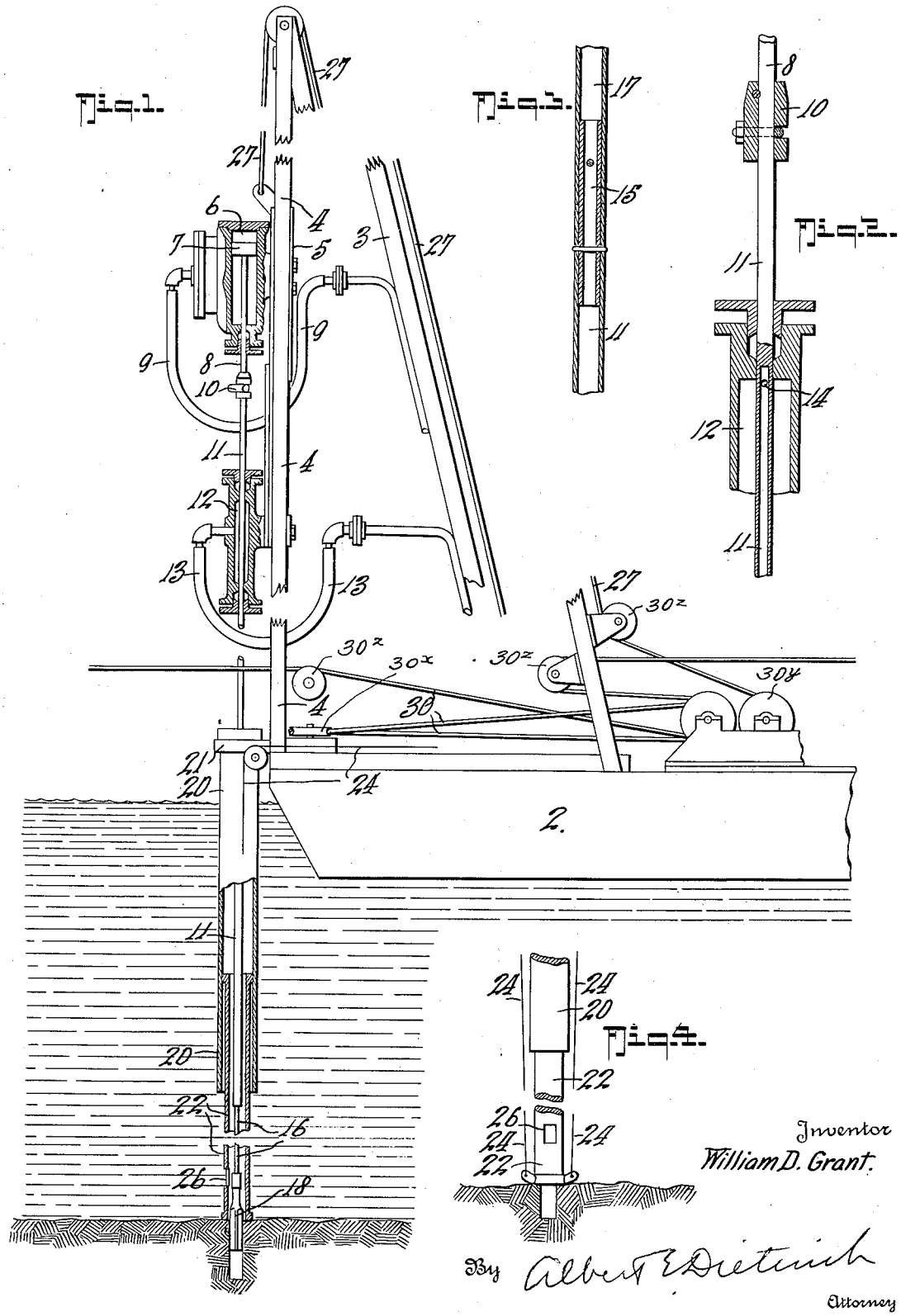
Dec. 2, 1924. 1,517,556

W. D. GRANT

SUBAQUEOUS DRILL

Filed Nov. 8, 1923 2 Sheets-Sheet 1



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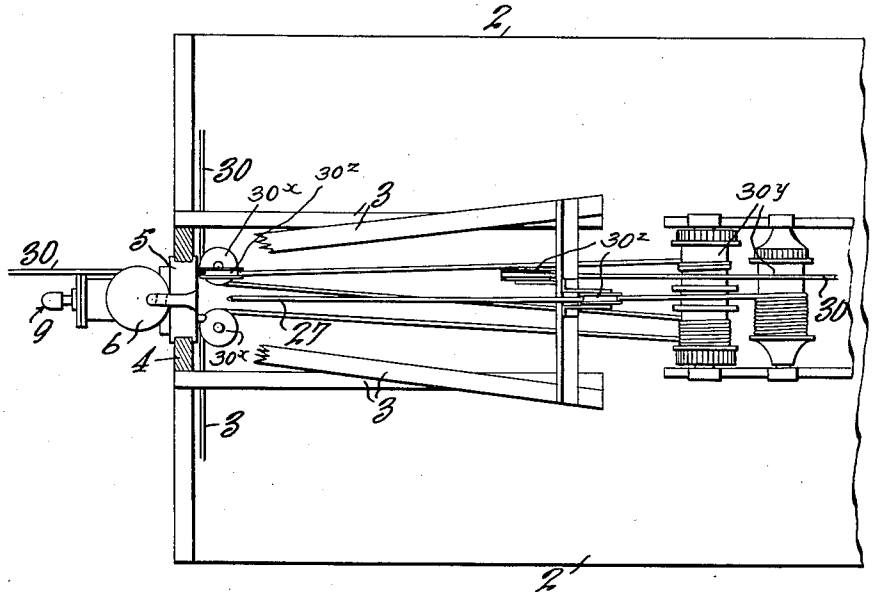
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Fig. 5.



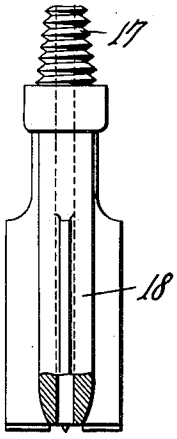


Fig. 6.

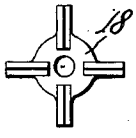


Fig. 7.

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UNITED STATES PATENT OFFICE.

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SUBAQUEOUS DRILL.

Application filed November 8, 1923. Serial No. 673,572.

To all whom it may concern:

Be it known that I, WILLIAM D. GRANT, citizen of the Dominion of Canada, residing at Vancouver, in the Province of British Columbia, Canada, have invented certain new and useful Improvements in Subaqueous Drills, of which the following is a specification.

This invention relates to a mechanism for drilling rocks under water in preparation for blasting, and the improvements comprise the means by which the drilling may be effected from a floating vessel moored at the location of the drilling by wire ropes to suitable anchorages, but without the requirement of spuds for supporting the vessel directly on the bottom. The vessel may thus be readily removed from the immediate vicinity of the drill hole while the charge is being fired and as quickly returned to drill a fresh hole.

The invention also comprises the provision of a means for delivering water under pressure through a tubular drill rod to the cutting end of the drill for washing the detritus from the drill hole as the drilling proceeds, and in the provision of a telescopic, tubular casing suspended from the floatable vessel to surround the drill rod, the lower end of which casing tube seats on the rock bottom around the drill hole. Through an aperture in this casing the water circulated through the drill rod is projected with the detritus of the drilling away from the hole.

