the suspension means can travel the full length of the first and second pair of rails when the support means is in the offset position.

U.S. Patent 5,544,978 discloses a machine for simultaneously augering and thrusting an anchor into the ground for later attachment of a utility pole or road sign. A vehicle is used to transport the thruster machine with a hydraulic control system such that a rail track is moved into thrusting position and locked in place. A winch, plus a system of hydraulic pistons will raise and lower an auger and thrusting device into the position desired. With an anchor affixed to the bottom of a platform, the auger is then used to drill out the dirt and other material so that the anchor may be more easily inserted into the ground. The thrusting process is facilitated by an indexing feature contained within the platform. A series of hydraulic pistons drive the anchor

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into the ground until fully stroked, whereupon the platform is re indexed as needed to completely sink the anchor. A counter thrust device may also be employed to stabilize the vehicle during the thrusting operation.

5 Upon completion of the thrusting process, the platform is disengaged from the anchor and raised to its starting position. The rail track is then lowered back onto the flatbed truck, and the vehicle can then be driven to the next desired location for sinking an anchor. In one

10 aspect a combined auger and thruster machine for driving anchors into the ground is disclosed that has: a thrust rail track maintainable in a stationary position, the thrust rail track having a top, the thrust rail track having a pair of spaced apart channel members

15 interconnected by a plurality of cross piece members, each the channel members having a plurality of dog receiving holes; a platform movable upon the thrust rail track, the platform having a dog wall assembly received by the channel members, the dog wall assembly having a

20 dog piston to selectively engage a plurality of dogs that are received by the dog receiving holes, the platform having a platform wall, wherein the platform wall and the dog wall assembly are slidably interconnected by a plurality of pistons, the platform wall adaptable to

25 receive an anchor, the anchor having an axial bore; and an auger carried by the platform and passing through the axial bore when the anchor is received by the platform, said plurality of pistons driving the platform with attached anchor and the auger when the plurality of dogs

30 are received in the dog receiving holes.

In accordance with the present invention, there is provided a method for drilling an auxiliary hole useful in wellbore drilling operations, the method comprising

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the steps of installing an auger drive unit on a drill floor of a drilling rig, the auger drive unit comprising a drive having a rotor, and a structure for supporting the drive, the drive movable in a substantially vertical plane in relation to the structure, the method further comprising the steps of connecting an auger to the rotor and rotating the auger to drill the auxiliary hole. Preferably, the auger drive unit is installed above the drill floor. Advantageously, the auger is connected directly to the rotor or indirectly via an extension member, which may be drill pipe or the like.

Preferably, the method further comprises the step of connecting the structure to the drill floor. Preferably, the structure is connected to the drill floor with a lug hole and pin structure. Advantageously, the drilling rig has a mast and the auger drive unit is arranged within the foot print of the mast on the drill floor. Advantageously, the structure comprises a frame elements to form a frame.

Preferably, the structure comprises at least one rail on which the drive is movable, the method further comprising the step of moving the drive along the rail to raise and lower the drive. Advantageously, the drive is arranged in or on a carriage, the method further comprising the step of raising and lowering the drive in or on the carriage. Preferably, the carriage comprises members, the method comprising the step of the members allowing movement of the carriage along the at least one rail, and inhibiting horizontal movement. Preferably, the members are sleeves. Advantageously, the further comprises the step of setting the at least one rail at angle with respect to the structure. Preferably, the at least one rail has a lower end arranged on a pivot and an

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upper end having moveable connection apparatus wherein the step of setting the at least one rail at an angle is carried out by moving the at least one rail on the pivot and connecting the upper end of the at least one rail to the structure. Preferably, the at least one rail further comprises a guide for guiding a line for raising and lowering the drive. This makes it possible to drill the auxiliary hole at a desired angle to the drill floor. To accommodate non-flat ground on which the rig is located, the auger drive unit is raised or lowered and/or its angle with respect to the rig and ground is adjusted.

Preferably, an up line is provided the method comprising the step of drawing in the up line to raise the drive with respect to the structure. Advantageously, a winch is provided the method comprising the step of using the winch to winch in and out the up line. Preferably, a rig guide is arranged in a mast of the drilling rig, the method further comprising the steps of guiding the up line with the mast guide.

Preferably, a down line is provided the method comprising the step of drawing in the down line to lower the drive with respect to the drive. Preferably, the step of drawing in the down line facilitates drilling of the auxiliary hole, as the weight of the drive alone may provide insufficient force to drill the auxiliary hole effectively. Preferably, a winch is provided, the method comprising the step of using the winch to winch in and out the line. The winch for raising the drive may be separate from a winch for lowering the drive or may be one winch. The winch may be the drawworks of the drilling rig or may be a separate winch. One or more lines such as cables connected to the drive unit may be used. When using a single cable, the cable is disconnected for

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various steps. These cable(s) will be used in relative hard ground, in some rock formations, and in some frozen ground.

Preferably, the drive is hydraulically powered;
5 electrically powered; or pneumatically powered.

Preferably, a guide is provided for guiding the line. The guide may comprise rollers and advantageously be fixed to the bottom of the structure. Advantageously, a rig guide arranged in a mast of the drilling rig the
10 method further comprising the steps of guiding the up and/or down line with the mast guide. The mast guide guides the line so that the line is inhibited from interfering with other drilling rig operations. Preferably, the line guide is mounted at, on or near to a
15 racking board arranged on the mast of the drilling rig.

Advantageously, the drill floor comprises at least one hole the method comprising the step of moving the auger drilling unit over the at least one hole and fixing the structure to fixing apparatus on or in the drill
20 floor about the at least one hole. Preferably, the auxiliary hole is one of a conductor hole, a rathole, and a mousehole.

Preferably, the method further comprises the step of following drilling down into the earth with the auger,
25 raising the drive apparatus to add a drilling extension between the auger and the rotor for further drilling into the earth.

Advantageously, the method further comprises the step of removing the auger drive unit from the rig upon
30 completion of the auxiliary hole, preferably, so that installation of the main drilling equipment can commence

The present invention also provides a drilling rig comprising a mast having a foot print at the drill floor

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covering at least a portion of a drill floor, the drill floor having a hole therein at wellcentre and at least one further hole spaced from wellcentre and an auger drive unit for drilling an auxiliary hole useful in wellbore drilling operations, the auger drive unit movably installed on a part of the portion of the drill floor and movable from the hole at wellcentre to the at least one further hole, the auger drive unit comprising a drive having a rotor, and a structure for supporting the drive, the drive movable in a substantially vertical plane in relation to the structure, and an auger connected to the rotor for rotating the auger to drill the auxiliary hole. Preferably, the drive is movable in a substantially vertical plane in relation to and within the structure.

The present invention, in certain aspects, provides systems and methods for drilling an auxiliary hole useful in drilling operations, such as a conductor hole, rathole or mousehole.

Preferably, the auger drive unit is portable. The weight of the drive provides downward force on the auger for drilling.

Precision, accuracy, portability, efficiency are increased in using the apparatus and method of the invention. With a unit in accordance with the present invention precise holes can be drilled from the drill floor in exactly the correct spot and angle.

In certain aspects units in accordance with the present invention can be mounted on the back of a regular truck since the overall dimensions, in some aspects, are 1.22m (4 feet) by 1.83m (6 feet) making it very portable.

The auger drilling unit may be transported to other similar rigs, thus this one unit can service many rigs.

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In certain aspects, units in accordance with the present invention use hydraulics and winch lines from the crown, and there is, therefore, no need for the mud system to drill auxiliary holes. While some crew members
5 drill the auxiliary holes, other crew members can set up the mud system thus saving time.

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For a better understanding of the present invention, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a side schematic view of a prior art
5 drilling system;

Figure 2A is a side view of a rig in accordance with the present invention comprising an auger drive unit in accordance with the present invention;

Figure 2B is a front view of the rig shown in Figure
10 2;

Figure 2C is a top view of a racking board of the rig shown in Figure 2A;

Figure 2D is a top view of a part of the rig shown in Figure 2A showing a guide pivot arm;

Figure 2E is a side view of a part of the rig shown in Figure 2D showing a guide pivot arm;

Figure 2F is a front view of the part of the rig shown in Figure 2D;

Figure 2G is a top view of a part of the rig shown
20 in Figure 2A;

Figure 3A is a perspective view of a top part of an auger drive unit in accordance with the present invention;

Figure 3B is a front view of the auger drive unit shown in Figure 3A, indicating parts in dotted line in a second step of operation;

Figure 3C is a side view of the auger drive unit shown in Figure 3A;

Figure 3D is a top view of the auger drive unit
30 shown in Figure 3A;

Figure 4 is a perspective view of a part including a structure of the auger drive unit shown in Figure 3A;

Figure 5A is a perspective view of a drive apparatus

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part of the auger drive unit shown in Figure 3A;

Figure 5B is a perspective view of a rail assembly of the drive apparatus shown in Figure 5A;

Figure 5C is a perspective view of a drive of the
5 drive apparatus shown in Figure 5A;

Figure 5D is a perspective view of a carriage of the drive apparatus shown in Figure 5A;

Figure 5E is a perspective view of a roller apparatus of the drive apparatus shown in Figure 5A;

10 Figure 5F is a perspective view of a cable assembly of the auger drive unit shown in Figure 3C;

Figure 5G is a perspective view of a cable of the auger drive unit shown in Figure 3C;

15 Figure 5H is a perspective view of a roller apparatus of the auger drive unit shown in Figure 3B;

Figure 5I is a perspective view of a sheave of the auger drive unit shown in Figure 4;

20 Figure 6A is a schematic perspective view of an auger drive unit in accordance with the present invention ready to drill a hole;

Figure 6B is a perspective view of an extension used in drilling with the auger drive unit shown in Figure 3A;

25 Figure 7A is a top view of part of a rig comprising an auger drive unit in accordance with the present invention in a first step of operation over wellcentre;

Figure 7B is a top schematic view of the part of the rig shown in Figure 7A;

Figure 7C is a side view of part of the auger drive unit shown in Figure 7A;

30 Figure 8A is a top view of part of the rig shown in Figure 7A in a second step of operation with the auger drive unit moved away from wellcentre;

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Figure 8B is a top schematic view of the rig shown in Figure 8A;

Figure 8C is a side view of part of the auger drive unit shown in Figure 8A, with an angle scale superimposed on the part;

Figures 9A and 9B are top views showing steps in a method of drilling a rathole in accordance with the present invention;

Figure 9C is a side view of part of the auger drive unit shown in Figure 8A, with an angle scale superimposed on the part, the angle set for drilling the rathole;

Figure 9D is a top view of part of the rig shown in Figure 9A;

Figure 10A is a perspective view of an auger drive unit in accordance with the present invention in a step of a method in accordance with the present invention;

Figure 10B is a perspective view of the auger drive unit shown in Figure 10A in a subsequent step of the method in accordance with the present invention;

Figure 10C is a perspective view of the auger drive unit shown in Figure 10A in a subsequent step of the method in accordance with the present invention;

Figure 11A is a perspective view of connection apparatus between an auger drive unit in accordance with the present invention and a drill floor; and

Figure 11B is a perspective view of connection apparatus between an auger drive unit in accordance with the present invention and a drill floor.

Figure 1 illustrates a prior art drilling rig which, as shown, has a top drive system for rotating a drill string; but as is well-known, any suitable rotary apparatus on a drill floor may be used for this purpose. The prior system as shown in Figure 1 has a drilling rig

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with a rig floor, a derrick, a crown block, and strands of a cable, by which a traveling block is vertically positioned. A lower end of the traveling block is connected to an upper end of a swivel. The swivel is supported by bails from a connector. A drilling motor has a hollow output shaft that directly drives a drill string with a drill bit used for drilling a main wellbore. The motor has opposed arms attached to a motor frame. The traveling block moves vertically within the derrick and the swivel, motor, and drill string are carried therewith. A drawworks drive is positioned to accept the marginal end of a cable about a drawworks drum. A dog house houses control panels and electronic circuitry for controlling the operation of the drilling rig. A fast line extends from drum of the draw works and is rove between the crown block and traveling block. The system of Figure 1 includes an auxiliary hole (or holes) adjacent a main wellbore which was not drilled with the drill string and drill bit; e.g., a rathole or mousehole used in the drilling operations. Optionally, a typical rotary apparatus, not shown, is used to drill the main wellbore.

Figures 2A and 2B show a rig R in accordance with the present invention with an auger drive unit 10 in accordance with the present invention secured to a drill floor 8 of a substructure 5. The drill floor 8 supports a mast 6 which has a racking board 4 secured thereto. Cables 11 and 12 extend from the auger drive unit 10 up to a crown block structure 9 of the rig R and down to winches 2a, 2b on a rig carrier frame 1 (e.g. a trailer or drilling unit that supports equipment, e.g. a drawworks, engines, winches, etc). An extension 14 with an auger 16 attached thereto project down from the auger

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drive unit 10. In certain aspects, with a rig floor that is about 6m (20 feet) high, about eight (plus-or-minus one) extensions 14 are used, each about 1.2m (4 feet) long, with an auger that is about 2.7m (9 feet) long for
5 a 4.5m (15 feet) deep mousehole or a 4.5m (15 feet) deep rathole.

As shown in Figure 2B, the auger 16 of the auger drive unit 10 has drilled a conductor hole H in the earth E.

