W. J. TRAVERS.

WELL DRILLING APPARATUS.

APPLICATION FILED JUNE 3, 1912.

1,076,469. Patented Oct. 21, 1913.

Fig. 1.

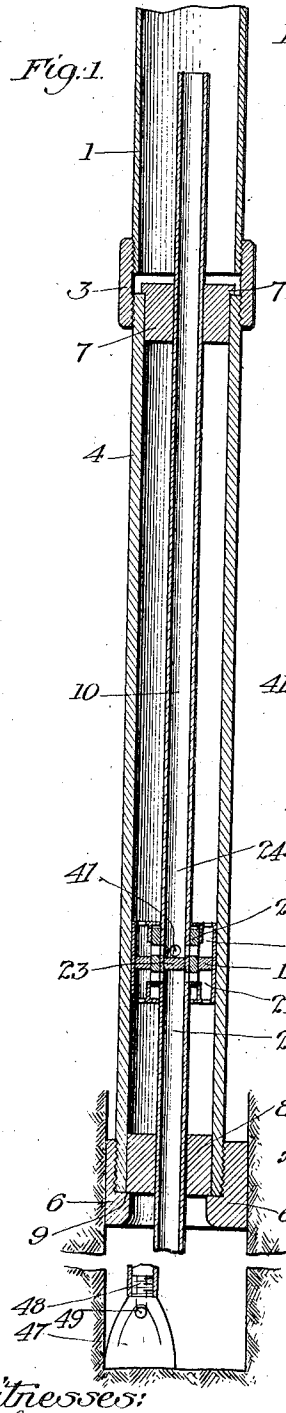


Fig. 3.

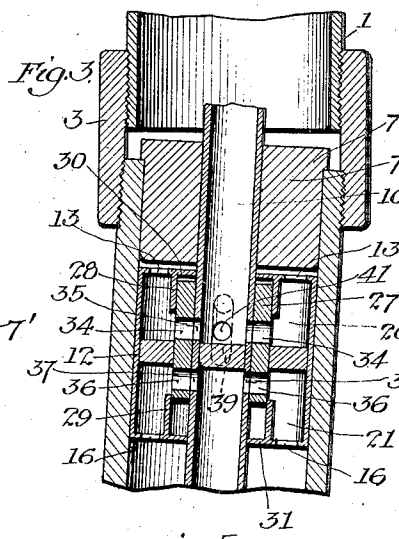


Fig. 4.

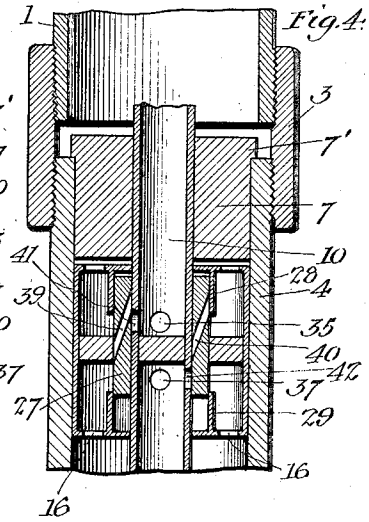


Fig. 5.

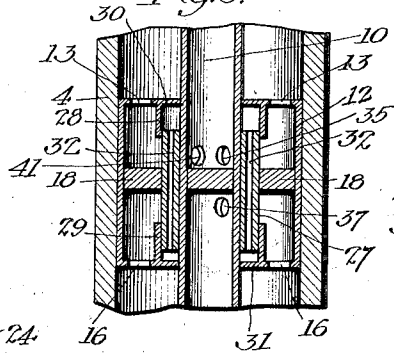


Fig. 6.

