W. K. RILEY.

WELL DRILLING MACHINE.

APPLICATION FILED MAY 15, 1917.

1,245,274.

Patented Nov. 6, 1917.

2 SHEETS—SHEET 1.

FIG. 1.

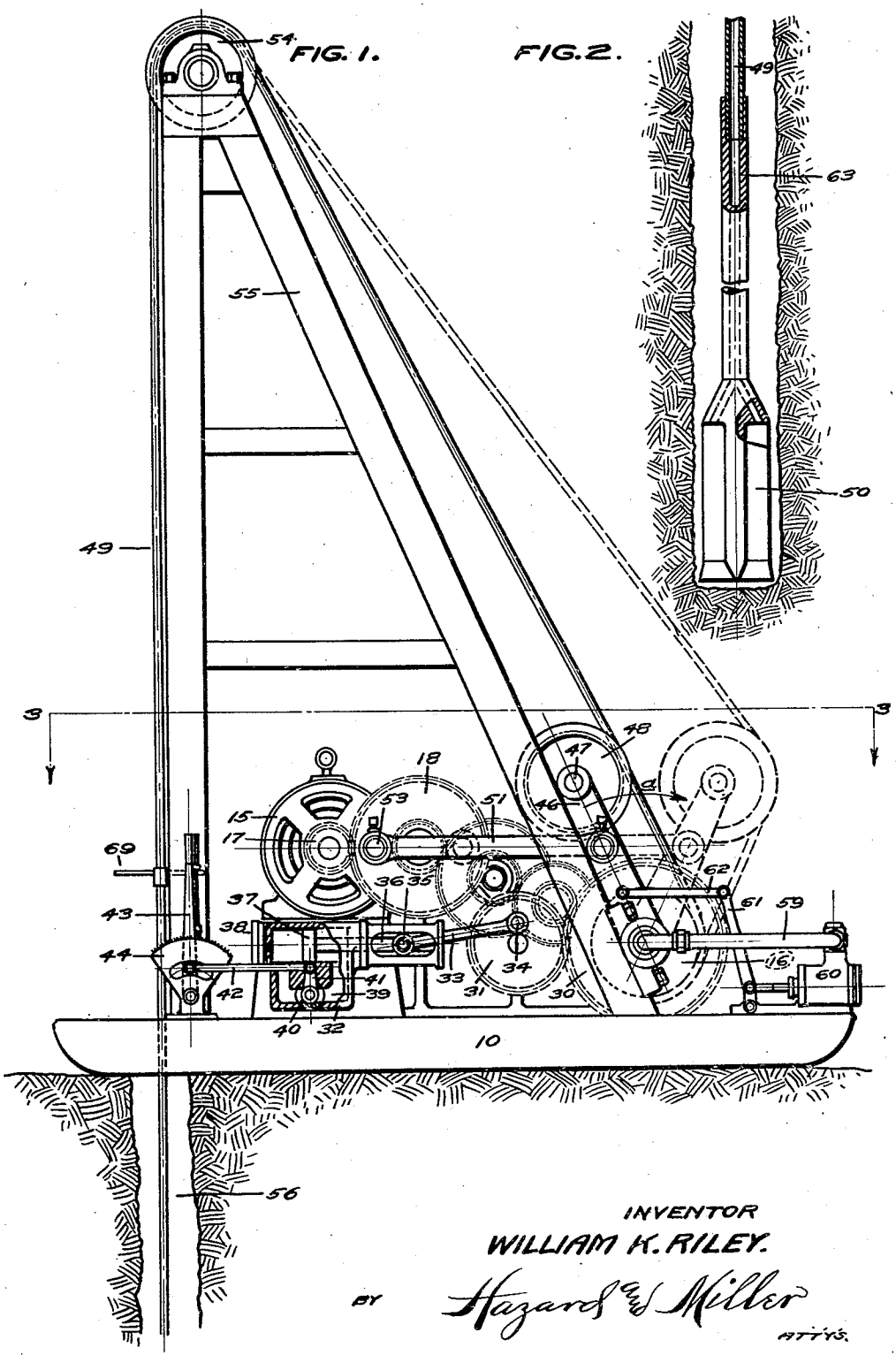

FIG. 2.