10 Figure 2C illustrates the racking board 4 and a guide pivot arm 7a with a roller apparatus 7b for guiding the cable 12; and a guide pivot arm 7c with a roller apparatus 7d for guiding the cable 11. Each guide pivot arm is pivotable on a shaft 7f by moving a handle 7g;
15 e.g. to move the guide pivot arms out of the way of a travelling block in the rig.

The winches, winches 2a and 2b, typically mounted close to a drawworks DK winch the cables that run from the winches up to the crown block structure 9, around
20 sheaves 2d and 2e, and then down to the drill floor 8 to the auger drive unit 10. The cable 12 goes from the winch 2a to the sheave 2d to a cable assembly 70. The cable 11 goes from the winch 2b to the sheave 2e to a cable assembly 60. The winches 2a and 2b are powered,
25 e.g., hydraulically, and these winches winch the cables 11, 12 up.

Figures 2D to 2F show one of the guide pivot arms 7a in detail. The roller apparatuses 7b, 7d have two pairs of rollers, a pair of rollers 7r and a pair of rollers
30 7s, one pair above the other and at right angles to one another in a horizontal plane. A chain 7h has one end connected to the guide pivot arm 7a and the other end connected to the racking board 4.

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Figures 3A to 3D show the auger drive unit 10. A guide rail assembly 30 is secured to a frame 20. Ladders 22 are provided on opposed sides of the frame 20. A base 24 of the frame 20 is connected to and supports frame structural members 25a, 25b, 25c and 25d. A carriage 40, movable on rails 32 of the guide rail assembly 30, supports a drive 50 which is secured to the carriage 40. The drive 50 has a drive shaft 51 for connection to an auger. Turnbuckles 24a (or other suitable connectors releasably secured to lugs 24b) are used to secure the frame 24 to the drill floor 12.

The rails 32 comprise seats 33 providing a lower stop for the carriage 40. Each of the pair of rails 32 is selectively connected to the frame 20 with pin 29 through holes in lugs 34. A cross member 35 extends between the pair of rails 32. The cross member 35 has a guide tube 36 through which passes an extension or an auger connected to the drive shaft 51 of the drive 50.

A cable assembly 60, connected to the carriage 40, has two cable connectors 62 each connected between the housing 40 and a link 64. The cable 11 is connected to a third cable connector 66 which is connected to the link 64. A cable 68 of the connector 66 passes under and around a sheave 25 and through a roller apparatus 26 and is then connected to the cable 11 from the sheave 2e. Pulling up on the cable 68 pulls the housing 40 and the drive unit 50 down.

A cable assembly 70 with a cable 72 is connected to the housing 40 and extends up through a roller assembly 80 between the rollers 82. The roller assembly 80 is secured to the guide rail assembly 30. The cable 72 is used to lift drive unit 10 with the drive 50, e.g., to add additional extension member(s).

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Each rail 32 has a top member 38 with two plates 38p each with a plurality of holes 38h. A frame top member 31 has cross members 31a, 31b each with a plurality of holes 31h which correspond to and are adjacent holes 38h of the top members 38 of the rails 32. Pins 31p which extend through a hole 31h and a hole 38h to secure the guide rail assembly 30 in position so that the auger 16 is at a desired angle for drilling an auxiliary hole at a desired angle.

The carriage 40 has two side members 42 through which pass the rails 32 and a top member 44 interconnected between the side member 42. Clamps 46 secured to the side members 42 hold the drive unit 50 in place in the carriage 40. Lugs 58 of the drive 50 are releasably pinned to lugs 48. The clamps 46 are held in a recess 56 of a housing 59 of the drive 50. The cable 70 is connected to a lug 49 of the carriage 40. Lugs 201 provide lifting points for the frame 20. The drive 50 is a commercially auger drive unit.

As shown in Figure 6A, the auger drive unit 10 is preparing to drill a conductor hole at well centre W. The guide rail assembly 30 can be repositioned for drilling a mousehole M through a guide G or a rathole R through a guide D. The angle of these holes is shown in dotted lines (although the holes themselves are in the earth and not directly adjacent the drill floor).

Figures 7A, 8A, and 9A show different positions for the auger drive unit 10 for drilling different auxiliary holes.

As shown in Figures 7A and 7B, the auger drive unit 10 is positioned for drilling a conductor hole at well center W. As shown in Figure 7C, so that the auger 16 is substantially aligned vertically above the well centre W

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(angle of 0 degrees), the pins 31p are inserted through specific holes 31h of the frame and 38h of the guide rail assembly to achieve this alignment.

As shown in Figure 7B, for drilling a conductor hole, the cable 11 goes to the winch 2b and the cable 12 goes to the winch 2a. The cable going to the winch 2b does not go through the guide pivot arm rollers as shown in Figure 2C. The cable 11 - going to the winch 2b - does not go through the guide pivot arm rollers on the racking board. The guide pivot arm rollers are used to allow the cables a clear passage around a travelling block or where any other obstructions can interfere with the cables 11 and 12. These rollers are optional.

As shown in Figures 8A and 8B, the auger drive unit 10 is positioned for drilling a mousehole M. As shown in Figure 8C, the pins 31p are inserted through specific holes 31h, 38h so that the auger unit 10 is at the desired angle (e.g. 4.75 degrees) for drilling a mousehole.

As shown in Figure 8B, for drilling a mousehole, the cable 11 goes to the winch 2b and the cable 12 goes to the winch 2a. The cables 11, 12 go through guide pivot arm rollers as shown in Figure 2C.

As shown in Figures 9A and 9B, the auger drive unit 10 is positioned for drilling a rathole R. As shown in Figure 9C, the pins 31p are inserted through specific holes 31h, 38h so that the auger unit 10 is at a desired angle (e.g. 7 degrees) for drilling a rathole.

As shown in Figure 9B, for drilling a rathole, the cable 11 goes to the winch 2b and the cable 12 goes to the winch 2a. Both cables go through the pivot arm rollers 7b on both sides of the racking board.

Figures 10 A to 10C illustrate steps in methods in

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accordance with the present invention using a rig in accordance with the present invention and an auger drive unit in accordance with the present invention.

As shown in Figure 10A, while cable 12 supports the carriage 40 and the drive 50, pulling up on the cable 11 results in a downward force on the carriage 40, drive 50 and the auger 16 to drill an auxiliary hole X. Both the weight of the housing 40 and drive 50 and the downward force exerted by the cable 11 forces the auger 16 down. It is within the scope of the present invention (as is true of any system and of any method herein in accordance with the present invention) that, as desired, the upward pulling of the cable 11 can be eliminated and the auxiliary hole can be drilled using solely the weight on the auger to provide a downward force (e.g., in loose earth).

As shown in Figure 10A, the auger drive unit 10 has reached a lower limit of its travel. As shown in Figure 10B, pulling up on the cable 12 raises the auger drive unit 50 so that another extension 14 can be added above the auger 16 for further downward drilling. The cable 11 has, correspondingly, moved down allowing the auger drive unit 50 to be raised.

As shown in Figure 10C, an additional extension 14 has been added, connected to the drive shaft 51 of the auger drive unit 10. Upon raising the drive 50, this additional extension 14 is connected to the uppermost extension 14 above the auger 16 for further downward drilling.

Figures 11A and 11B illustrate different ways to secure the frame 20 to the drill floor 8.

As shown in Figure 11A a turnbuckle device 24t (like the turnbuckles 24a described above) is connected to a

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lug 24b and is releasably pinned with a pin 95a to a lug 12m. The lug 12m is releasably pinned with a pin 95b to a hideaway lug frame 96 which is part of the drill floor 8. A pin 95c pins the lug 12m in an upright position.

5 As shown in Figure 11B, a turnbuckle device 24s (like the turnbuckles 24a described above) is connected to a lug 24b and is releasably pinned with a pin 95d to a lug 12r of a bolting plate 97 which is bolted to the drill floor 8; e.g. a bolting plate welded to the drill
10 floor that the lug assembly can bolt to and from which it can be removed when not needed.

The present invention, therefore, provides in some, but not in necessarily all, embodiments a method for drilling an auxiliary hole useful in wellbore drilling
15 operations, the method including: connecting a support frame to a rig (at any suitable location or position; e.g., but not limited to, to and above a drill floor of the rig); securing a mount structure to the support frame; connecting a drive apparatus to the mount
20 structure, the drive apparatus including a drive unit movable with respect to the mount structure; connecting an auger apparatus to the drive unit; rotating the auger apparatus with the drive unit to drill an auxiliary hole; and drilling the auxiliary hole with the auger apparatus.
25 Such a method may include, in any possible combination, one or some of the following: connecting a primary cable to the drive unit, and pulling on the primary cable to force the drive unit and auger apparatus downwardly to facilitate drilling of the auxiliary hole; wherein the
30 rig includes a primary winch for pulling the primary cable, the method further including pulling the primary cable with the primary winch; wherein the rig has a mast and cable guide apparatus on the mast, the method

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including guiding the primary cable with the cable guide apparatus; wherein the cable guide apparatus is movably connected to the mast, the method further including moving the cable guide apparatus and the primary cable with respect to the mast; wherein the drive unit includes a housing and the mount structure has a pair of opposed rails, the housing mounted for movement on the pair of opposed rails, the method further including moving the housing on the pair of opposed rails of the mount structure to move the drive unit and the auger apparatus with respect to the rig; wherein the mount structure includes a plurality of spaced-apart mount structure holes and the drive apparatus includes a plurality of corresponding drive apparatus holes, a pin being insertable through one of the mount structure holes and an adjacent drive apparatus hole to releasably pin the drive apparatus at a desired angle to the mount structure, the method including inserting a pin through a mount structure hole and an adjacent drive apparatus hole to hold the drive apparatus at a desired angle to the mount structure so that the drive apparatus is positioned for drilling the auxiliary hole at a desired angle in the earth; wherein the auxiliary hole is one of a conductor hole, a rathole, and a mousehole; following drilling down into the earth with the auger apparatus, raising the drive apparatus to add a drilling extension between the auger apparatus and the drive apparatus for further drilling into the earth; wherein the rig includes a secondary winch for winching a secondary cable, the secondary cable connected to the drive apparatus, the method further including raising the drive apparatus by winching in the secondary cable with the secondary winch; removing the support frame, mount structure, drive

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apparatus, and auger apparatus from the rig upon completion of the auxiliary hole; and/or wherein the drive unit is not driven by pumped drilling fluid.

5 The present invention, therefore, provides in some, but not in necessarily all, embodiments a method for drilling an auxiliary hole useful in wellbore drilling operations, the method including connecting a support frame to and above a drill floor of a rig; securing a mount structure to the support frame; connecting a drive
10 apparatus to the mount structure, the drive apparatus including a drive unit movable with respect to the mount structure; connecting an auger apparatus to the drive unit; wherein the mount structure includes a plurality of spaced-apart mount structure holes and the drive
15 apparatus includes a plurality of corresponding drive apparatus holes, a pin being insertable through one of the mount structure holes and an adjacent drive apparatus hole to releasably pin the drive apparatus at a desired angle to the mount structure, the method including
20 inserting the pin through a mount structure hole and an adjacent drive apparatus hole to hold the drive apparatus at a desired angle to the mount structure so that the drive apparatus is positioned for drilling the auxiliary hole at a desired angle in the earth; rotating the auger
25 apparatus with the drive unit to drill an auxiliary hole; connecting a cable to the drive unit; pulling on the primary cable to force the drive unit and auger apparatus downwardly to facilitate drilling of the auxiliary hole; the rig including a primary winch for pulling the primary
30 cable, the method further including pulling the primary cable with the primary winch; and wherein the auxiliary hole is one of a conductor hole, a rathole, and a mousehole; and drilling the auxiliary hole with the auger

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apparatus.

The present invention, therefore, provides in some, but not in necessarily all, embodiments a system for drilling an auxiliary hole useful in wellbore drilling operations, the system including: a support frame releasably connectible to and above a drill floor of a rig; a mount structure releasably secured to the support frame; a drive apparatus releasably connected to the mount structure, the drive apparatus including a drive unit movable with respect to the mount structure; an auger apparatus releasably connected to the drive unit; and the auger apparatus rotatable by the drive unit to drill an auxiliary hole. Such a system may include, in any possible combination, one or some of the following: a primary cable connected to the drive unit so that pulling on the primary cable to force the drive unit and auger apparatus downwardly to facilitate drilling of the auxiliary hole; a primary winch on the rig for pulling the primary cable; the drive unit including a housing; the mount structure having a pair of opposed rails; the housing mounted for movement on the pair of opposed rails so that moving the housing on the pair of opposed rails of the mount structure moves the drive unit and the auger with respect to the rig; the mount structure including a plurality of spaced-apart mount structure holes and the drive apparatus including a plurality of corresponding drive apparatus holes, a pin inserted through one of the mount structure holes and an adjacent drive apparatus hole releasably pinning the drive apparatus at a desired angle to the mount structure to hold the drive apparatus at a desired angle to the mount structure so that the drive apparatus is positioned for drilling the auxiliary hole at a desired angle in the earth; and/or raising

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apparatus connected to the rig for raising the drive apparatus to add a drilling extension between the auger apparatus and the drive apparatus for further drilling into the earth.

