Jan. 2, 1951 J. MOON 2,536,304

SPINNING HEAD

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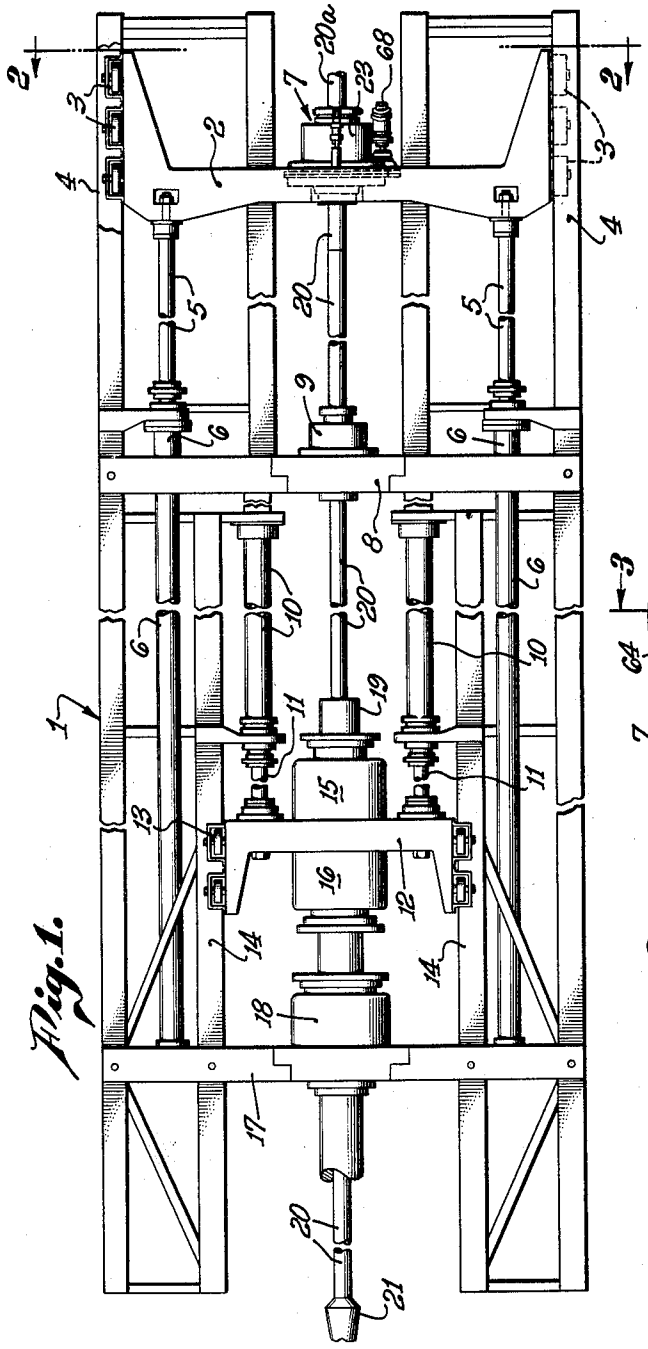


Fig. 1.

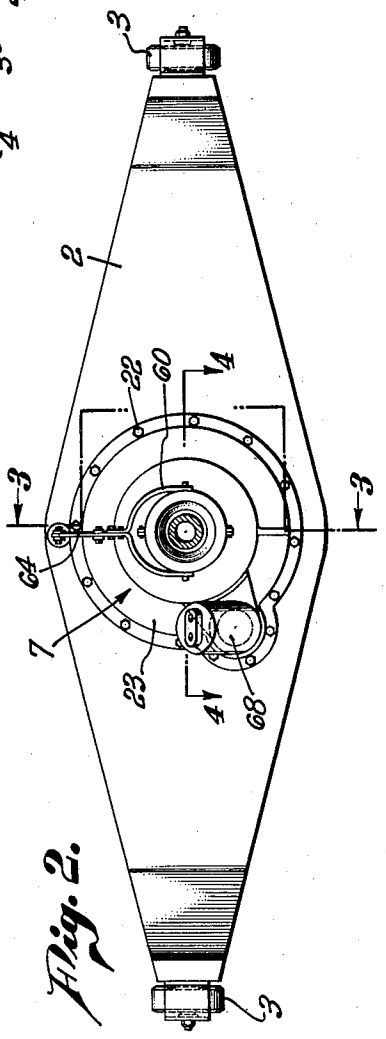


Fig. 2.

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Fig. 3.