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2 SHEETS—SHEET 2.

FIG. 3.

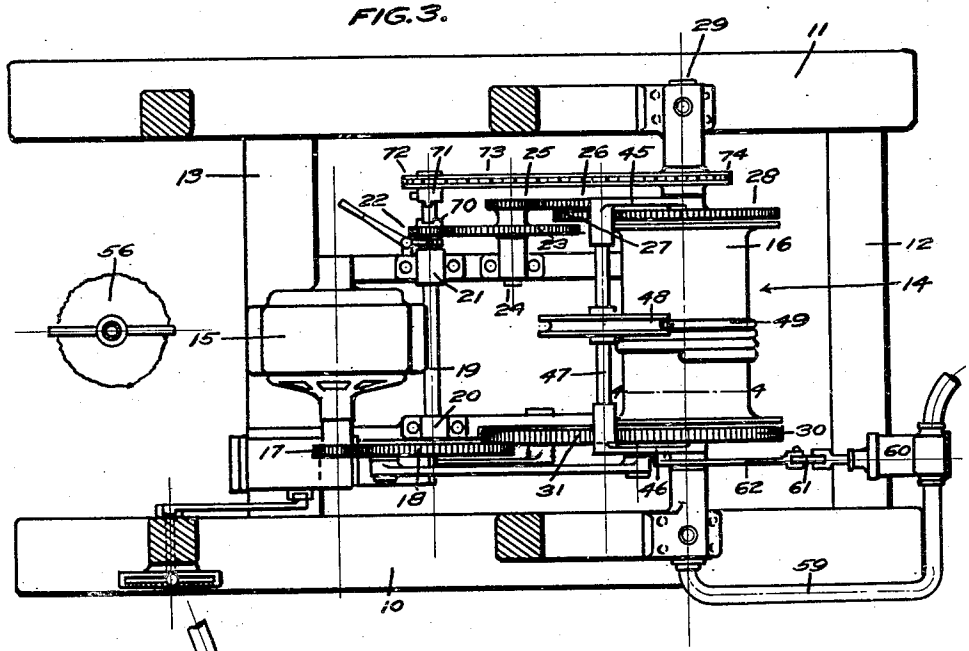


FIG. 6.

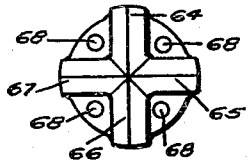


FIG. 4.

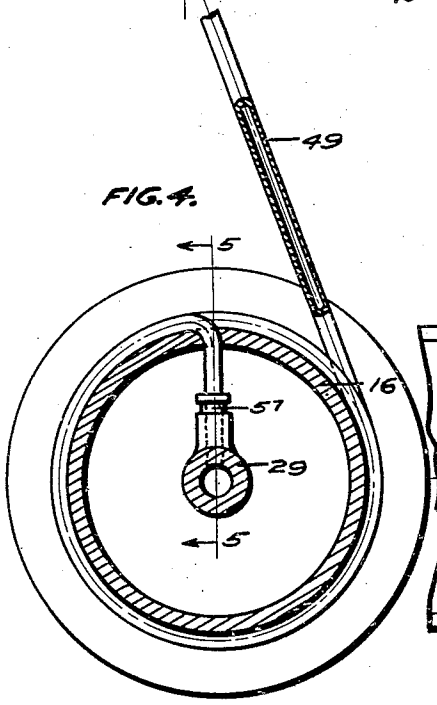
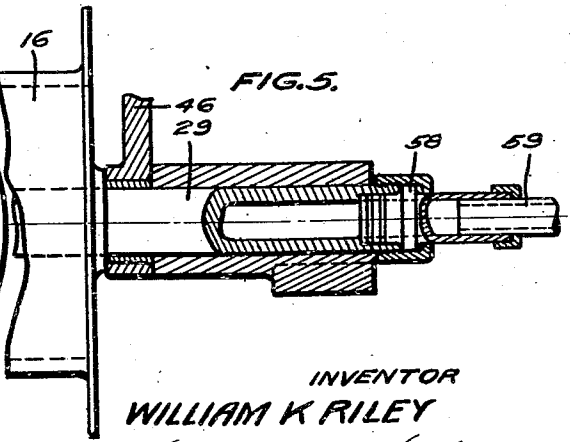


FIG. 5.