5 The present invention, therefore, provides in some, but not in necessarily all, embodiments an auxiliary hole drilled in the earth by any method in accordance with the present invention for drilling an auxiliary hole useful in wellbore drilling operations, the method, in one
10 aspect, including: connecting a support frame to a rig; securing a mount structure to the support frame; connecting a drive apparatus to the mount structure, the drive apparatus including a drive unit movable with respect to the mount structure; connecting an auger
15 apparatus to the drive unit; and rotating the auger apparatus with the drive unit to drill the auxiliary hole.

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CLAIMS:

1. A method for drilling an auxiliary hole useful in wellbore drilling operations, the method comprising the steps of installing an auger drive unit (10) on a drill floor (8) of a drilling rig (R), the auger drive unit (10) comprising a drive (50) having a rotor (51), and a structure (20) for supporting the drive (50), the drive (50) movable in a substantially vertical plane in relation to said structure (20), the method further comprising the steps of connecting an auger (16) to said rotor (51) and rotating said auger (16) to drill said auxiliary hole.
2. A method in accordance with Claim 1, further comprising the step of connecting said structure to said drill floor.
3. A method in accordance with Claim 1 or 2, wherein said structure (20) comprises frame elements (25,a,25b,25c) to form a frame.
4. A method in accordance with any preceding claim, wherein the drive (50) is arranged in or on a carriage (40), the method further comprising the step of raising and lowering the drive in or on the carriage (40).
5. A method in accordance with Claim 1, 2 or 3, wherein said structure comprises at least one rail (32) on which said drive (50) is movable, said method further comprising the step of moving the drive along said rail (32) to raise and lower the drive (50).
6. A method in accordance with Claim 4 and 5, wherein said carriage (40) comprises members (42), the method comprising the step of the members (42) allowing movement of the carriage along the at least one rail (32), and inhibiting horizontal movement. [Preferably, the members are sleeves.

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7. A method in accordance with Claim 5 or 6, further comprising the step of setting the at least one rail (32) at angle with respect to said structure (20).

8. A method in accordance with Claim 7, wherein said at
5 least one rail (32) has a lower end arranged on a pivot (29) and an upper end having moveable connection apparatus (38h) wherein said step of setting the at least one rail (32) at an angle is carried out by moving the at least one rail (32) on said pivot (29) and connecting the
10 upper end of the at least one rail (32) to the structure (20).

9. A method in accordance with any of Claims 5 to 8, wherein the at least one rail (32) further comprises a guide (80) for guiding a line (70,12) for raising and
15 lowering said drive (50).

10. A method in accordance with any of Claims 1 to 8, wherein an up line (70,12) is provided the method comprising the step of drawing in the line to raise the drive (50) with respect to the structure (20).

20 11. A method in accordance with Claim 10, wherein a winch (2a) is provided the method comprising the step of using the winch to winch in and out said up line (70,12).

12. A method as claimed in Claim 10 or 11, wherein a rig guide (7a) is arranged in a mast (6) of the drilling rig
25 (R), the method further comprising the steps of guiding said up line (70,12) with said mast guide (7a).

13. A method in accordance with any preceding claim, wherein a down line (60,11) is provided the method comprising the step of drawing in the down line to lower
30 the drive (50) with respect to the drive (20).

14. A method in accordance with Claim 13, further comprising a winch (2b) the method comprising the step of using the winch to winch in and out said down line

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(60,11) .

15. A method in accordance with Claim 13 or 14, wherein a guide (26) guides the down line (60,11) .

16. A method in accordance with any of Claims 13, 14 or
5 15, further comprising a rig guide (7a) arranged in a mast (6) of the drilling rig (R) the method further comprising the steps of guiding said down line (60,11) with said mast guide (7a) .

17. A method in accordance with any preceding claim,
10 wherein said drill floor comprises at least one hole (W,M,R) the method comprising the step of moving said auger drilling unit over said at least one hole (W,M,R) and fixing said structure to fixing apparatus on or in said drill floor (8) about said at least one hole
15 (W,M,R) .

18. A method in accordance with any preceding claim, wherein the auxiliary hole is one of a conductor hole, a rathole, and a mousehole.

19. A method in accordance with any preceding claim,
20 further comprising the step of following drilling down into the earth with the auger (16), raising the drive apparatus to add a drilling extension (14) between the auger (16) and the rotor (51) for further drilling into the earth.

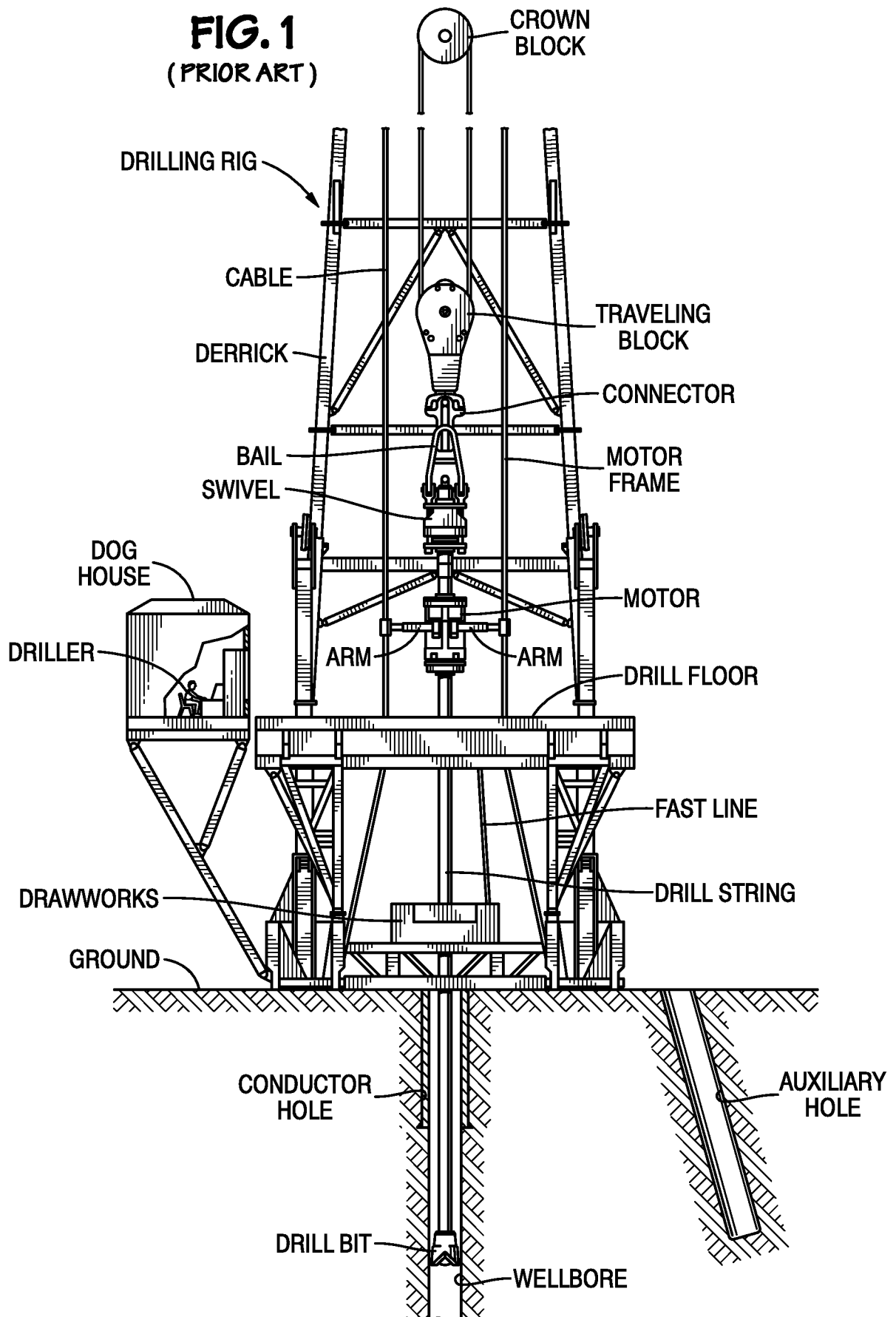
20. A method in accordance with any preceding claim,
25 further comprising the step of removing the auger drive unit from the rig upon completion of the auxiliary hole.

21. A drilling rig comprising a mast (6) having a foot print at the drill floor covering at least a portion of a
30 drill floor (8), the drill floor having a hole therein at wellcentre and at least one further hole spaced from wellcentre and an auger drive unit (10) for drilling an auxiliary hole useful in wellbore drilling operations,

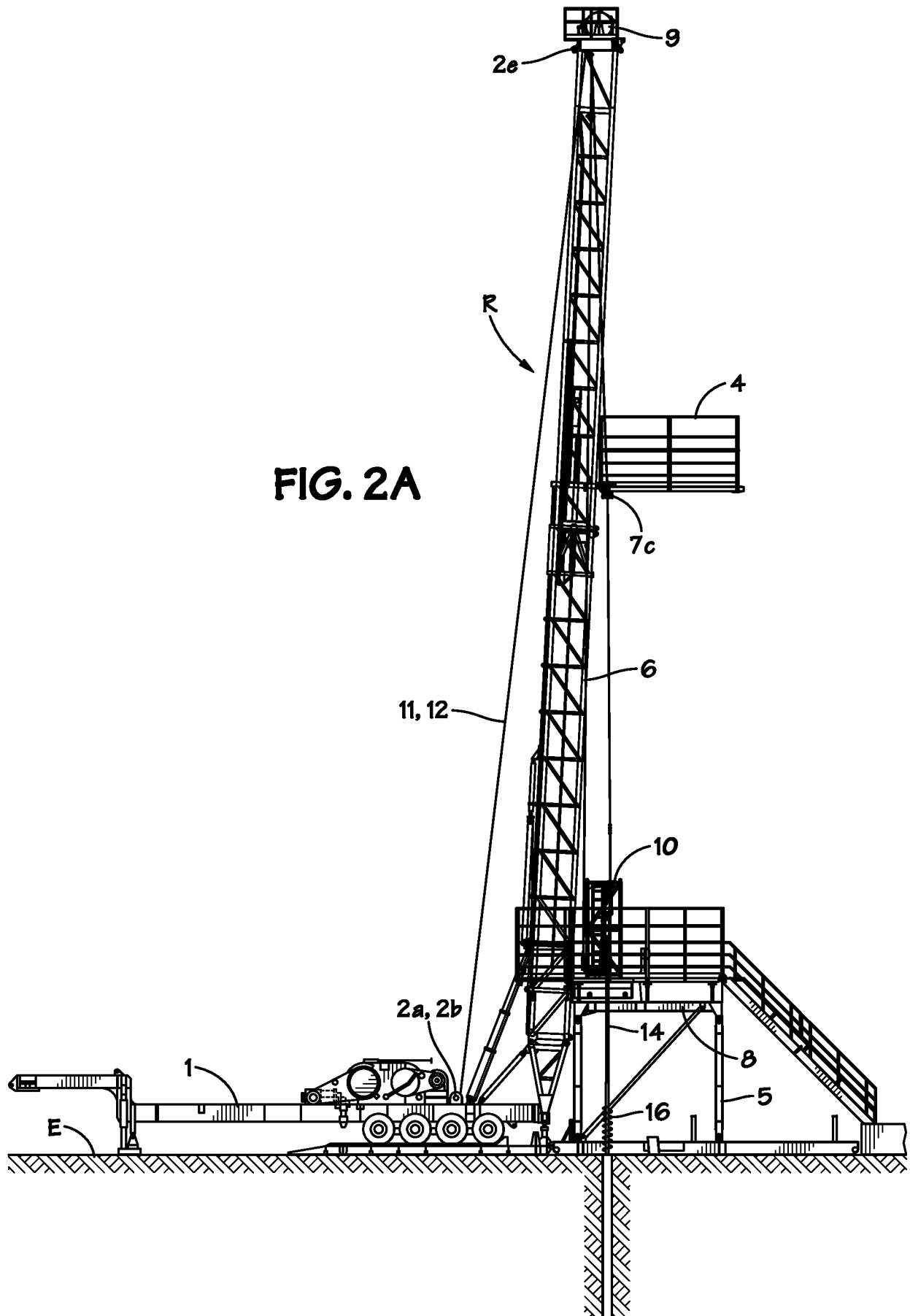
- 30 -

- said auger drive unit (10) movably installed on a part of said portion of said drill floor (8) and movable from said hole at wellcentre to said at least one further hole, the auger drive unit (10) comprising a drive (50) having a rotor (51), and a structure (20) for supporting the drive (50), the drive (50) movable in a substantially vertical plane in relation to said structure (20), and an auger (16) connected to said rotor (51) for rotating said auger (16) to drill said auxiliary hole.
22. An drilling rig as claimed in Claim 21, wherein said drive (50) is movable in a substantially vertical plane in relation to and within said structure (20).
23. An auger drilling unit of the drilling rig as claimed in Claim 21 or 22.