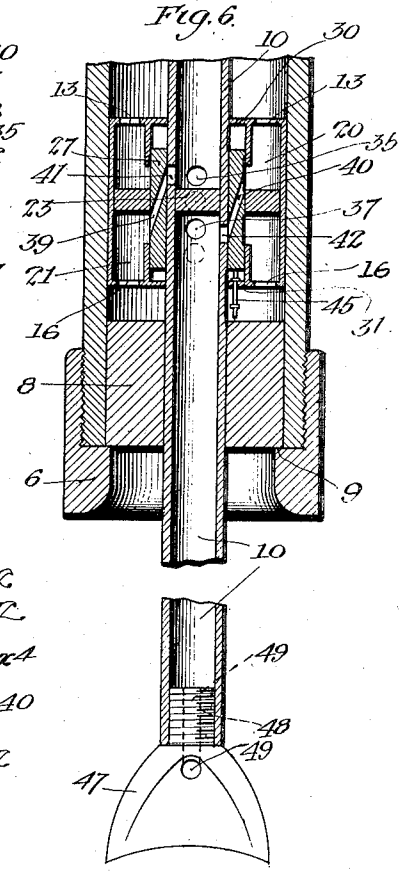
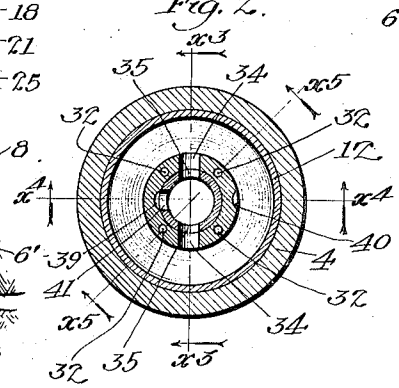


Fig. 2.



Witnesses:

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by Lyon & Hadley attys

UNITED STATES PATENT OFFICE.

WILLIAM J. TRAVERS, OF OLINDA, CALIFORNIA.

WELL-DRILLING APPARATUS.

1,076,469. Specification of Letters Patent. Patented Oct. 21, 1913.

Application filed June 3, 1912. Serial No. 701,442.

To all whom it may concern:

Be it known that I, WILLIAM J. TRAVERS, a citizen of the United States, residing at Olinda, in the county of Orange and State of California, have invented a new and useful Well-Drilling Apparatus, of which the following is a specification.

This invention relates to an apparatus for drilling wells by the operation of a reciprocating or impacting drill, and the main object of the invention is to provide for operation of such drill by hydraulic means.

A further object of the invention is to provide for utilization of the same water for operation of the drill and for hydraulicking.

A further object of the invention is to provide a drilling device of the character described which will drill a hole of greater diameter than the drill, thereby performing the function of an underreamer.

Other objects of the invention will appear hereinafter.

The accompanying drawings illustrate an embodiment of the invention, and referring thereto: Figure 1 is a vertical section of the drilling apparatus. Fig. 2 is a transverse section of the hydraulic operating means. Fig. 3 is a vertical section on line x^3—x^3, in Fig. 2, showing the piston at the upper end of its stroke, and showing the ports for admitting hydraulic pressure to the upper end of the cylinder. Fig. 4 is a section on line x^4—x^4 in Fig. 2. Fig. 5 is a section on line x^5—x^5, in Fig. 2. Fig. 6 is a vertical section of the lower part of the hydraulic cylinder, showing the piston in such lower part.