A further important feature of improvement lies in the fact that the operating cylinder of the drill is slidably movable lengthwise and is weighted to absorb the reaction of the impulses imparted to the drill rod, and is adjustably suspended from the derrick frame in which it is movable in a manner that enables it to be lowered to follow up the drill, or to be lifted entirely from the drill rod casing without disturbing the seat of that casing on the edge of the drill hole, whereby the blasting charge may be introduced through the same casing tube and the silting up of the drill hole and the requirement of cleaning it out before the blasting charge can be inserted is avoided.

There are other novel and advantageous features in the design of the several parts of the mechanism to which attention will be drawn in the following specification, reference being made to the drawings by which it is accompanied, in which:

Fig. 1 is a side elevation and part section of the drilling apparatus shortened in height where indicated.

Fig. 2 is an enlarged detail of the connection of the drill cylinder piston rod to the tubular drill rod and of the water delivery to within the drill rod.

Fig. 3 is a detail of the means of connecting the drill rod lengths.

Fig. 4 is a front elevation of the lower casing tube showing the connection of the lifting lines thereto.

Fig. 5 is a plan of the end of the floatable vessel and of the drill supporting derrick.

Fig. 6 is an elevation and part section of the drill head, and

Fig. 7 is an end view of the same.

In these drawings 2 represents the floatable vessel or scow, from one end of which a derrick frame 3 projects vertically upward to a height of from eighty to a hundred feet, dependent on the depth of water under which the drilling is to be performed. This derrick 3 has parallel guideways 4 in which is vertically movable a slide-block 5 to which the steam drill cylinder 6 and its connected parts are secured. This slide-block and its cylinder are suspended by a line 27 over a sheave in the upper end of the derrick, which line passes to the donkey engine on the after part of the vessel that the drill may be raised and lowered as desired.