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FIG. 1
(PRIOR ART)

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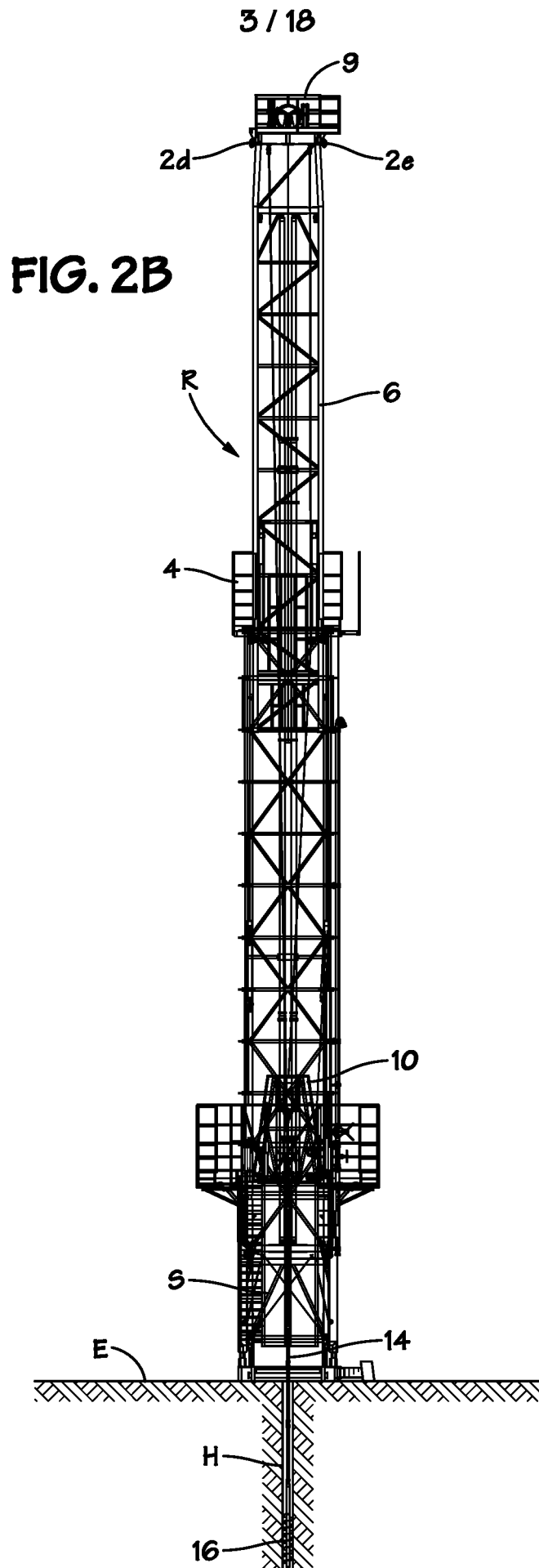
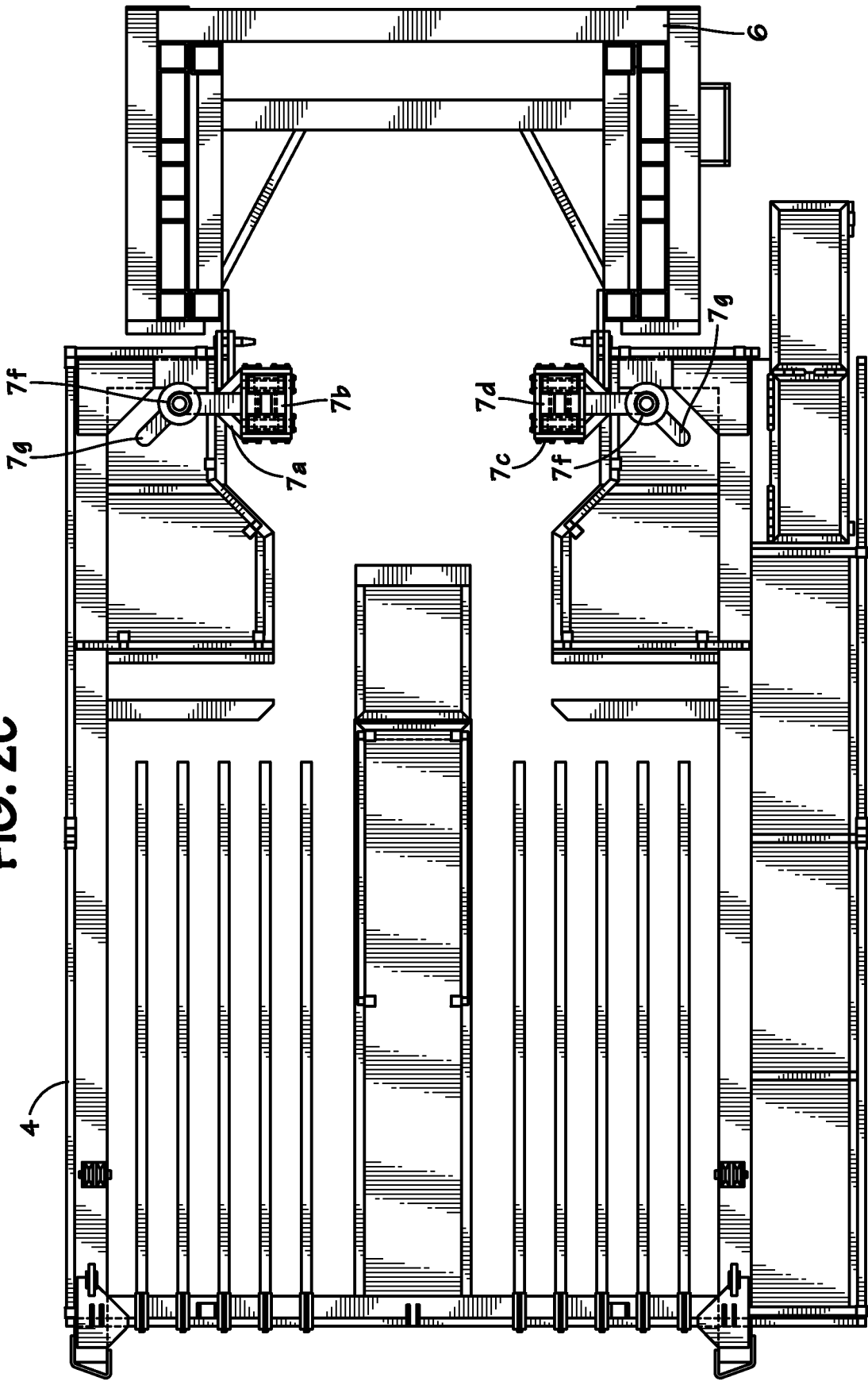


FIG. 2C



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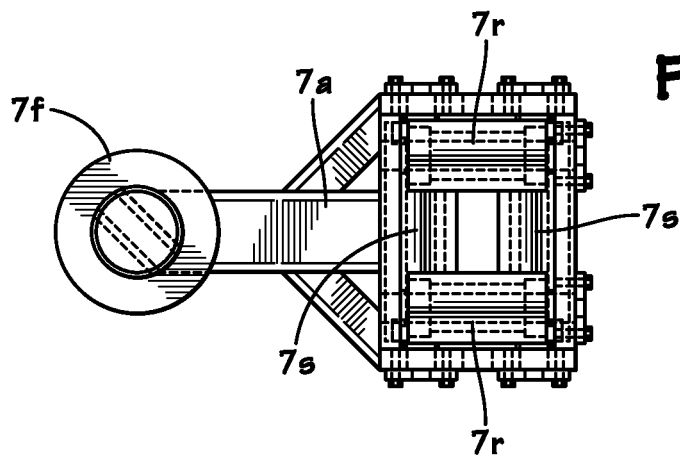


FIG. 2D

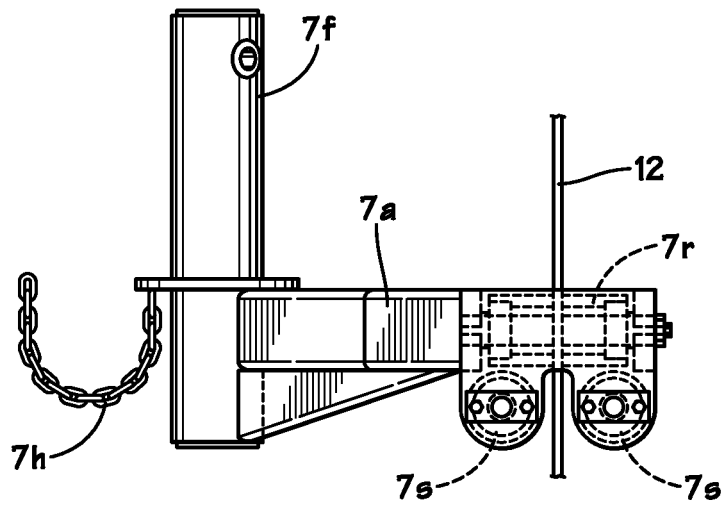


FIG. 2E

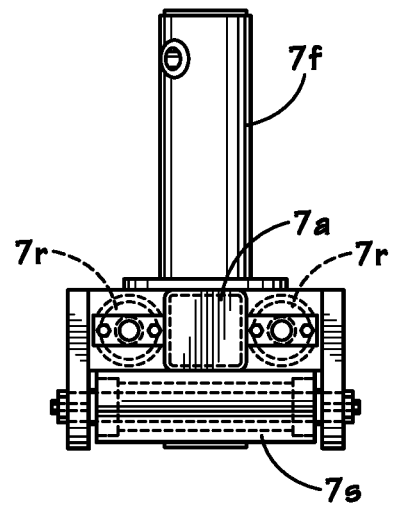


FIG. 2F

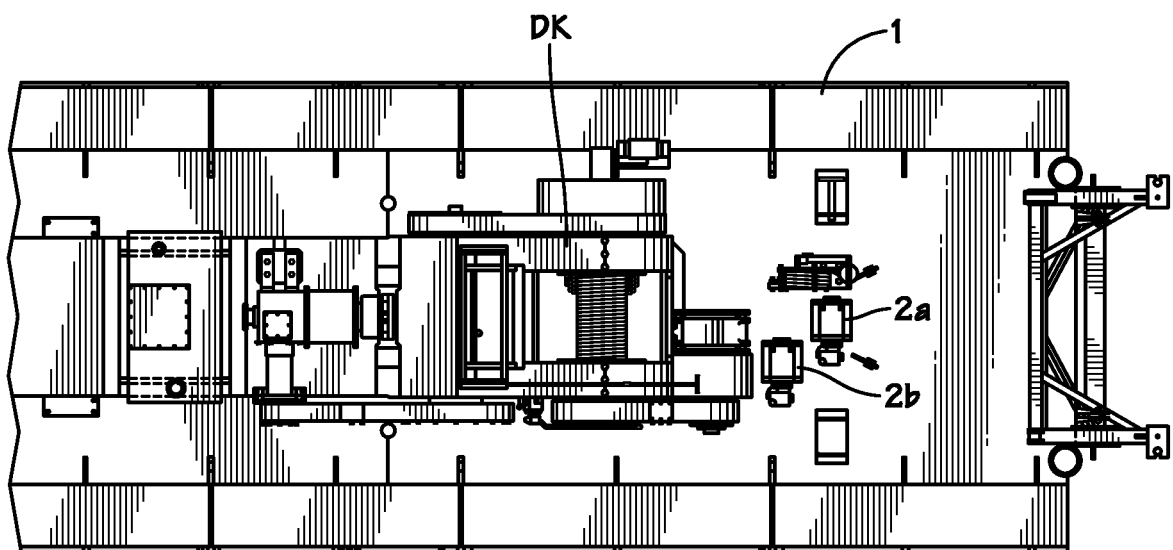
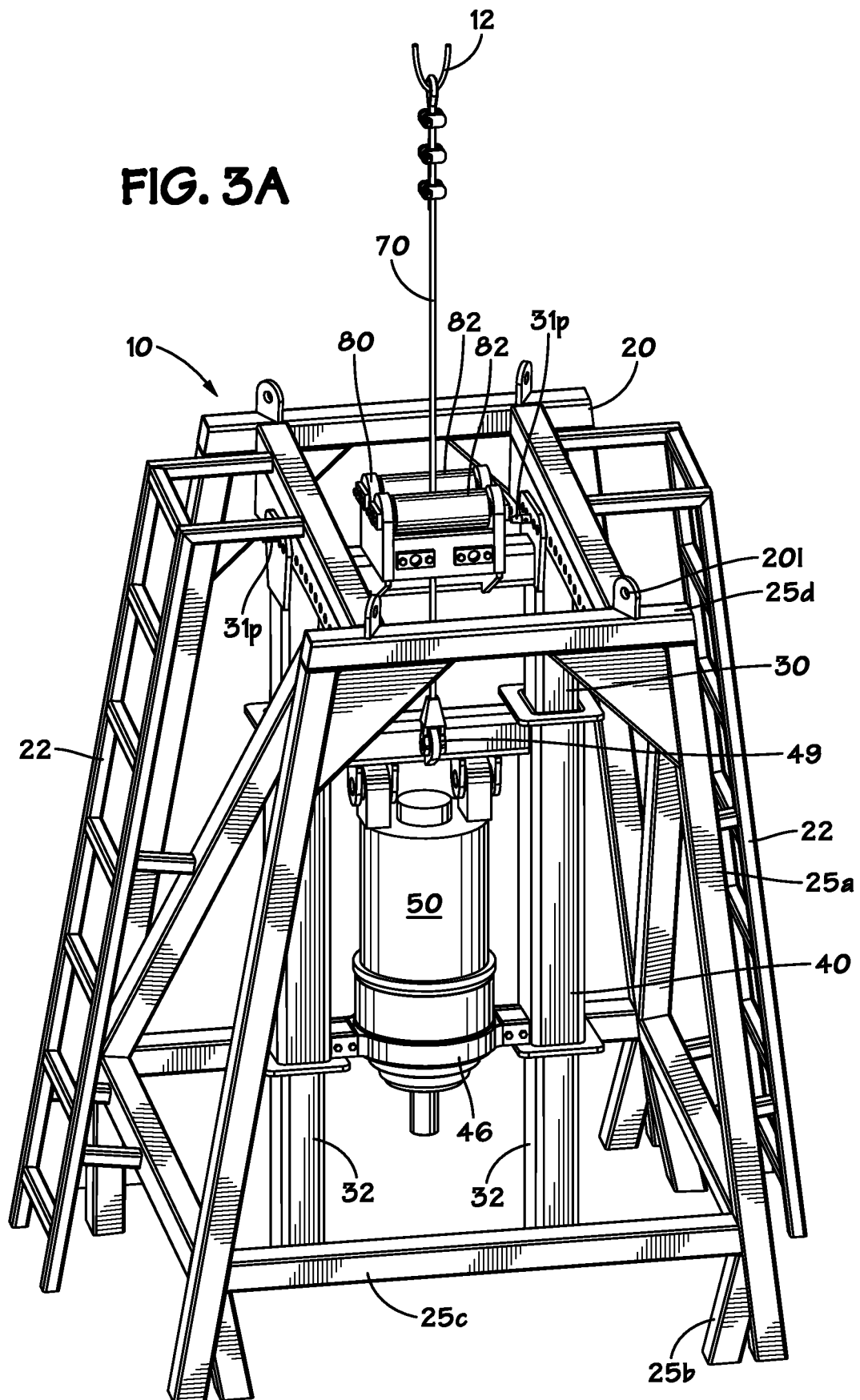