1 designates the casing or tube for supporting the drilling apparatus, said tube being provided at its lower end with a screw coupling 3 into which is screwed the hydraulic cylinder 4, said hydraulic cylinder being screwed or set into the coupling 3 at a slight angle so as to throw its lower end sufficiently out of vertical line with the upper end to provide for underreaming action, as hereinafter set forth. A shoe 6 may be screwed onto the lower end of the cylinder 4 and said shoe may be made eccentric to the cylinder 4 or made thicker at one side, as shown at 6′, so that the center of the shoe is substantially in line with the center of the casing 1, this eccentricity of the shoe compensating for the offset of the cylinder 4. A plug 7 is mounted in the upper end of the cylinder 4, being, for example, provided with a flange 7′ fitting on the upper end of cylinder 4, and a plug 8 may be similarly mounted in the lower end of the hydraulic cylinder 4 and resting on an internal shoulder 9 on the shoe 6. The plugs 7 and 8 are longitudinally bored for passage therethrough of a piston rod 10, said rod being tubular and serving to support and guide the piston, and also as a means for supplying water to and conducting it from the hydraulic cylinder 4. The piston 12 consists of a cylindrical member secured to the tubular rod 10 and working with a sliding fit in the cylinder 4, the said cylinder having openings 13 at its upper end and openings 16 at its lower end, and being provided with a transverse partition 18 dividing the interior of said piston into upper and lower chambers 20 and 21. A partition 23 also extends across the longitudinal bore of the tubular rod 10, dividing said bore into an upper, inlet passage 24, and a lower outlet passage 25. A valve member formed as a cylindrical sleeve 27 slides on the tubular rod 10 within the piston 12, the upper and lower ends of said valve sliding within cylindrical housings 28 and 29, projecting inwardly from the upper and lower heads or end plates 30 and 31 of the cylinder, the purpose of these housings being to take end pressure off of the valve member so that the valve is balanced so far as hydraulic pressure is concerned, and said valve member is provided with vertical passages 32 establishing communication between the interior of these housings, so that the water will flow from one to the other in the movement of the valve, and such movement will, therefore, not be resisted by the water in the housings.

Valve member 27 is formed with upper ports 34 for establishing communication when said valve member is raised, between the upper valve chamber 20 and ports 35 in the wall of the tubular rod 10, and said valve member 27 is provided with lower ports 36 for establishing communication, when said valve member is raised, between the lower valve chamber 21 and ports 37 in the wall of the tubular rod 10, below the partition 23. Passages 39 and 40 are provided in the valve member 27 for establishing communication when the valve member 27 is in lowermost position between port 41 in the tubular member 10 above partition 23

and the lower valve chamber 21 and between the upper valve chamber 20 and the port 42 in the tubular member 10, below the partition 23.

In order to prevent the piston from striking the plug 8 at the bottom of the hydraulic cylinder 4, a slide member 45 is mounted to slide vertically in the lower wall of the piston, so that its lower end projecting downwardly from the piston is adapted to strike the plug 8 before the piston reaches the plug and its upper end is then caused to engage the valve 27 to prevent descent of said valve and hold the same in position for admitting hydraulic pressure above the piston so as to prevent return upward movement of the piston and thereby arrest the reciprocating movement thereof. Any suitable drilling tool may be provided at the lower end of the tubular rod 10, for example, a fish-tail bit screw 47 having a shank 48 screwed into the lower end of said tubular rod 10 and provided with a passage 49 for efflux of water from the interior of the tubular rod 10 through the bit into the lower part of the well.