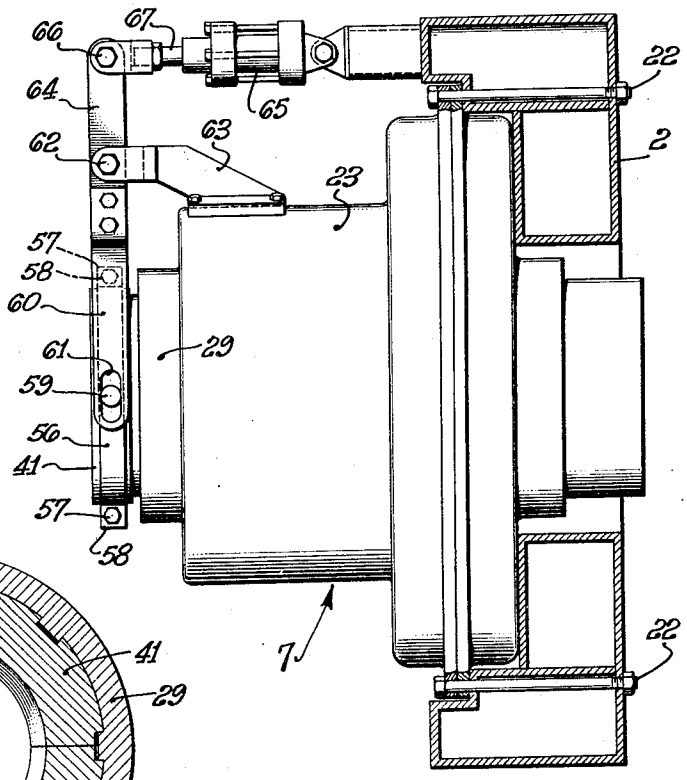


Fig. 5.

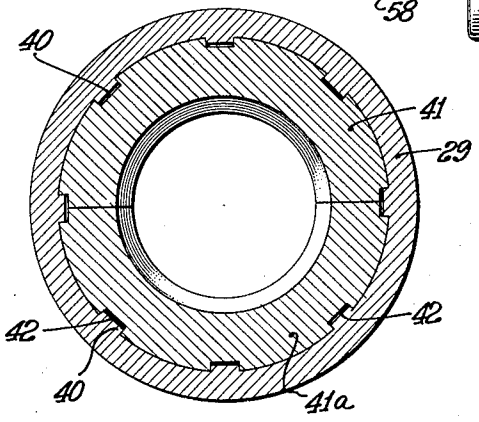


Fig. 6.

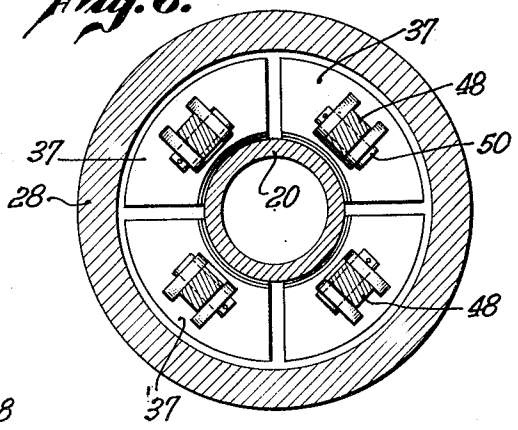
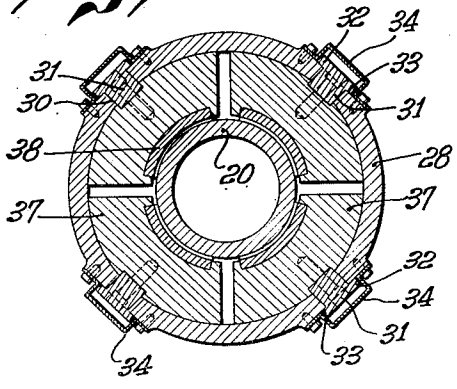


Fig. 7.



