April 15, 1924. 1,490,759

L. J. BLACK

ROTARY DRILLING MACHINE

Filed Oct. 25, 1921 3 Sheets-Sheet 1

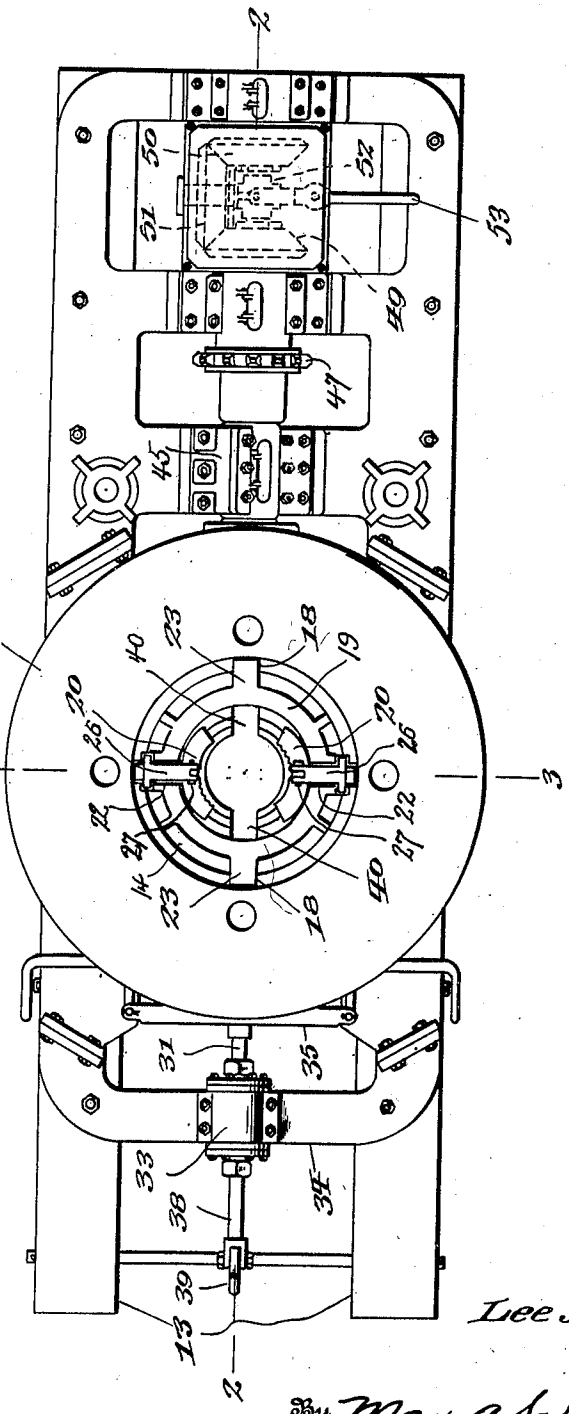

Fig. 1.

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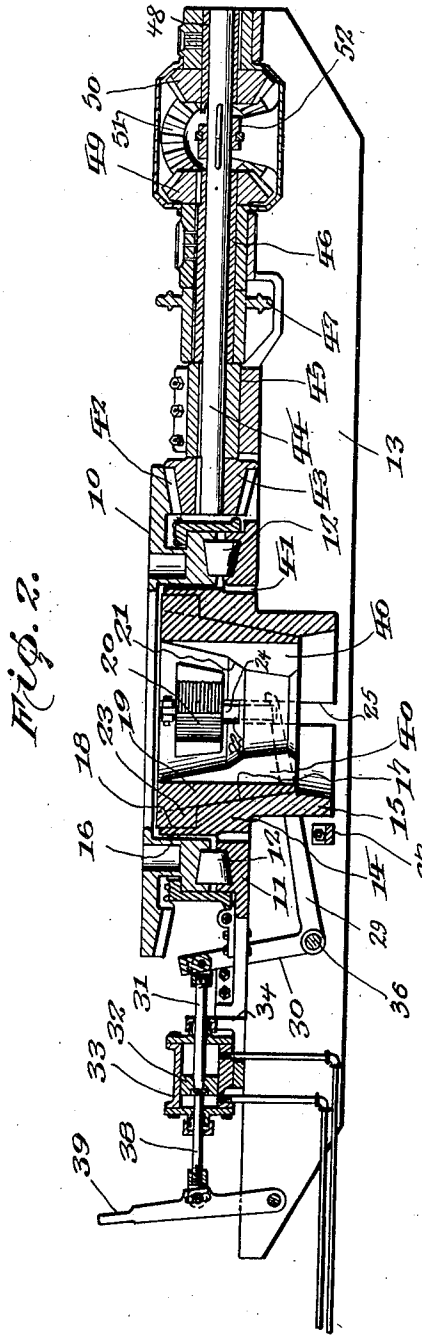

Fig. 2.