The operation is as follows: Assuming that the bit and the tubular rod 10 carrying the same are in lowered position and at rest, the valve member 27 will move by gravity to position shown in Fig. 6, water under pressure being supplied through the bore 24 or tube 1, passes down through the bore 24 of the tubular rod 10 and through the port 41 and passage 39 to the lower valve chamber 21, whence it passes out through openings 16 to the interior of the cylinder 4 below the piston, the pressure on the piston tending to raise the same. If there is any water in the upper part of the cylinder, it will find its way out through the passage 40 and port 42 to the lower bore portion 25 of the tubular rod 10, and the passage 49 of the drill. The piston 12 and rod 10 are raised by the pressure of the water until the piston strikes the plug 7 at the upper end of the cylinder 4, whereupon the momentum of the valve member 10 causes it to slide upwardly to position shown in Figs. 3 and 4, opening communication from the upper portion 24 of the tubular rod 10 through ports 35, passages 34, valve chamber 20 and openings 13 to the cylinder space above the piston, so as to tend to force the piston downwardly and at the same time, communication is open from the cylinder space below the piston through openings 16, lower valve member 21, passage 36, ports 37, lower bore portion 25 and passages 49 to the outside of the bit, so that the water in the lower part of the cylinder will be expelled in the downward movement of the piston and passing through the bit will serve to hydraulic the well, the bit being forced downwardly by the downward movement of the piston, eventually strikes the bottom of the well, and the movement of the piston thereby being arrested, the valve member 27 moves downward with relation to the piston under the action of its own momentum and again takes the position shown in Fig. 6 whereupon the operation is repeated. The tube or casing 1 being turned gradually as the drilling proceeds, the bit 47 is caused to cut a cylindrical bore in the ground or rock, and owing to the offset of the drill by reason of the inclination of the cylinder 4 with respect to the casing 1, this bore is of somewhat larger diameter than the bit, so as to provide for reception of a casing which is larger than the bit. As drilling proceeds, the casing must be lowered and if at any time, the operator fails to lower the casing, so that the piston in its descent is in danger of striking the lower end of the cylinder, the slide member 45 is lifted so that the valve is not allowed to descend to the lower end of the piston and remains in position to maintain pressure on the upper face of the piston. As a consequence, the piston remains at the lower end of the cylinder and the reciprocating operation ceases. This stop device, therefore, serves the purpose of notifying the operator that the casing should be lowered, the cessation of reciprocation being evidenced by the cessation of the sound of drilling. Inasmuch as this action takes place before the drill has descended far enough to enable the piston to actually strike the lower end of the cylinder, such impact of the piston on the cylinder is prevented. It will be understood that owing to the great weight which ordinarily rests on the suspending tube 1, which is sometimes hundreds of feet in length, any jar on the tube in a downward direction is liable to cause the tube to part at the coupling and the action of the stop device just described, in preventing the jar of the piston on the cylinder is, therefore, of great importance.

The piston, lower plug, and drill bit are all smaller than the bores of cylinder 4 and casing 1, and the upper plug is smaller than casing 1, so that these parts can be drawn up through the casing 1 when required.

What I claim is:

1. A well drilling apparatus, comprising a casing, a cylinder at the lower end of said casing, a piston mounted to reciprocate in said cylinder, a piston rod connected to said piston, a drilling tool carried by said piston rod, said cylinder being provided with water inlet and outlet means, and valve means operated by the movement of the piston for controlling connection of the water inlet and outlet means with the cylinder to reciprocate the piston and drilling tool positively by water pressure in both directions, said valve traveling with the piston and drilling tool to shift the position of the

piston stroke along the cylinder as the drilling tool descends.

2. A well drilling apparatus, comprising a casing, a cylinder at the lower end of said casing, a piston mounted to reciprocate in said cylinder, a piston rod connected to said piston, a drilling tool carried by said piston rod, said cylinder being provided with water inlet and outlet means, and valve means controlling connection of the water inlet and outlet means with the cylinder to reciprocate the piston and drilling tool positively by water pressure in both directions, said valve means being slidably mounted on the piston and operating to move in either direction by its own momentum, on arrest of the piston.

3. A well drilling apparatus, comprising a casing, a cylinder at the lower end of said casing, a piston mounted to reciprocate in said cylinder, a piston rod connected to said piston, a drilling tool carried by said piston rod, said cylinder being provided with water inlet and outlet means, and valve means controlling connection of the water inlet and outlet means with the cylinder to reciprocate the piston and drilling tool positively by water pressure in both directions, said valve means being slidably mounted on the piston and operating to move in either direction by its own momentum on arrest of downward movement of the piston, and means at the lower end of the cylinder for engaging with the valve means to prevent such operation of the valve means and thereby stop the reciprocating operation when the piston approaches close to the lower end of the cylinder.

4. In a well drilling apparatus, a casing, a cylinder connected to the lower end of said casing, a drill operating means mounted to reciprocate in said cylinder, a drilling tool carried by said drill operating means, the axis of said cylinder and the line of motion of said drilling tool being oblique to the axis of said casing to enable the drilling tool to cut a hole larger than said casing.

In testimony whereof, I have hereunto set my hand at Los Angeles, California this 24th day of May, 1912.

WILLIAM J. TRAVERS.

In presence of—

MARY E. BLASDEL,

ARTHUR P. KNIGHT.