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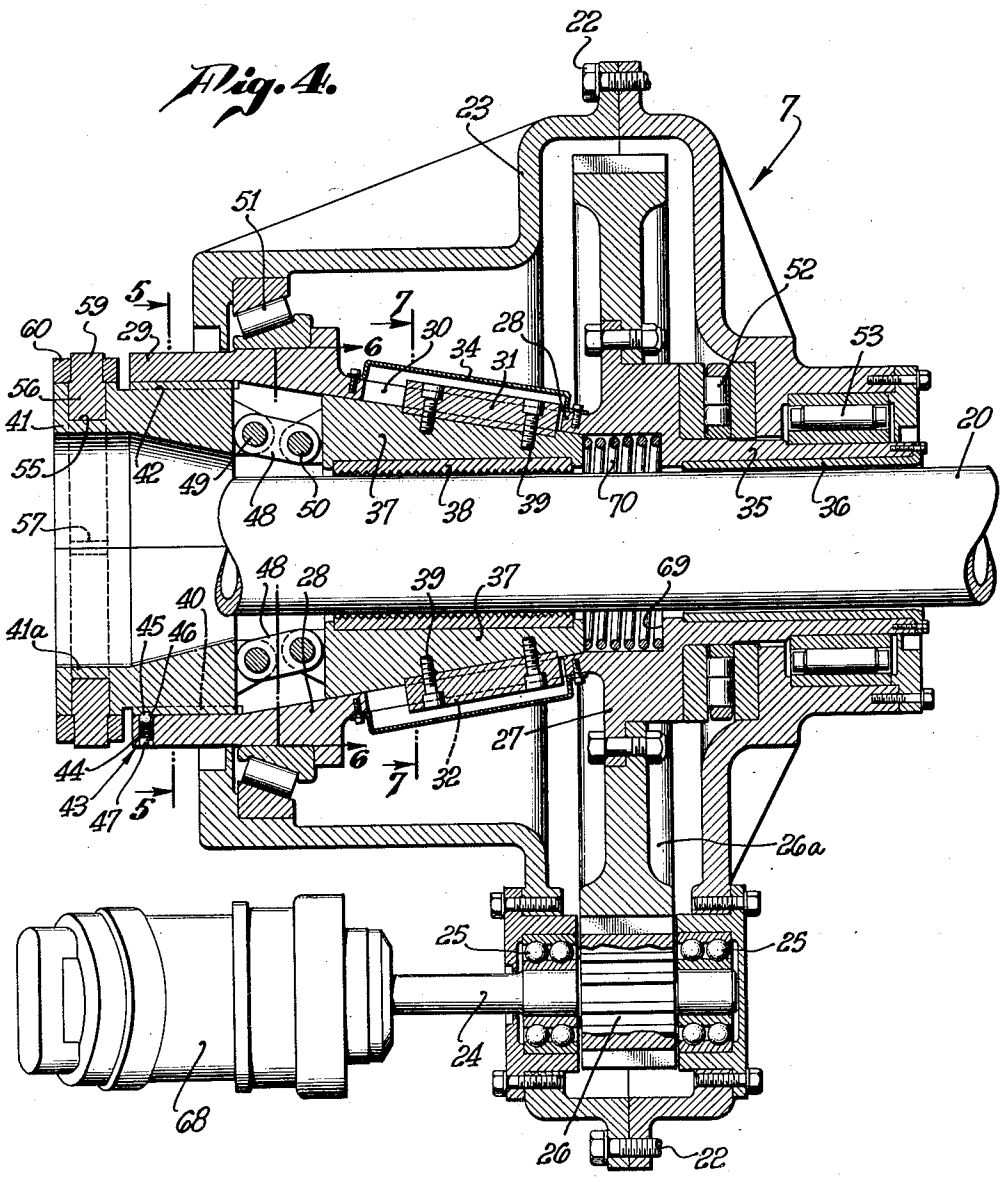
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Fig. 4.



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Patented Jan. 2, 1951 2,536,304

UNITED STATES PATENT OFFICE

2,536,304

SPINNING HEAD

James Moon, Altadena, Calif., assignor to Signal Oil and Gas Company, Los Angeles, Calif., a corporation of Delaware

Application January 12, 1946, Serial No. 640,720

5 Claims. (Cl. 255—23)

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This invention relates to a drilling device suitable for use in drilling bore holes in the earth for production of oil, gas, water, sulfur, and other fluids from the earth. The drilling machine may be employed for drilling bore holes from an initial vertical direction or from an initial horizontal direction, and also for the drilling of curved bores from either initial direction.

My invention will be better understood by reference to the drawing, showing a preferred embodiment of my invention, in which

Fig. 1 is a plan view of my drilling machine with parts broken away;

Fig. 2 is an enlarged end view of Fig. 1, the yoke assembly being shown in the direction of line 2—2 but omitting the frame;

Fig. 3 is a section taken on the line 3—3 of Fig. 2;

Fig. 4 is a section taken on the line 4—4 of Fig. 2 omitting the yoke mounting;

Fig. 5 is a section taken on the line 5—5 of Fig. 4;

Fig. 6 is a section taken on line 6—6 of Fig. 4; and

Fig. 7 is a section taken on line 7—7 of Fig. 4.