FIG. 2G

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FIG. 3A



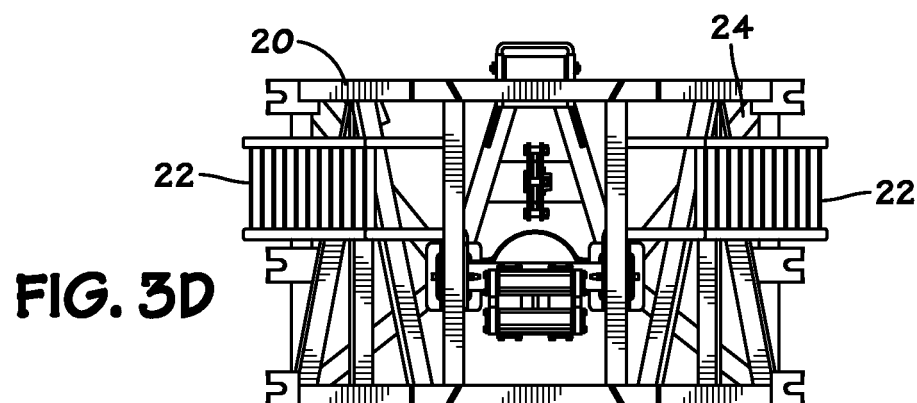
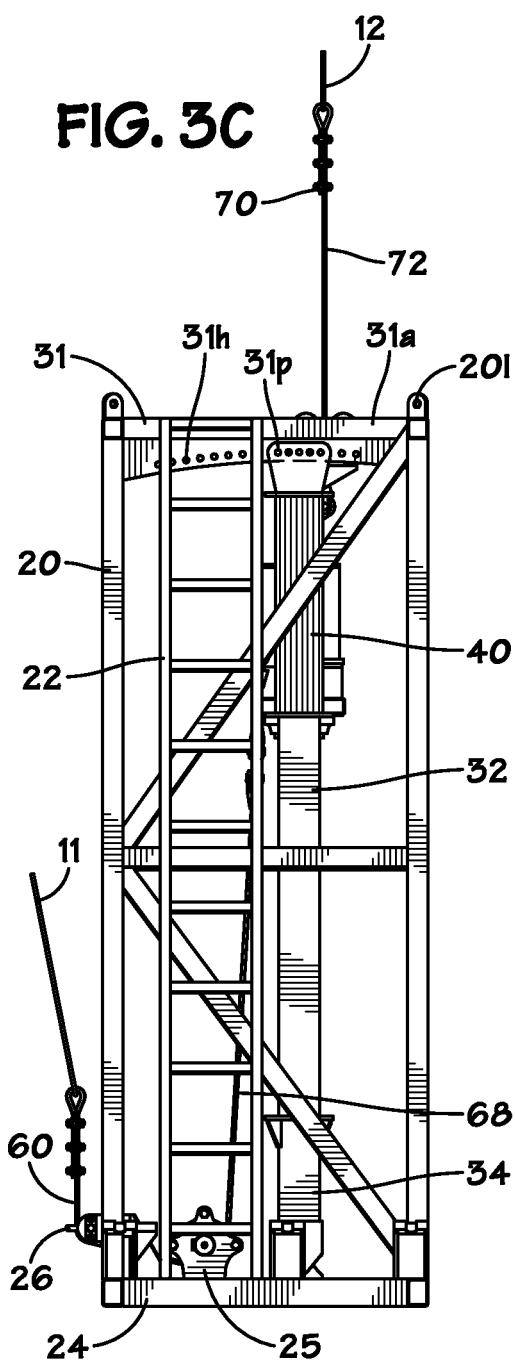
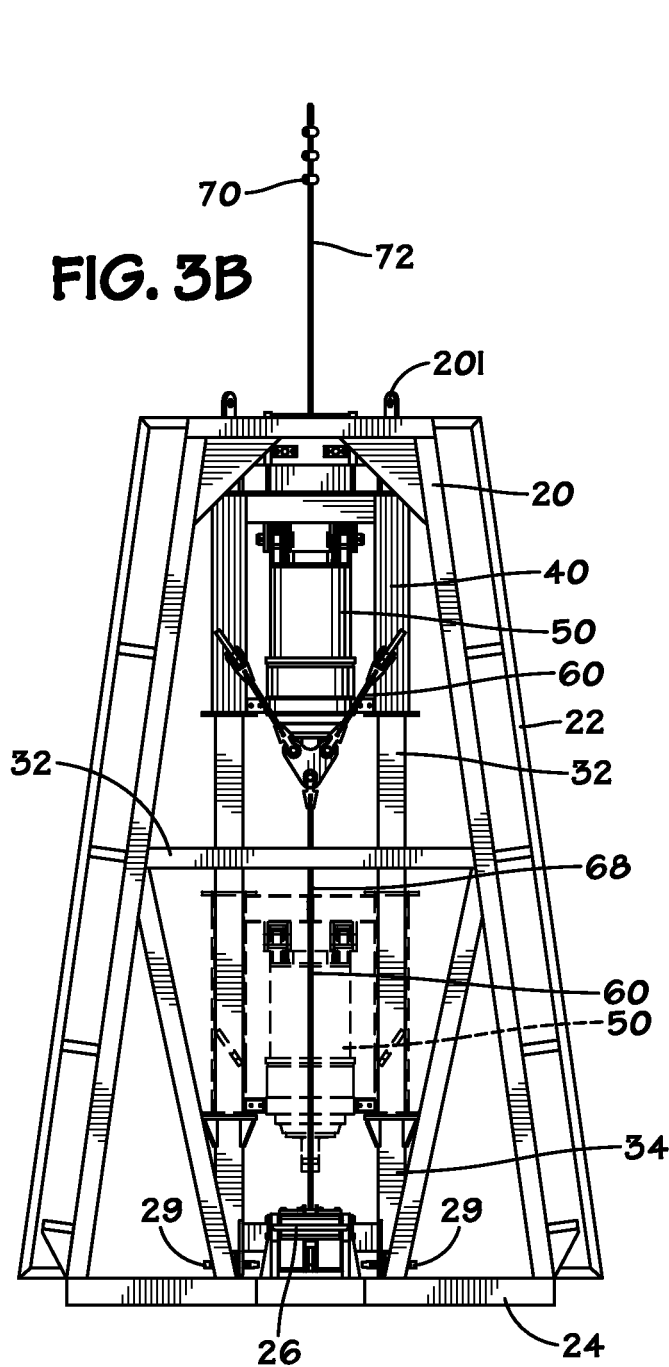
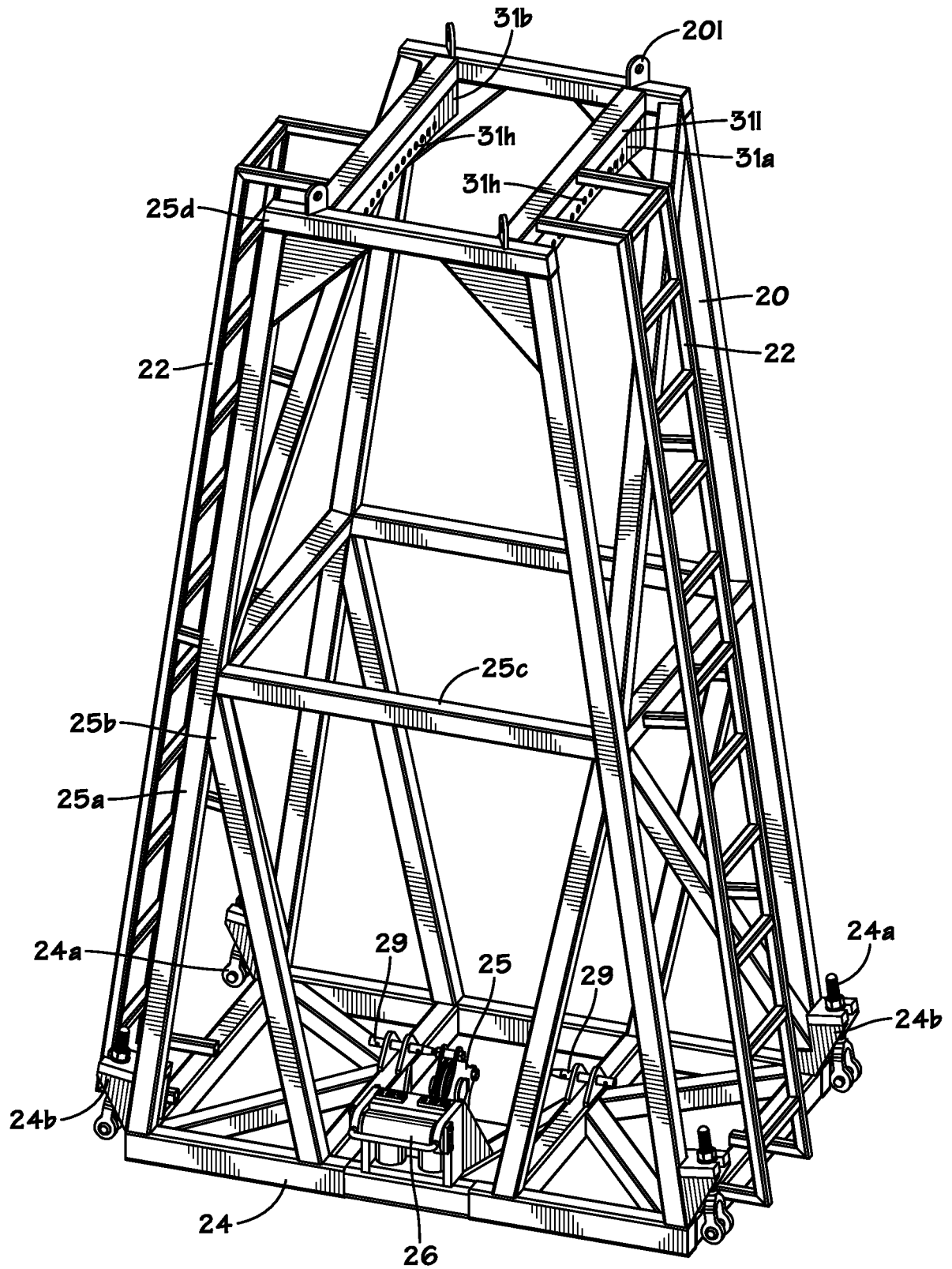


