Sept. 21, 1926.

B. F. SCHMIDT

1,600,492

OIL WELL DRILLING TOOL

Filed Oct. 3, 1921

Fig. 2.

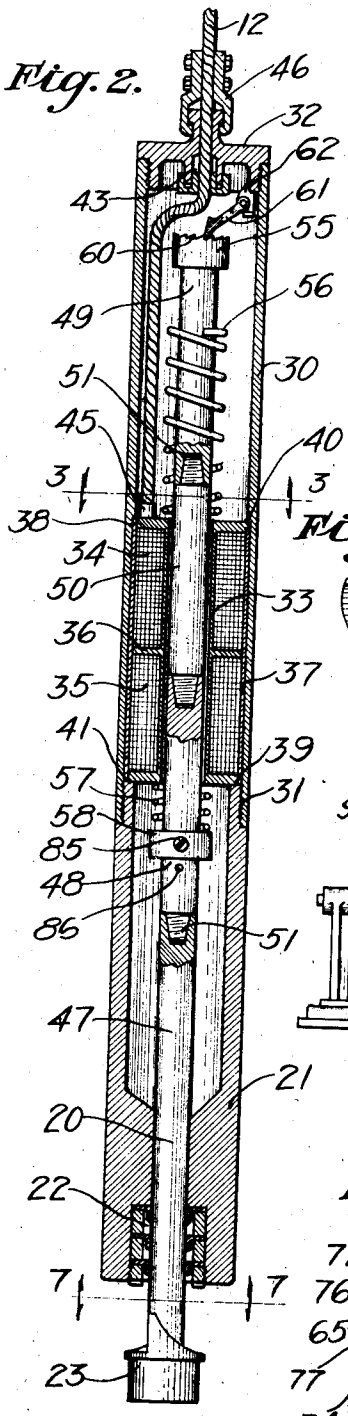


Fig. 1.

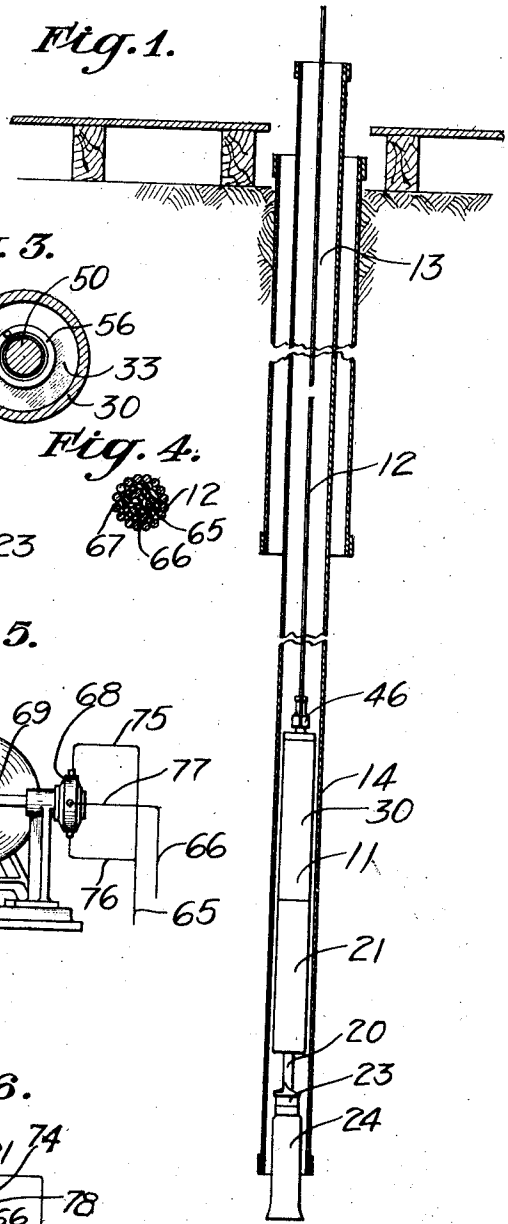


Fig. 3.

Fig. 7.

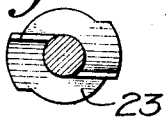
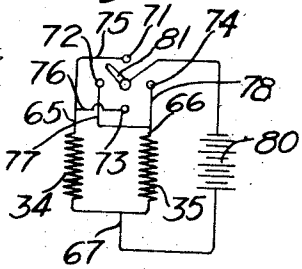


Fig. 4.

Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

BENJAMIN F. SCHMIDT, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-FOURTH TO KING C. GILLETTE AND OF ONE-FOURTH TO KING G. GILLETTE, BOTH OF LOS ANGELES, CALIFORNIA.

OIL-WELL-DRILLING TOOL.

Application filed October 3, 1921. Serial No. 504,941.

This invention relates to well drilling apparatus and especially to electrically operated reciprocating apparatus which may be lowered into a well so that the motive-power will be applied at a point adjacent to the drilling operation, thus eliminating the necessity for drill pipe.

It is an object of my invention to provide an apparatus of this character suitable for drilling operations within the smaller sizes of well casing.

It is a further object of my invention to provide an apparatus in which the reciprocation of the parts is accomplished without the use of rotating and crank mechanisms.

It is a further object of my invention to provide an apparatus of this nature in which the drill bit is partially rotated at each cutting stroke thereof.

It is a further object of my invention to provide a means for adjusting the length of stroke of the reciprocating parts thereof.

It is a further object of my invention to provide an apparatus of this type of such construction that the electrically responsive parts will be impervious to moisture in order that the liability of short-circuit from this cause will be eliminated.