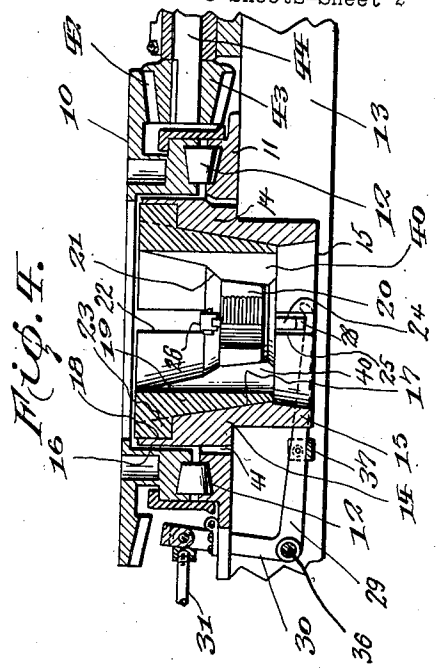

Fig. 4.

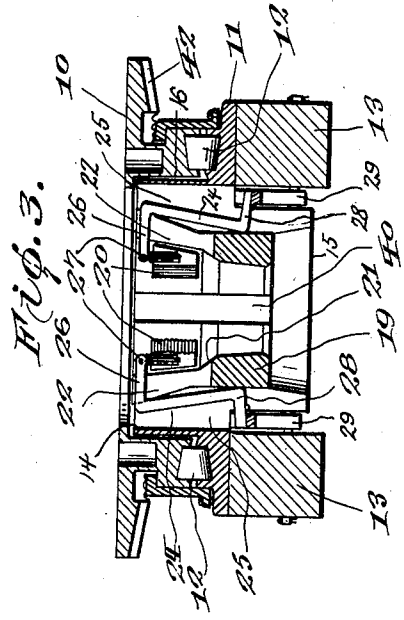

Fig. 3.

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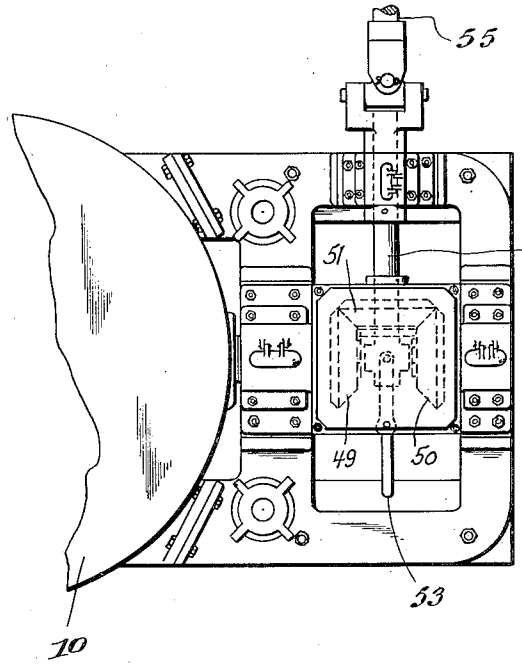
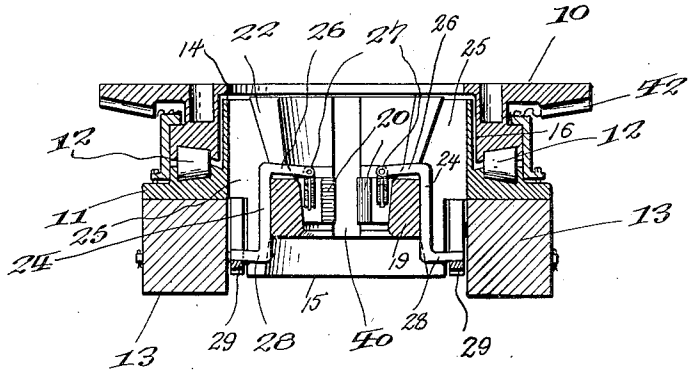


Fig. 6.