In Fig. 1 the drilling machine is mounted upon the supports 1, suitably braced and positioned on a foundation and mud-receiving system at the desired well site. Yoke 2 is mounted on wheels 3 and travels on suitable guides 4 in the supports 1 on each side of the yoke. The yoke is moved by piston rods 5 operating in the hydraulic jack cylinders 6 mounted on the frame 1. The drilling and spinning head 7 is mounted on yoke 2. Positioned on cross beam 8 is a slip 9 and hydraulic jacks 10 in which operate piston rods 11 carrying a yoke 12 mounted on wheels 13 operating on tracks 14. Two-way slips 15 and 16 are mounted on the yoke 12 and travel therewith. A stationary holding slip 18 is mounted on cross beam 17. Slips 15, 16, and 17 are employed for running casing 19, and slips for holding the drill pipe 20 at the end of which is attached the conventional earth boring drill 21, such as is used in bore hole drilling.

The spinning and drilling head 7 is mounted on the frame of the yoke 2 by bolts 22. The housing 23 carries a shaft 24 mounted in suitable bearings 25 and carrying a gear 26. The gear 26a is bolted to a ring 27 carrying a cylindro-conical flange or hub formed of conical flange or hub 28 terminating in a cylindrical rim 29. The conical wall is slotted at 30. In each slot 30 is positioned a slidable key 31 formed with a flange 32 to engage the outer flattened portion 33 of the exterior wall of the flange 28. Covers 34 are mounted over the slides.

The ring 27 carries a depending rim 35 to which is attached a wear or bearing sleeve 36.

Mounted in the conical section of 28 is a plu-

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rality (shown as four) of wedge slips 37 carrying a gripping sleeve 38 having a cylindrical serrated inner surface to engage the pipe. The slides 31 are bolted to the slips 37 by means of bolts 39. The end of the slips bear against the spring 70 mounted in the recess 69 formed in the ring 27. The inner wall of the cylindrical sleeve 29 carries splines 40 in which the split collar, formed of semi-cylindrical sections, 41 and 41a, is set by means of mating female spline member 42 formed in the exterior wall thereof. A spring lock 43 is set in bores formed in the wall of 29. The spring lock is composed of spring 44 and ball 45 which sets in a detent 46 in the exterior wall of the collar 41. The bore is closed by a plug 47. A plurality of such locks may be employed.

Each half of the collar is connected by means of links 48 to each of two slips 37 by pins 49 and 50 on which the links may pivot.

The cylindro-conical members (35, 28, and 41) are mounted in thrust bearings 51 and 52 and in roller bearings 53. The cylindrical sleeves 41 and 41a are grooved at 55 and carry a split clamping ring 56 which holds the cylindrical sections in place by means of ears 57 and bolts 58. The ring 56 carries pins 59. A shifting fork 60 engages the pin 59 by means of slots 61. The fork 60 is connected to a lever 64 and pivoted at 62 on bracket 63. The lever 64 is operated by a hydraulic jack 65 by means of a pivot connection 66 to the piston rod 67.

The gear 25 is driven by a hydraulic motor 68 or by an electrical motor positioned in its place and connected to the shaft 24.

A suitable hydraulic motor 68 having the required power to operate the slips is such as is described in United States Patent No. 2,320,727 and No. 2,313,407. It will be observed that the slips may be advanced and retracted to move them into pipe-gripping position or to move them from the pipe-gripping position independently of the rotation of the ring gear. In this fashion the pressure applied on the slips is controllable so that the pipe is not damaged. This also permits of the use of the head with differently sized pipe.

To employ the spinning head as a mechanism for unscrewing drill pipe, any rotary mechanism which may be mounted on the yoke 2 and employed for rotating the pipe during drilling (as, for example, such as is described in my co-pending application Serial No. 633,934, filed December 10, 1945) is removed from the yoke 2. The spinning head 7 is bolted in its place on yoke 2 by means of bolts 22. The hydraulic jack 65 is operated to pull down the rod 67 whereupon the shifting fork will cause the rings 41 and 41a to lift the slips 37 and thus enlarge the opening formed by the inner face of the gripping member 38. The pressure of the fork 60 is sufficient

to force the ball 46 out of the detent 45 to permit of the movement of the ring. The yoke 2 descends and the pipe 20 passes through the opening 71 which with the slips 37 in lifted position is greater than the external diameter of the pipe and any tool joint employed on the pipe 20. The piston rods 67 are then lifted, moving the collars 41 and 41*a* downward, causing the slips to move downward, against the spring 70, in their conical seat until the gripping surfaces of the slips grip the pipe 20. The gripping pressure may be controlled by controlling the hydraulic pressure in the jack 65. The ball 46 moves into position in the detent 45 to hold the ring against accidental longitudinal movement.