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UNITED STATES PATENT OFFICE.

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WELL-DRILLING MACHINE.

1,245,274. Specification of Letters Patent. Patented Nov. 6, 1917.

Application filed May 15, 1917. Serial No. 168,740.

To all whom it may concern:

Be it known that I, WILLIAM K. RILEY, a citizen of the United States, residing at San Bernardino, in the county of San Bernardino and State of California, have invented new and useful Improvements in Well-Drilling Machines, of which the following is a specification.

This invention relates to a well drilling machine.

It is the principal object of this invention to provide a well rig which affords continuous operation of the bit.

Another object of this invention is to provide a hollow cable as a flexible support for the drill bit which also conducts water to the bit in a continuous and direct manner.

Another object of this invention is to provide an operating mechanism which simultaneously reciprocates the drilling bit and lowers or raises said bit continuously.

Another object of this invention is to provide a hydraulic brake which will act to retard the movement of the operating mechanism when desired.

Another object of this invention is to provide simply operated means for delivering water through the hollow cable to the bit under pressure.

It is a further object of this invention to provide a well rig of the above character which is composed of a few parts so arranged as to be strongly designed and to operate continuously without great danger of becoming objectionably worn or otherwise rendered inoperative.

Other objects will appear hereinafter.

The invention is illustrated, by way of example in the accompanying drawings in which:

Figure 1 is a view in section and elevation illustrating the well rig as it is positioned over the shaft being drilled.

Fig. 2 is a view in section and elevation illustrating the drill bit as it appears at the bottom of the shaft.

Fig. 3 is a view in plan as seen on the line 3—3 of Fig. 1 particularly disclosing the relation of the operating elements of the driving mechanism.

Fig. 4 is a view in transverse section and elevation as seen on the line 4—4 of Fig. 3 illustrating the manner in which constant communication is established between the drill bit cable and a source of water supply.

Fig. 5 is a view in section and elevation as seen on the line 5—5 of Fig. 4 and as disclosing the connection between the rotating trunnions of the cable drum and a water pipe.

Fig. 6 is a view in end elevation disclosing the formation of the drill bit and its cutting edges.

Referring more particularly to the drawings, 10 and 11 indicate skids which are secured together by means of cross members 12 and 13, which form a sub-frame for the driving mechanism 14 of the well rig. This mechanism comprises an electric motor 15, a cable drum 16, and power transmission means connected therewith. The motor is secured upon the frame and is fitted with a driving gear 17 which constantly meshes with a driven gear 18 of large diameter. This gear is fixed upon a jack-shaft 19 which extends parallel to the shaft of the motor and is rotatably mounted within bearings 20 and 21. The opposite end of the jack-shaft is fitted with a small driving gear 22 which is in constant mesh with a secondary driven gear 23. This gear is mounted upon a stud-shaft 24 at the outer end of which is secured a small gear 25 which meshes with a gear 26. This gear is fixed upon a small shaft upon which a gear 27 is secured which is in constant mesh with the main driven gear 28. The main gear is fixed upon a drum-shaft 29 upon which the drum 16 is secured. This shaft is of special construction and will be hereinafter described. At the opposite end of the drum a gear 30 is fixed and is in mesh with a brake actuating gear 31.

The actuating gear 31 is provided to drive a hydraulic brake 32 by means of a pitman rod 33 secured by one end by a wrist pin 34 to the gear and at its other end by a pin 35 to the piston rod 36 of piston 37. The piston 37 is here shown as reciprocably mounted within a horizontally disposed cylinder 38. This cylinder is formed with ports at its opposite ends, said ports being connected by a by-pass 39 adapted to be controlled by an oscillating valve 40. It will be understood that the cylinder and the by-pass are filled with oil or other liquid and that as the piston reciprocates within the cylinder this oil will be displaced and alternately forced ahead of the piston and in the rear thereof. The valve 40 is mounted upon a shaft to

which a lever 41 is secured. This lever is fitted with a connecting rod 42 pivotally secured to a shifting lever 43. The lever 43 is pivotally mounted upon a quadrant 44 and may be adjustably set in relation thereto. Adjustment of this lever will indirectly determine the size of the opening through the by-pass and thereby cause a compression of the liquid within the cylinder so that the well rig menchanism will be retarded in its movement when desired.