Fig. 5.



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Patented Apr. 15, 1924. 1,490,759

UNITED STATES PATENT OFFICE.

LEE J. BLACK, OF BEAUMONT, TEXAS.

ROTARY DRILLING MACHINE.

Application filed October 25, 1921. Serial No. 510,323.

To all whom it may concern:

Be it known that I, LEE J. BLACK, a citizen of the United States, residing at Beaumont, in the county of Jefferson and State of Texas, have invented certain new and useful Improvements in Rotary Drilling Machines, of which the following is a specification.

This invention relates to well-drilling machines of the rotary type, the same employing a turntable for rotating the tool and other parts.

The invention has for its object to provide a novel and improved means for handling the work-gripping members or "slips" associated with the turntable, as well as other novel and improved structural details and modes of operation as will be pointed out in the detailed description appearing hereinafter.

In order that the invention may be better understood, reference is had to the accompanying drawings, forming a part of this specification, and in said drawings:

Figure 1 is a plan view of the machine; Fig. 2 is a central longitudinal section on the line 2—2 of Fig. 1; Fig. 3 is a cross-section on the line 3—3 of Fig. 1; Fig. 4 is a longitudinal section showing the "slips" in lowered position; Fig. 5 is a view similar to Fig. 3 and with the slips also shown in lowered position, and Fig. 6 is a plan view showing a modified form of turntable drive gearing.

Referring specifically to the drawings, 10 denotes the turntable or rotating drive-member of a rotary well-drilling machine, the same being supported on a stationary base 11, with anti-friction rollers 12 interposed therebetween. The base 11 seats on sills 13 and has upward and downward tubular extensions 14 and 15, the former entering a central opening 16 in the turntable 10. The opening 17 of the extensions has a downward taper to seat certain elements to be presently described. Near the top, the wall of the opening 17 has two diametrically opposite recesses 18.

In the opening 17 is mounted a bushing 19 containing diametrically opposite and vertically movable work-gripping members 20, or "slips" as they are commonly termed in the art, two of such being provided. Of course, any other number of slips may be employed. The bushing 19 has downward taper on the inside, and its lower half has an internal diameter which is less than that of its upper half, so that there is produced at the junction of said upper and lower halves a shoulder 21. The bushing 19 also has two diametrically opposite vertical slots 22 extending from the top down to the shoulder 21. On the outside of the bushing, at the top thereof, are two diametrically opposite, outwardly projecting lugs 23 which seat in the recesses 18 and serve to prevent rotation of the bushing in the opening 17.

To each slip 20 is connected an arm 24 for raising and lowering the same. This arm is vertically positioned and seats in a vertical slot 25 in the base extensions 14 and 15, said slot extending entirely therethrough from the outside thereof to the opening 17. At the top, the arm 24 has an inturned laterally extending branch 26 to the extremity of which a slip 20 is pivotally connected as shown at 27. The lower end of the arm 24 has an outturned lateral branch 28 which is engaged by one of the arms 29 of an angle-lever having its other arm 30 connected to the rod 31 of a piston 32 working in a fluid-pressure cylinder 33 supported by an extension 34 of the base 11. The two angle-levers which operate the arms 24 of the two slips are both connected to the rod 31 for simultaneous operating of the slips, the connection being a cross bar 35, and the sills 13 carry a cross-shaft 36 on which the angle-levers are fulcrumed. Stops 37 on the sills 13 limit the downward swing of the lever arms 29. The fluid-pressure for operating the angle-levers may be steam, compressed air, or any other fluid under pressure. A suitable valve mechanism for controlling the admission and the exhaust of the fluid-pressure to the cylinder 33 will be provided, but as this mechanism is well-known and immaterial to the present invention it has not been illustrated. The piston 32 is also shown with a second rod 38 extending in the opposite direction from the rod 31, and connected to a hand lever 39, so that the angle-levers may be operated manually. The branches 26 of the arms 24 extend through the slots 22, and they work up and down therein when the slips 20 are elevated and lowered.