FIG. 4



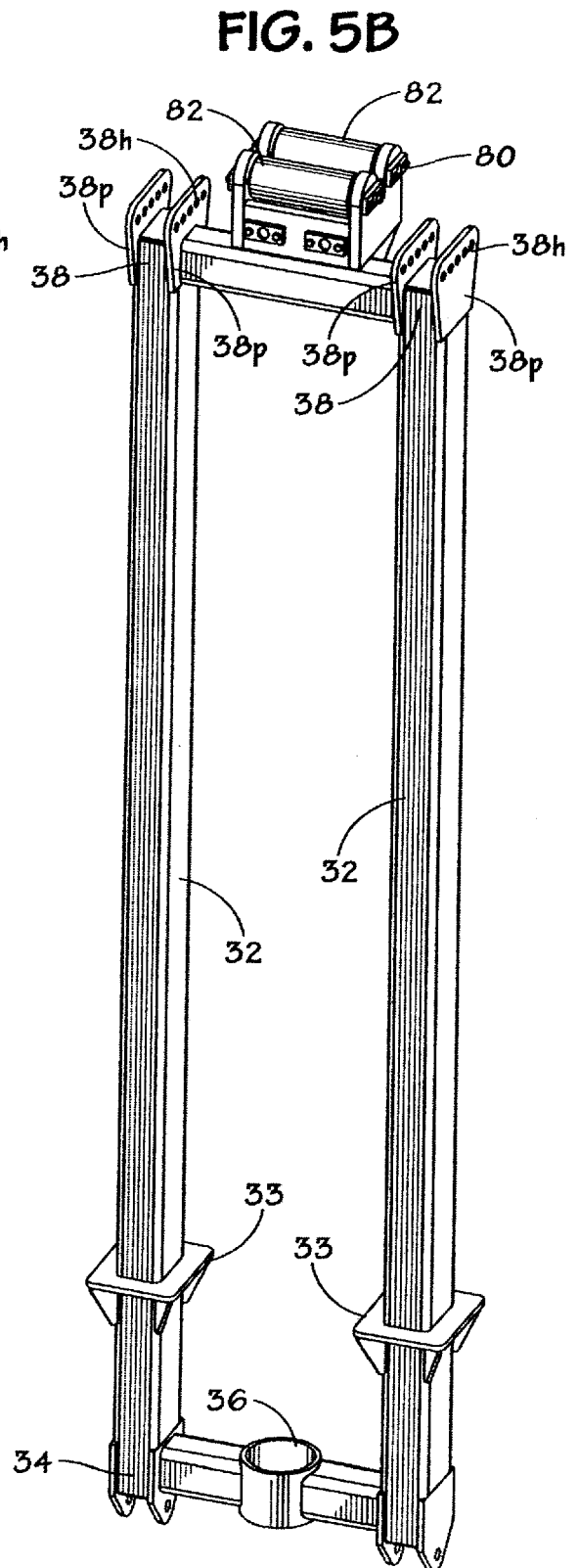
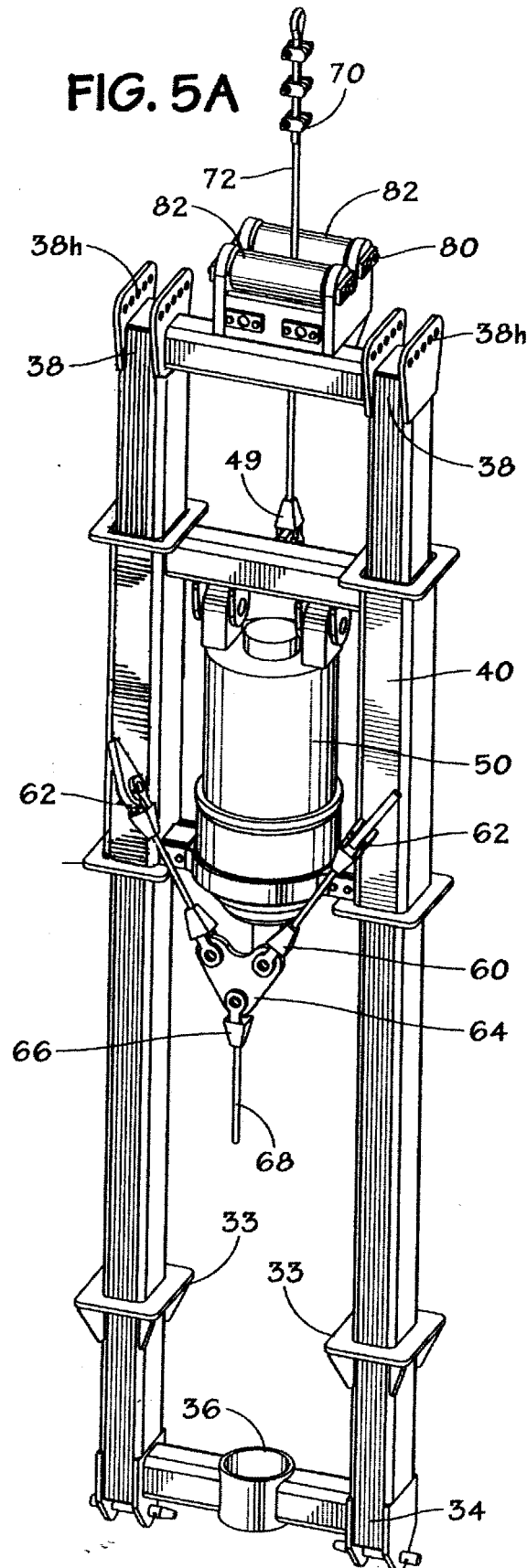


FIG. 5C

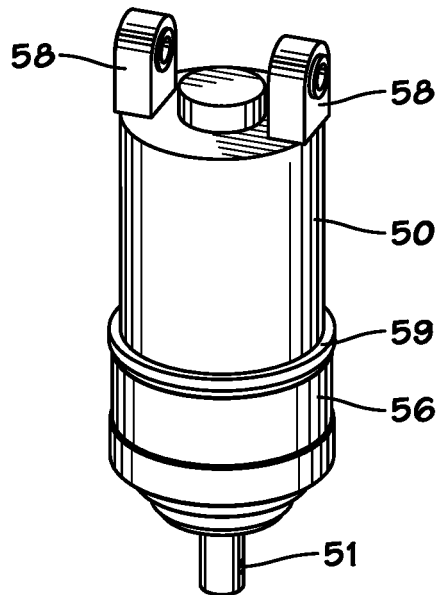


FIG. 5D

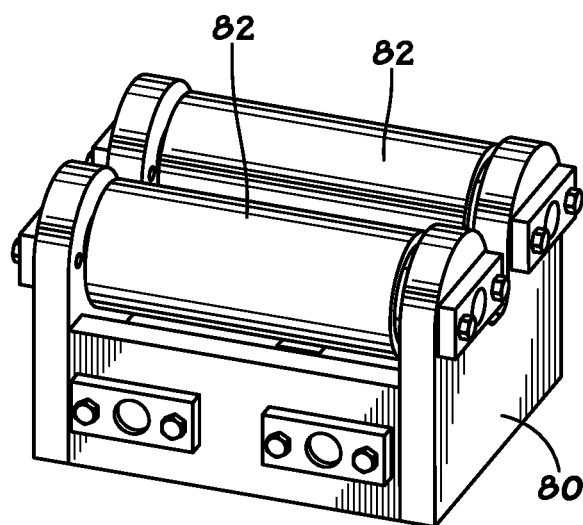
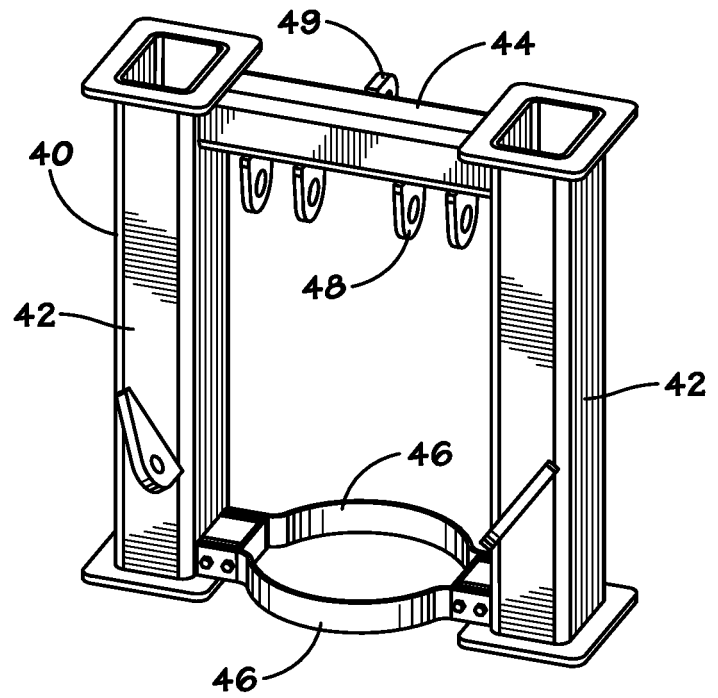