Pivotally mounted upon the drum-shaft 29 is a pair of oscillating arms 45 and 46 adapted to be connected at their free outer ends by means of a connecting shaft 47 upon which an idler pulley 48 is free to rotate. This pulley is formed with flanges between which the hollow cable 49 is guided. The peculiar mounting of this pulley upon the swinging arms is provided to impart a drilling stroke to the cable and in turn to raise and lower the drill bit 50. This is effected by means of a large pitman rod 51 pivotally secured upon a connecting pin 52 which is mounted on the side of the arm 46. The opposite end of this rod is pivotally mounted upon a wrist pin 53 secured to the outer face of the driven gear 18. As this gear rotates, an oscillating motion will be imparted to the arms 45 and 46 and will cause them to swing inwardly and outwardly in the directions indicated by the arrow —*a*—. This will alternately raise and lower the drill bit 50 in a manner which will be readily understood.

The cable is mounted to be wound around the drum 16 and is led upwardly over an idler pulley 54 which is supported upon the top of the frame structure 55. This structure comprises upright members, one of which is vertically disposed and stands parallel to the portion of the cable which hangs downwardly and upon which the drill bit 50 is secured. As will be understood, this cable extends between the skids 10 and 11 and may be raised and lowered to form a well shaft 56. The cable is of special construction, as particularly illustrated in Fig. 4 of the drawings, where it will be seen that the fixed end is mounted within the drum 16 and secured by means of a connection 57 to the drum shaft 29. This shaft is tubular as well as is the cable. The tubular shaft 29 is fitted with a union 58 which establishes communication between the shaft and a water supply pipe 59. By this construction water may be delivered through the shaft 29 to the cable 49 and from thence along the hollow central portion of the cable to the drill bit, thereby continuously supplying water to the cutting member.

In order to positively force the water through the hollow cable, a reciprocating pump 60 is provided and mounted upon the sub-frame of the rig. This pump is actuated by means of a lever arm 61 pivotally secured to its base and connected by a pitman rod 62 to the oscillating arm 46. As this arm is moved it will in turn reciprocate the plunger of the pump and force water from a suitable source of supply through the intervening conduits and down the cable.

Reference being had to Fig. 2 of the drawings, it will be seen that the lower end of the cable is opened and is mounted within a tubular drill shank 63 at the bottom end of which is mounted the drill bit 50. The bit is formed with four cutting edges 64, 65, 66 and 67, which are here shown as disposed at ninety degrees to each other, and between which water openings 68 occur. These openings communicate directly with the hollow center of the shank 63 and convey the water from the cable directly to the opposite sides of the cutting edges.

In operation, the gear trains are set in motion by actuation of the motor 15, it being understood that other power supply units might be used to advantage. When the motor drives the shaft 19, rotation will be indirectly imparted to the tubular drum shaft 29 and the drum will be caused to rotate in a direction to pay out the cable 49. Due to the reduction of speed between the motor and the drum, the drum will rotate very slowly and will thus gradually lower the drill bit 50. Simultaneous with the rotation of the drum, the gear 18 with its wrist pin 53 will act to oscillate the idler pulley 48 and the arms 45 and 46. This will alternately draw the cable 49 from the position indicated in solid lines of Fig. 1 to the position indicated in the same figure by dotted lines, thus raising and lowering the drill bit within the well shaft 56. In cases where the drill bit has been removed from a shaft and is to be again directly lowered to the bottom of the shaft, the motor is stopped and the drum allowed to run idle under the weight of the bit. The speed of rotation of the drum at that time may be directly controlled by the hydraulic brake 32 which is fitted with the valve 40. As will be understood, regulation of this valve will retard the piston to any speed desired, and will indirectly control the rotation of the gear trains and the drum. When the drill rig is operating, the pump 60 will continuously operate to force water through the hollow shaft 29 of the drum, along the hollow central portion of the drill cable 49, and will thereafter deliver it to the opposite sides of the cutting edges of the drill bit. It will be understood that during the drilling operation the bit may be turned in the shaft by means of a controlling arm 69 fastened upon the cable. When the drill bit is to be raised from the well shaft, the gear 22 is shifted from mesh with the gear 23

and its clutch face 70 is brought to engage a clutch 71 secured to the outer end of the shaft 19. The gear 22 is, of course, splined upon the shaft 19 and will cause it to drive either the gear 23 or a sprocket wheel 72 which is formed integral with the clutch member 71. This wheel transmits power through a sprocket chain 73 to a driven sprocket 74 fixed upon the shaft 29. It will thus be seen that by the movement of the clutch member 70 into engagement with the clutch member 71 the drum 16 will be driven in a reverse direction and the drill cable 49 rewound.