The slips 20 are elevated by admitting fluid-pressure to the cylinder 33 on that side of the piston 32 which will carry the latter in a direction to swing the lever arms 29 upwardly. This movement of the lever arms

29 pushes the arms 24 upwardly, and as said arms carry the slips, the latter are elevated. By a reversal of this operation the slips are lowered. By reason of the inside taper of the bushing 19, the slips 20 are crowded inwardly to grip the work as they go down in the bushing, and when moved upwardly they recede from the work and release the same. Figs. 1, 2 and 3 show the slips in elevated position, and Figs. 4 and 5 show the slips in lowered position.

The bushing 19 also has diametrically opposite vertical slots 40 on the inside at right angles to the slots 22. The purpose of the slots 40 is to permit putting in and taking out a drill bit of the full width of the bushing without removal of the bushing. When the slips 20 are in elevated position they are clear of the slots 40 to permit free passage of the drill bit.

In the base 11, to the rear of the rollers 12, are vertical openings 41 to permit the escape of mud and grit.

A reversible driving means is provided for the turntable 10. As usual, the turntable has an annular rack 42 with which meshes a drive pinion 43 carried by a shaft 44 supported by a bearing 45 and having a portion extending into a tubular shaft 46 fitted with a sprocket wheel 47 for obtaining motion from a suitable power source. The shaft 44 also extends into a second hollow shaft 48 in axial alinement with and spaced from shaft 46. On the opposed ends of shafts 46 and 48 are made fast bevel gears 49 and 50 which are both in mesh with an idler bevel gear 51. The gears 49 and 50 have clutch faces for engagement of a clutch member 52 having a sliding and driving connection with shaft 44, the same being a spline, feather or similar connection. Clutch member 52 is adjustable by a shifter lever 53 to interlock with gears 49 or 50. When clutch member 52 is locked to gear 49, a direct driving connection is established between shafts 46 and 44, and the latter rotates in the same direction as the former. To reverse the motion, clutch member 52 is shifted to lock shaft 48 to shaft 44. The motion of shaft 46 is now transmitted through gears 49, 51 and 50 to shaft 48, and the latter drives shaft 44 through clutch member 52, the drive being of course in a direction which is the reverse of the direction in which shaft 46 turns. The turntable 10 can therefore be readily reversed without reversing the engine, and it is possible to use a non-reversible engine, such as a gas or oil engine, a constant speed motor, or any other prime mover which could not be used successfully with the driving mechanism in ordinary use, because of its non-reversibilty.

Fig. 6 shows a slightly modified form of reversible driving means. The arrangement of shafts 44, 46 and 48, as well as that of the gears 49, 50 and 51, is the same as before. However the gear 51 is a driving member, its shaft 54 having a connection 55 with the prime mover.

I claim:

1. In a rotary drilling machine, a stationary tubular base member, a bushing mounted in said base member and having vertical work-clearance slots in its side, the interior of said bushing having a downward taper, and work-gripping members slidably mounted in the bushing and positioned, when moved upwardly therein, to clear the aforesaid slots.

2. In a rotary drilling machine, a stationary tubular base member having its interior tapered downwardly and provided with vertical side slots, a bushing in the base member and tapered externally to fit the taper of the base member, said bushing being provided with vertical side slots, and the interior of the bushing having a downward taper, work-gripping members slidably mounted in the bushing, supporting members for the gripping members movably mounted in the side slots of the base member and projecting into the slots of the bushing, and elevating and lowering means for said supporting members.

3. In a rotary drilling machine, a stationary base member having upwardly and downwardly directed tubular extensions provided with vertical side slots, and tapered internally, a bushing seating in the base extensions and tapered externally to fit the taper thereof, said bushing being provided with vertical side slots, and the interior of the bushing having a downward taper, work-gripping members mounted for vertical sliding movement in the bushing, supporting members for the gripping members movably mounted in the slots of the base extensions and projecting into the slots of the bushing, and elevating and lowering means for said supporting members.

4. In a rotary drilling machine, a member having a vertical opening, a bushing mounted in said opening and having vertical work-clearance slots in its side, the interior of said bushing having a downward taper, and work-gripping members slidably mounted in the bushing and positioned, when moved upwardly therein, to clear the aforesaid slots.

In testimony whereof I affix my signature.

LEE J. BLACK.