FIG. 5E

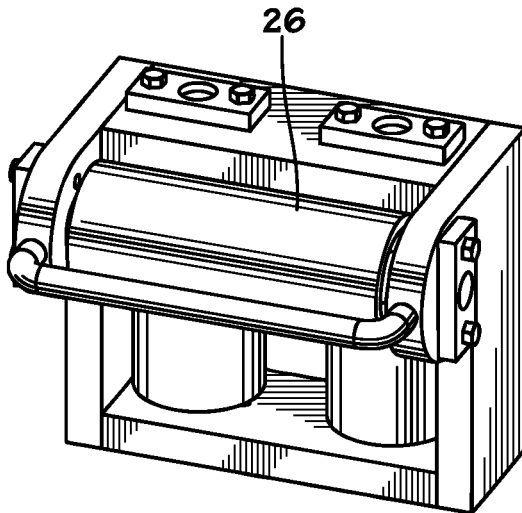


FIG. 5H

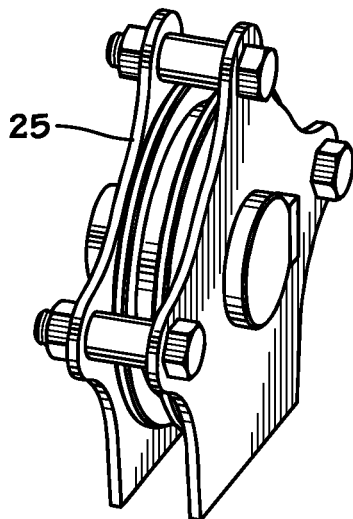


FIG. 5I

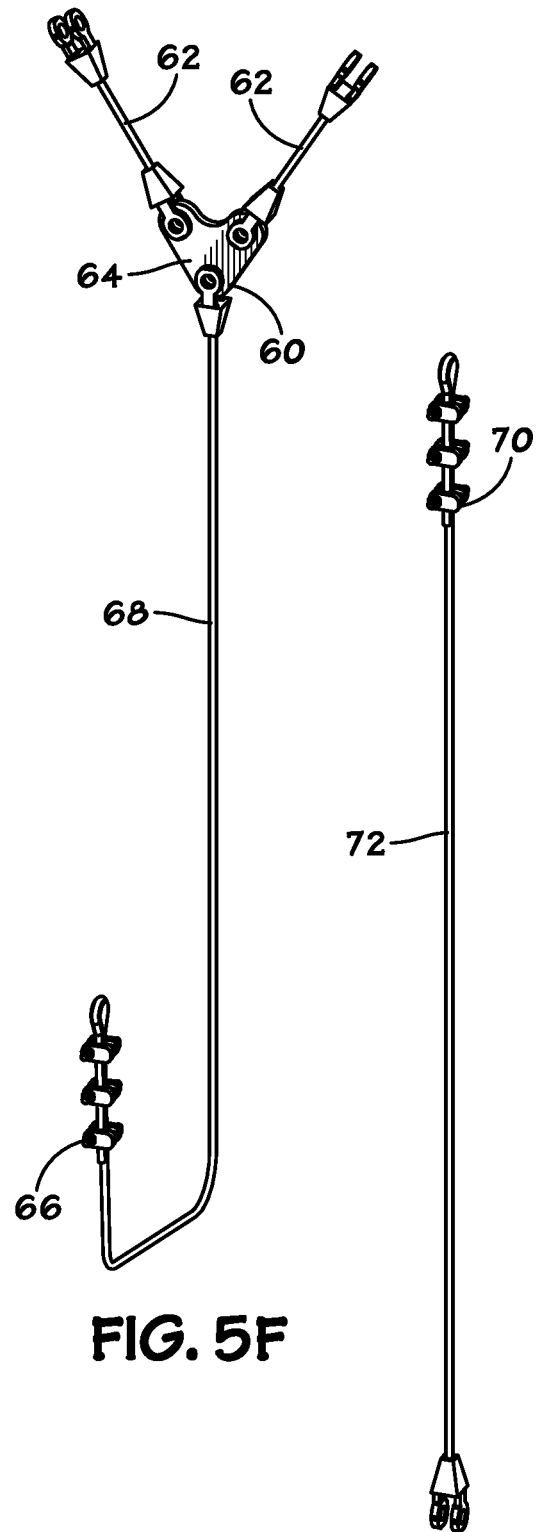


FIG. 5F

FIG. 5G

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FIG. 6A

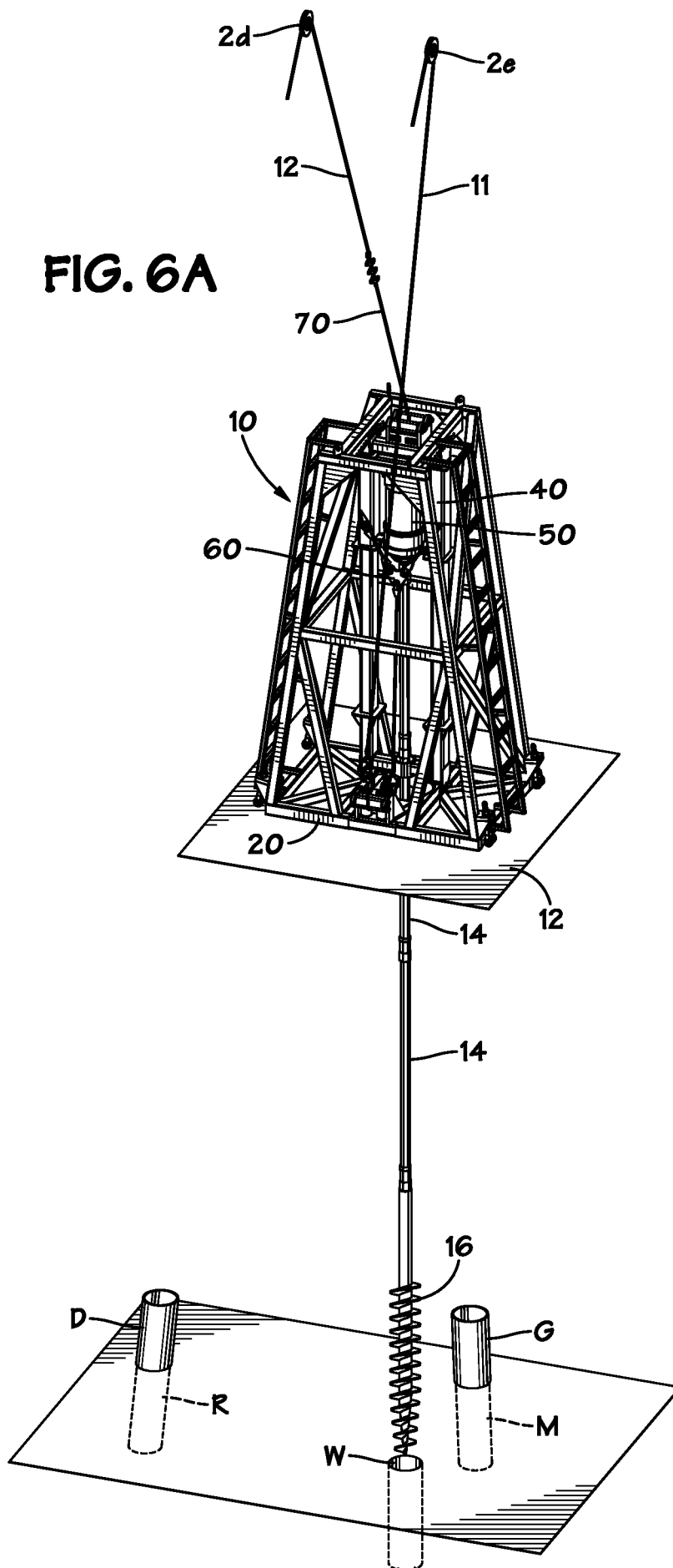
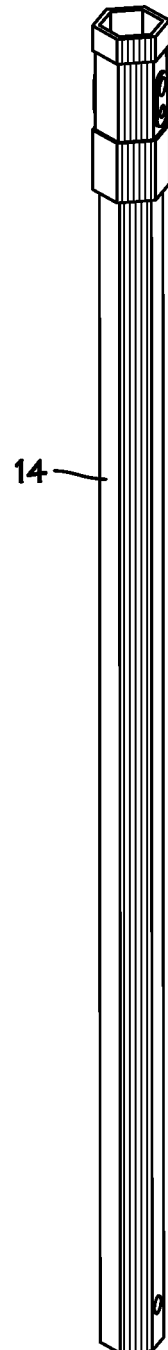


FIG. 6B



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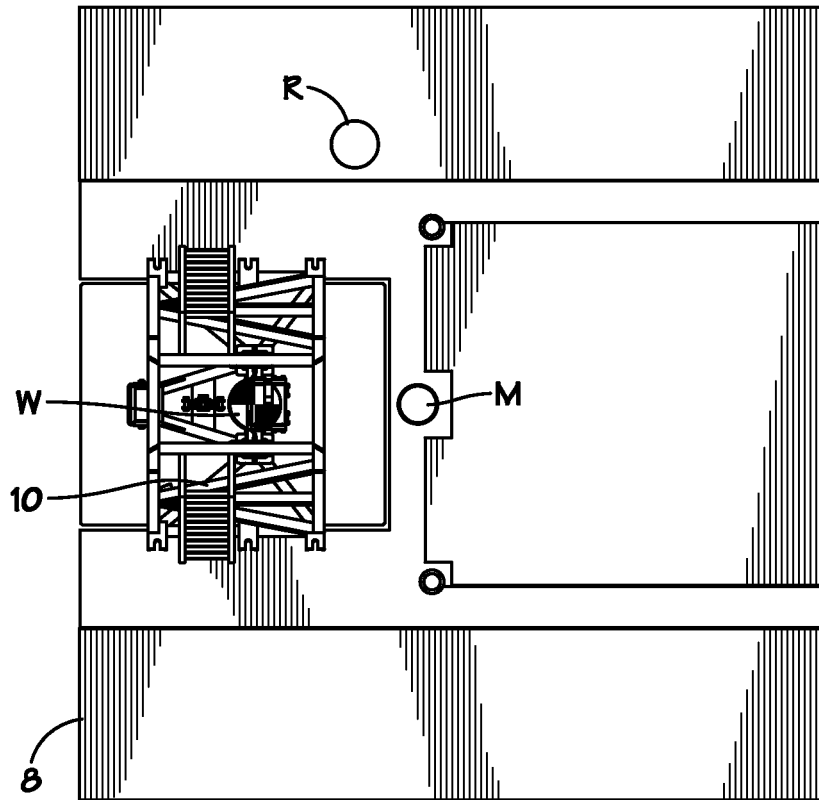


FIG. 7A (AUGER DRIVE UNIT IN WELL CENTER POSITION)

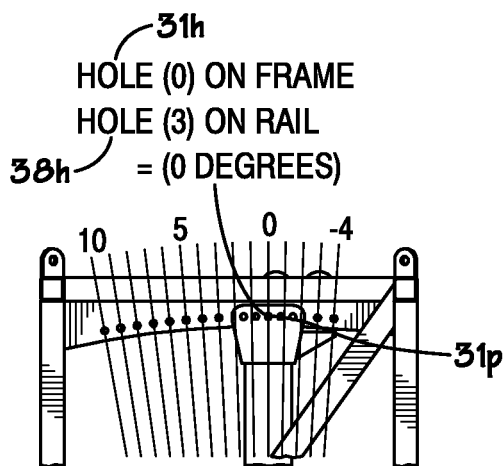


FIG. 7C

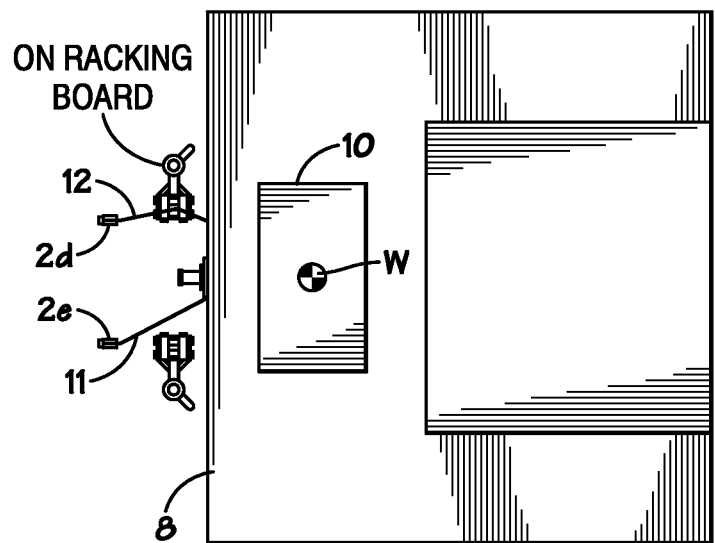


FIG. 7B

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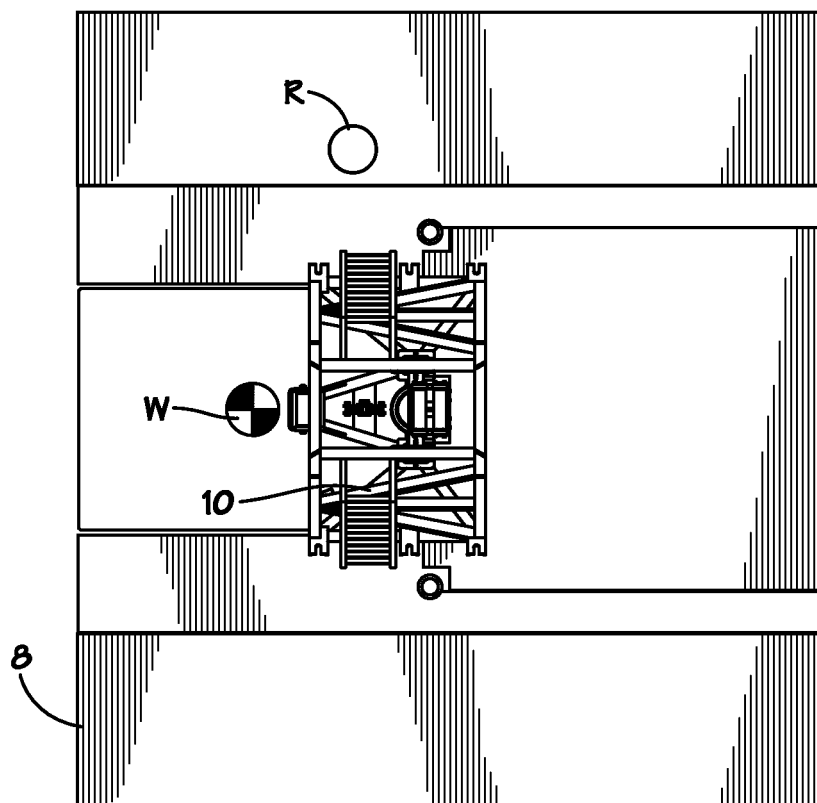


FIG. 8A (AUGER DRIVE UNIT IN
MOUSEHOLE POSITION)

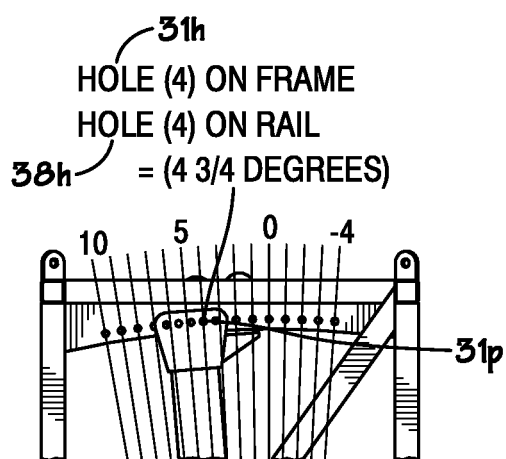


FIG. 8C

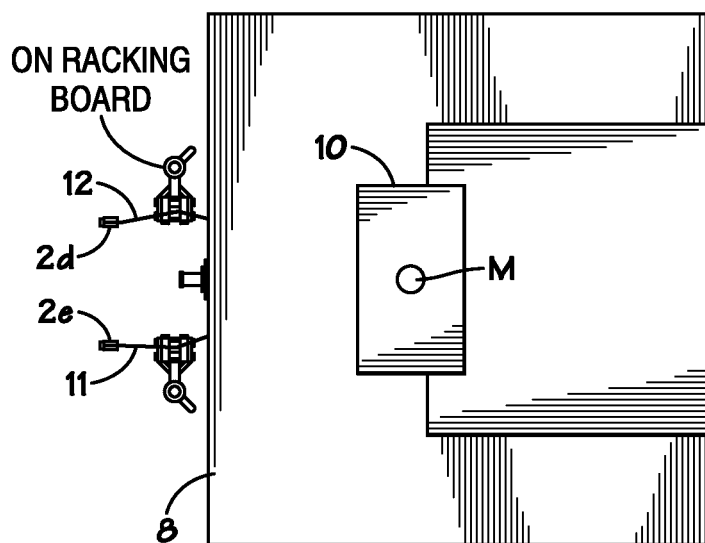


FIG. 8B

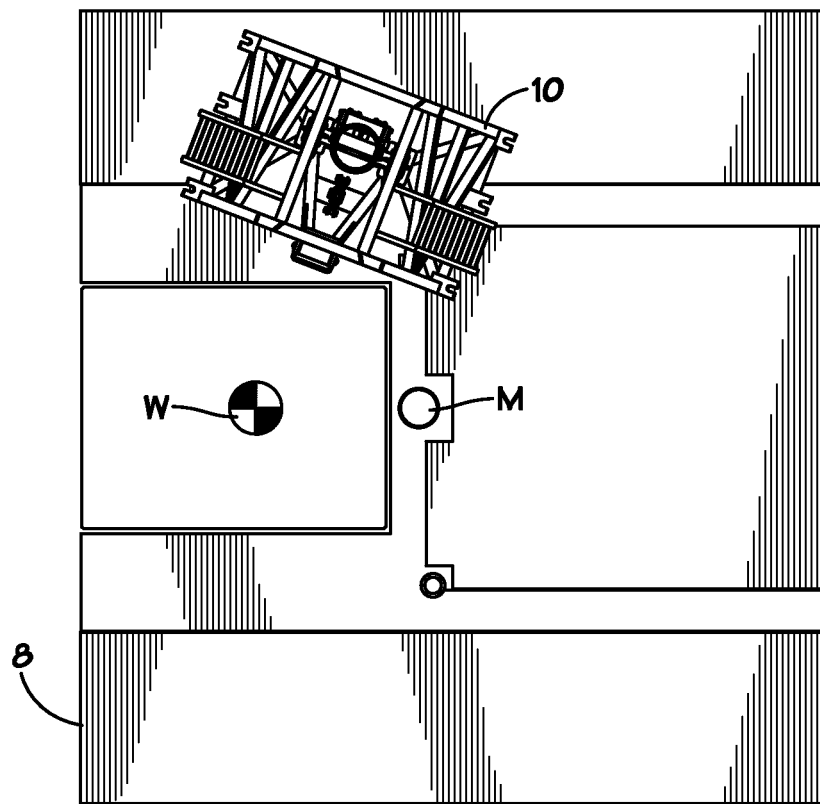


FIG. 9A (AUGER DRIVE UNIT IN RATHOLE POSITION)