It will thus be seen that the device here disclosed affords a continuously operating well rig which is composed of parts not liable to be subjected to excessive strains and which also provides simple means for directly conveying water to the cutting edges of the drill bit.

While I have shown the preferred construction of my well drilling machine as now known to me, it will be understood that various changes in the combination, construction, and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention.

I claim:

1. In a well drilling machine, a motor, a cable drum mounted parallel with the motor, a train of reducing gears connecting the motor to the cable drum, a hydraulic brake connected to the cable drum, a cable upon the cable drum, and a drilling bit connected to the cable.

2. In a well drilling machine, a motor, a cable drum mounted parallel with the motor, a train of reducing gears connecting the motor to the cable drum, the shaft of the cable drum being tubular, a hollow cable connected to the tubular shaft and wound upon the cable drum, and a pump connected to the tubular shaft for forcing water through the hollow cable.

3. In a well drilling machine, a motor, a driving gear upon the motor shaft, a large driven gear mounted to mesh with the driving gear, a cable drum mounted parallel with the motor, a train of reducing gears connecting the large driven gear to the cable drum, oscillating arms mounted at the ends of the cable drum, a pitman rod connecting the oscillating arms to the driven gear, a shaft connecting the free ends of the oscillating arms over the cable drum, a pulley upon the shaft, a cable wound upon the cable drum and running over the pulley, a derrick having a top pulley over which the cable runs, and a drilling bit connected to the cable; so that as the cable drum is wound to raise or lower the drilling bit, the oscillating arms are operated to vibrate the cable.

4. In a well drilling machine, a motor, a cable drum, a train of reducing gears connecting the motor to the cable drum, a piston cylinder, a piston mounted in the piston cylinder, a connection between the piston and the cable drum whereby the rotation of the cable drum reciprocates the piston, a by-pass connecting the ends of the piston cylinder, and a valve for controlling the by-pass; there being a liquid filling the piston cylinder; so as to form a hydraulic brake controlled by the valve for applying resistance to the cable drum.

5. In a well drilling machine, a motor, a cable drum having a hollow shaft, means connecting the motor to the cable drum, a pump connected to the hollow shaft, a hollow cable connected to the hollow shaft and wound upon the cable drum, a pulley mounted above the cable drum, means for oscillating the pulley to vibrate the hollow cable, a hydraulic brake connected to the cable drum, and a hand-lever for controlling the hydraulic brake.

6. A cable drum, a hollow drilling cable attached to wind upon the drum, a force pump connected to the end of the cable which is connected to the drum, a hydraulicking drilling bit connected to the other end of the hollow cable, means for driving the drum and force pump, and a hydaulic brake connected to the drum.

7. A hollow shaft, a water pipe connected to the hollow shaft, a force pump in the water pipe line, a cable drum upon the hollow shaft, a derrick, a hollow cable connected to the hollow shaft and wound upon the cable drum and running over a pulley in the derrick and downwardly, a drilling bit upon the lower end of the cable, a motor, a pinion upon the motor, a large gear in mesh with the pinion, a train of reducing gears connecting the large gear to one end of the cable drum, a pitman connected to the large gear, oscillating arms connected to the pitman and to the force pump, a pulley carried by the oscillating arms to engage the cable, a brake gear upon the other end of the cable drum, a second brake gear in mesh with the first brake gear, a piston cylinder, a piston in the piston cylinder, a pitman connecting the piston to the second brake gear, a by-pass connecting the ends of the piston cylinder, a liquid filling the piston cylinder, a valve in the by-pass, and a handle for the valve.

In testimony whereof I have signed my name to this specification.

WM. K. RILEY.