It is also a further object of my invention to provide a means of varying the frequency of the cutting strokes to suit the formation being penetrated.

Further objects and advantages will be made evident hereinafter.

Referring to the drawing which is for illustrative purposes only:—

Fig. 1 is a view illustrating the application of my invention.

Fig. 2 is a vertical sectional view through the drilling apparatus shown in Fig. 1.

Fig. 3 is a section taken on the plane represented by the line 3—3 of Fig. 2.

Fig. 4 is a cross section of the cable I employ for suspending the drilling apparatus within the well and which cable is adapted to contain suitable electric conductors.

Fig. 5 is a view illustrating the variable frequency timing device I employ.

Fig. 6 is a diagram of the electrical connections I employ with my device.

Fig. 7 is a section taken on the line 7—7 of Fig. 2.

As shown in Fig. 1 of the drawing my drilling apparatus 11 may be suspended by a cable 12 within a well 13 and is adapted due to its compact form to operate within a small diameter casing 14. A reciprocating shank 20 extends from the casting 21 of the apparatus 11, through a suitable packing member 22 and supports by means of a tool joint 23 a reciprocating bit 24.

In the construction of the apparatus 11 I provide a length of tubing 30 which makes threaded connection at 31 with the casting 21 and the upper end thereof is closed by a head 32. A solenoid spool 33 has windings 34 and 35 thereupon which are divided by a circular web 36. This spool is enclosed by a tubular member 37 and the joints 38 and 39 are impregnated with a suitable water proofing substance before the spool is placed within the member 30, being held in place between a shoulder 40 formed upon the interior of the member 30 and the end 41 of the casting 21. The cable 12 enters the head 32 through a packing member 43 and makes internal connection with the spool 33 through a boss 45. A clamp 46 grips the cable 12 and is adapted to transfer the weight of the apparatus 11 thereto so that no strain will be placed upon that portion of the cable situated within the interior of the member 30. The tool shank 20 is comprised of a lower portion 47 which extends upwardly from the joint 23, and brass sections 48 and 49 between which is situated a steel core piece 50, these sections being joined by suitable thread engagement as indicated at 51.

In Fig. 2 of the drawing the shank 20 is shown in raised position and it will be perceived that the core 50 coincides with the solenoid winding 34. When the solenoid 35 is energized, the magnetic attraction thereof upon the core piece 50 causes the shank 20 to be brought forcibly downward. Under ordinary conditions of operation, the apparatus 11 is so situated within the well that the bit 24 will strike the bottom of the hole and thereby be brought to rest. As the material is removed by the cutting action of the bit 24, the downward length of travel of the shank 20 increases, so to prevent the head 55 from striking the solenoid spool 33 I provide a spring 56 which cushions the blow at the end of each downward stroke. I also provide a spring 57 which operates between a collar 58 and the lower end of the spool

33 and absorbs the force of the upward stroke of the shank 20 and brings same to a stop in the position shown in the drawing. The collar 58 is secured upon the shank 20 by means of a screw 85 which threads into one of a number of holes 86 provided in the shank 20, a number of holes 86 being provided to allow for adjustment of the length of stroke of the reciprocating member.

The head 55 is provided with ratchet teeth 60 which are engaged by a pawl 61 at the end of each upward stroke, thus causing the drill shank 20 to be partially rotated at each stroke thereof so that the cutting action of the bit 24 will be distributed evenly over the bottom of the hole. The pawl 61 may be mounted upon a projection 62, as shown, or it may be otherwise mounted to correspond to the particular design of the apparatus.

The solenoid windings 34 and 35 are energized through conductors 65, 66 and 67, which extend within the cable 12 and have connection with a timer 68 mounted upon a shaft 69 which slidably carries a fiber wheel 70 having bearing against a revolving plate 91. This fiber wheel 70 is adapted to be moved radially across the plate 91 by a lever 92 so that the speed of the shaft 69 may be varied to transmit the desired frequency of electric impulses to the windings 34 and 35.

As shown in the diagram, Fig. 6, the timer I employ is provided with four contacts 71, 72, 73 and 74. Leads 75 and 76 connect with the conductor 65 while leads 77 and 78 connect with the conductor 66. The conductor 67 makes connection between a suitable current source 80 and the windings 34 and 35 and forms the return conductor of the circuits in which the windings 34 and 35 are situated. An arm 81, mounted upon the shaft 69, makes contact successively with the points 71, 72, 73 and 74 and the solenoid windings 34 and 35 are alternately energized causing the reciprocation of the shank 20 through the attraction of the core 50. By varying the speed of rotation of the shaft 69 as hereinbefore explained, the frequency with which the shank 20 reciprocates may be regulated by the driller to suit the subterranean structure being operated on.

It will be perceived that the movable elements of the device I have illustrated constitute a reciprocating motor which may be adapted to many other uses than that shown and which is particularly adapted to submergence as the electrical elements are impregnable to liquids.

I claim as my invention:—

In a well drilling tool, the combination of: an upper shell portion having the lower end thereof counterbored; a cap threaded into the upper end of said upper shell portion, said cap being arranged for attachment of suspension means; a solenoid element in said counterbore, said solenoid element being shorter than said counterbore; a lower shell portion threaded into the lower end of said upper shell portion and acting to hold said solenoid element in said counterbore; a reciprocating member extending through said solenoid and through said lower shell portion; and means at the lower end of said lower shell portion for resisting the entrance of foreign materials into said shell.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 27th day of Sept. 1921.

BENJAMIN F. SCHMIDT.