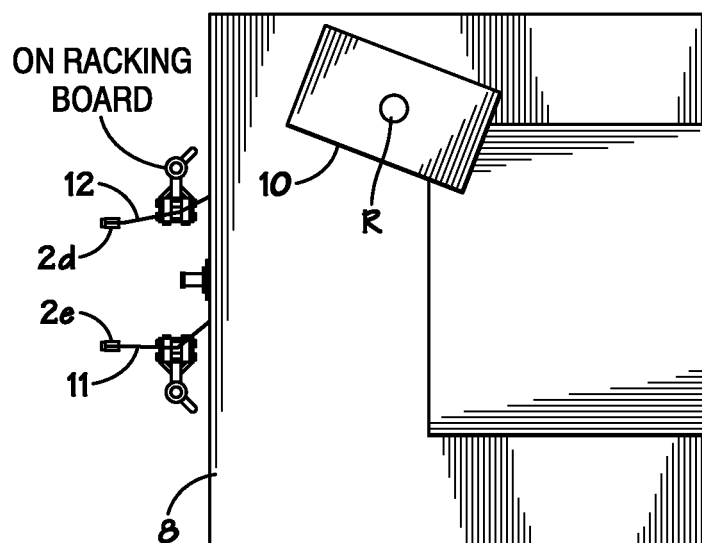


FIG. 9B

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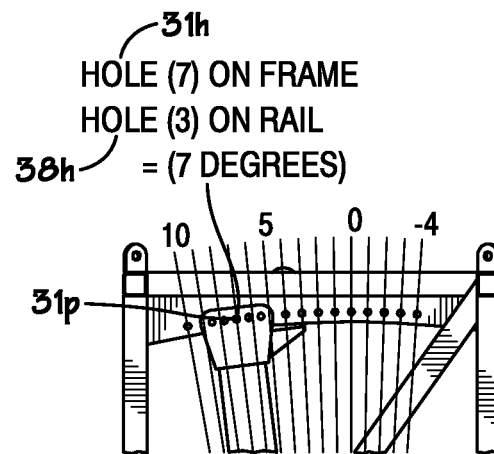


FIG. 9C

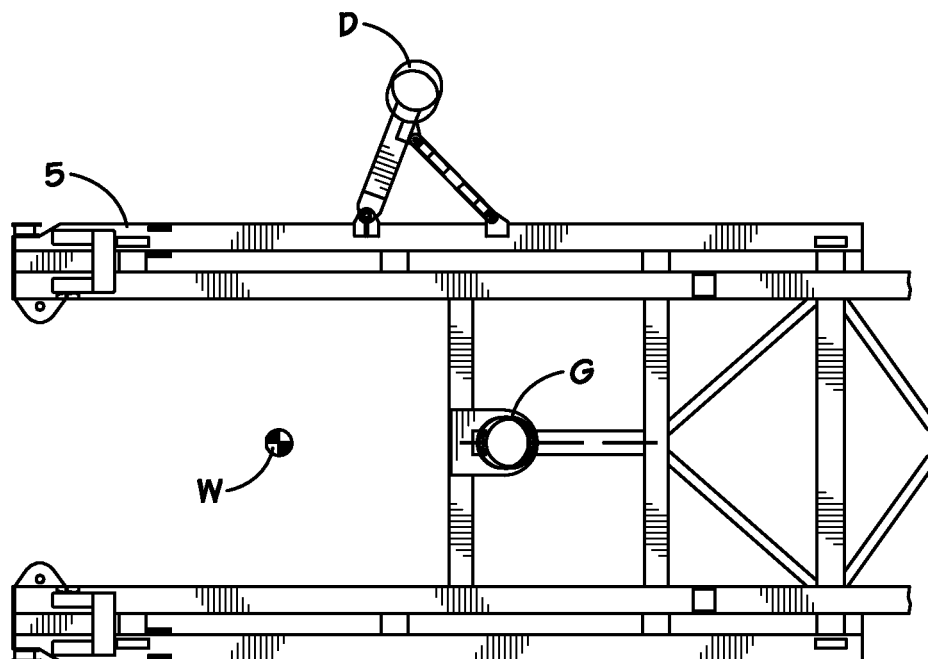
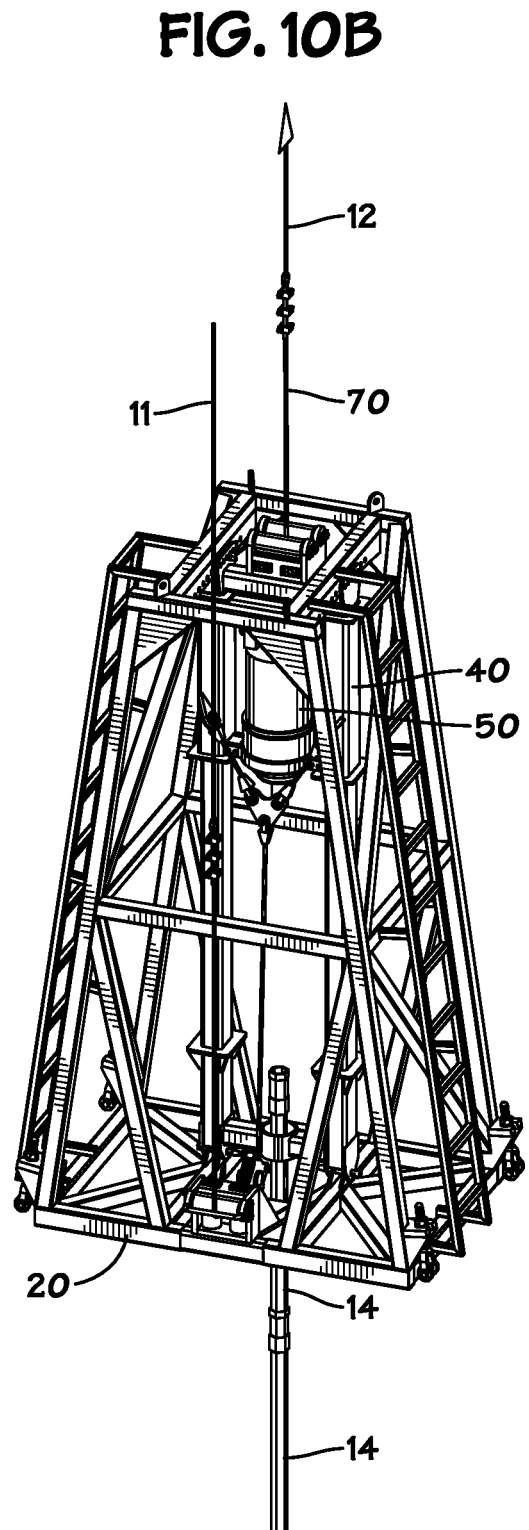
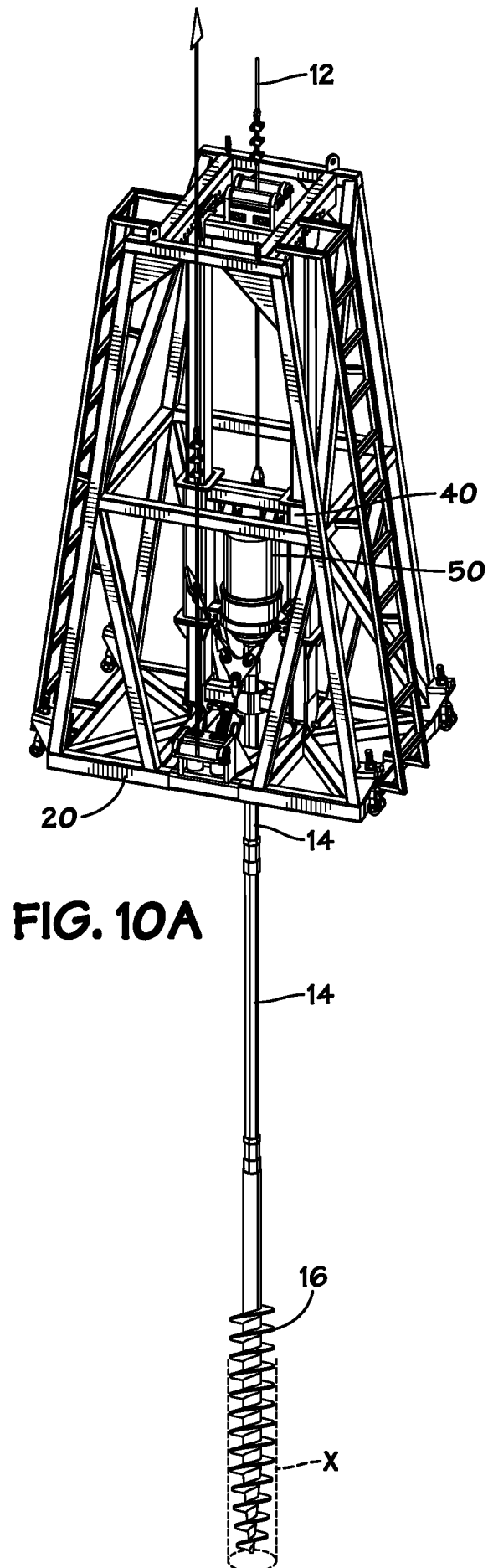


FIG. 9D



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FIG. 10C

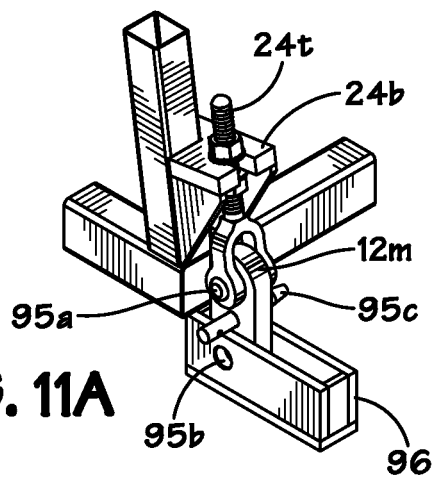
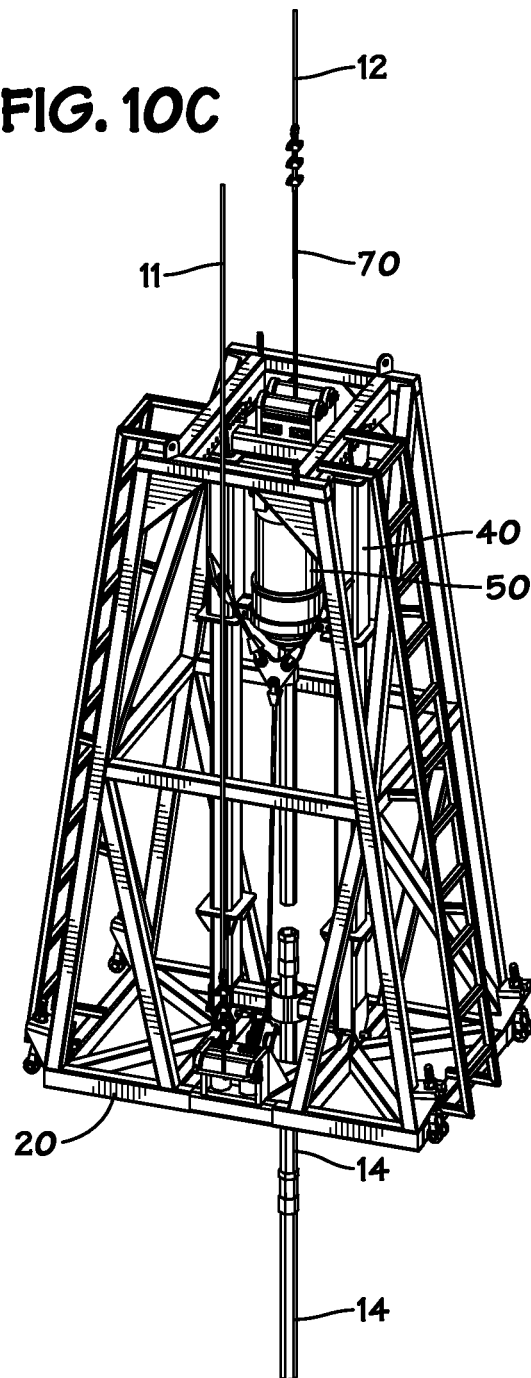


FIG. 11A

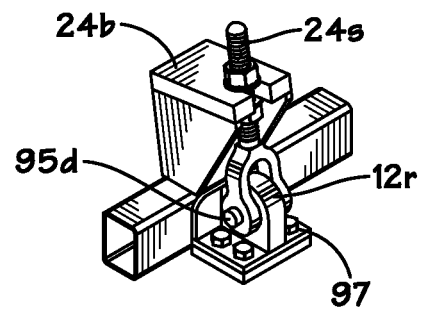


FIG. 11B