With slips 9 in open position, the yoke 2 may then be lifted to withdraw pipe from the hole until the screwed joint to be broken is above the slips 9. Back-up tongs are now placed below the joint to be broken and motor 68 rotates the gears 26 and 26*a*. This causes a rotation of the slips 37 through the slides 31 and a rotation of the collars 41 and 41*a* by means of the splines 40 and 42. With the slips in gripping position, the pipe 20 is rotated in a direction to unscrew the screw joint between the slips 38 and the back-up tongs. This breaks the joint. The protruding section 20*a* (Fig. 1) of the pipe may then be removed by lifting the sleeves 41 and 41*a* aided by the springs 70 to retract the slips 37 as described above. The spinning head may be employed to lift another section of pipe and break the joint in the manner specified above.

To add pipe to the drill string, the portion in position is held by slips 9 with the screw joint to be made up above the slips 9. With slips 37 in lifted position the pipe is passed through the slips with the joint below the head 7 and the threads engaged. Back-up tongs are placed below the joint to be made up. The slips 37 are forced down by means of the shifting fork 60 to cause a gripping of the pipe by the member 38. The motor 68 then rotates the slips through the gears 26 and 26*a* to make up the pipe. The slips 9 may then be opened and with the slips still in gripping position the yoke 2 may be moved to move the pipe into the bore.

In addition to employing the spinning head either as a spinning head or as a lifting head, it may also be employed to rotate the pipe for drilling of the bore hole.

In such case, the pipe section 20*a* protruding beyond the head is connected to a conventional mud swivel not shown. With the slips 37 in gripping position as described above and the slips 9 open, the pipe and the drill may be rotated and the yoke 2 advanced to bore the desired hole. When the yoke has reached the limit of its travel toward slips 9, the slips 9 are set and the mud swivel is removed and the drill head is employed as a spinning head to add pipe, as described above. The mud swivel is then attached to the pipe and drilling is continued as described above.

While I have described a particular embodiment of my invention for the purpose of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. In a drill pipe rotating device, a ring gear, a cylindro-conical flange on said gear, a plurality of slips slidably mounted in the said conical portion of said cylindro-conical flange, a sleeve slidably mounted in the cylindrical portion of the cylindro-conical flange, link connections between said sleeve and said slips, a driving connection between said slips and said conical portion, a driving connection between the sleeve and said cylindrical portion, means for rotating said gear, and means for advancing and retracting said sleeve in said cylindrical portion.

2. In a drill pipe rotating device, a ring gear, a cylindro-conical flange on said gear, a plurality of slips slidably mounted in the said conical portion of said cylindro-conical flange, a sleeve slidably mounted in the cylindrical portion of the cylindro-conical flange, link connections between said sleeve and said slips, a driving connection between said slips and said conical portion, a driving connection between the sleeve and said cylindrical portion, means for rotating said gear, means for advancing and retracting said sleeve in said cylindrical portion, and means for locking said slips in pipe-gripping position.

3. In a drill pipe rotating device, a ring gear, a conical flange mounted on said ring gear having longitudinal recesses in its interior wall surface, said recesses receiving and holding a plurality of pipe-engaging slips for slidable movement therein, said slips being rotatable with said flange, a collar carried by said flange, link connections between said slips and said collar, means for moving said collar to advance and retract said slips, and means for rotating said gear.

4. An apparatus of the class described comprising a case, a gear disposed in the case, a bore in said gear adapted to pass drill pipe therethrough, pipe-engaging slips disposed in said case, a driving connection between said gear and said slips, said connection including an outwardly divergent guide having recesses in its interior wall surface receiving and holding said slips, means independent of said gear for moving said slips in and out of pipe-gripping position while maintaining said driving connection between said slips and said gear, and means for moving said case in either direction axially of said pipe when said slips are in pipe-engaging position.

5. In a drill pipe rotating device, a ring gear, a conical flange mounted on said ring gear, said flange having in its interior wall surface recesses receiving and holding a plurality of pipe-engaging slips for rotation therewith and for relative longitudinal displacement, a collar, link connections between said slips and said collar, means for moving said collar to advance and retract said slips, and means for rotating said gear.

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