In the cylinder 6 is endwise movable the piston 7 secured to its rod 8. Steam is delivered to the cylinder 6 through a flexible pipe 9 and is controlled in its delivery to the opposite sides of the piston to effect reciprocation of the rod by the customary valves and with provision, (not shown) usual in drills of this class, for rotating the piston and its rod through a fraction of a revolution at each upward stroke.

The lower end of the piston rod 8 is connected to the tubular drill rod 11 by a clamp 10 and immediately adjacent this connection the drill rod 11 passes, gland-packed at each end, through a chamber 12 secured to the same weighted slide-block 5. Water under pressure is admitted to this chamber 12 through a flexible hose pipe 13 and the tubular drill rod 11 is apertured at 14 within the chamber to admit the water from the chamber to the bore of the rod, the length of the chamber being such that the water has access to the rod during any part of its stroke and during its rotation.

The drill rod 11 is of sufficient length, below the water vessel 12, to reach the depth of the water in which the drilling is to be effected and to the required depth of the drill hole from approximately the level of the deck of the scow.

The drill rod 11 is made up of lengths of hydraulic tubing, the abutting ends of which are welded together on an inserted reinforcing tube 15 pin-connected to each length, as shown in Fig. 3.

The lower length 16 of the drill rod is preferably of axially apertured drill steel, to withstand the lateral stress due to the impact of the drill, and is connected to the lower end of the hydraulic tube rod 11 by a tapered screw (not shown but similar in construction to the screw 17 shown in Figure 6), and the drill head 18 is connected in the same manner by a tapered screw 17 into the lower end of this lower length 16.

Suspended from a bracket 21 secured to and projecting over the end of the vessel 2 is the upper length 20 of a tubular casing concentric with the axis of the drill rod. The lower length 22 of this casing is telescopically slidable within the upper length 20, the lower length having a collar at its upper end, to avoid the frictional resistance of a full length bearing against endwise movement, and to provide a certain measure of flexibility. The lower end of the lower length 22 seats on the rock bottom to be drilled and is by its weight retained thereon during rise and fall of the water. It may be raised within the upper length 20 by a line or lines 24 connected to the lower end 22.

An aperture 26 is in the lower length 22 of the casing tube a short distance from its lower end, through which the water, circulated through the drill, is delivered with the detritus.

The end of the scow on which the drill mechanism is mounted is moored by four opposed lines 30 to retain it in position on the water, which lines are taken from suitable drums 30^y on the donkey engine and pass round sheaves 30^x and 30^z on the after end of the vessel to their respective anchors forward and aft and on each side.

In use, the vessel being moored in position, the lower casing tube 22 is lowered through the upper one 20, by the lines 24 until its lower end rests on the rock bottom to be drilled. The drill cylinder 6 with its water service 12 and drill rod 11 and drill 18 are then lowered in the derrick until the drill rests within the casing tube 22 on the rock bottom. Steam is then admitted to the cylinder 6 through the flexible pipe 9 and water to the chamber 12 through the hose pipe 13. These steam and water service pipes are connected from a position on the derrick frame midway between the upper and lower limits of movement of the drill mechanism to maintain connection with a minimum length of hose pipe.

As the drill works down in the rock the water service under pressure delivered through the lower end of the drill 18 washes the drill hole clean and delivers the detritus with the water flow through the aperture 26.

The slide-block 5 and its connected steam cylinder 6 and water service chamber 12 are of sufficient weight to absorb the reaction of the impulses imparted to the drill and its rod during reciprocation, so that vibration is not imparted to the frame of the derrick and the scow.

The service of water through the drill not only prevents the detritus obstructing the blow of the drill, but washes the drill hole clean for the reception of the explosive charge.

When the drill hole is carried to the required depth, the drill operating mechanism with the drill rod and drill are lifted by the line 27 clear of the upper end of the casing tube 20 and the lower length 16 of the drill rod may be removed to afford facility for the introduction of the explosive charge and its firing connection into the drill hole through the casing tubes 20, 22, the position of which, seated on the edge of the drill hole, remains undisturbed.

The means by which the charge is introduced forms no part of this case.

When the drill hole is charged with its explosive with the firing wires connected, the lower casing tube 22 is lifted by the line or lines 24 and the forward and lateral mooring lines 30 are slackened and the scow is drawn slowly back to a position of safety by winding in the after mooring line. The charge is then fired and the vessel may again be drawn up into position for the next drill hole.

The manipulation of the apparatus and the manner by which the drill hole is freed from the detritus are such that the work of drilling is greatly accelerated.

The novel features to which attention is particularly directed are: that the drill rod and its operative mechanism are suspended in a manner that they may follow the downward movement of the drill, i. e., the mechanism by which the drill is operated is connected to a heavy block 5 slidably suspended by the line 27 so that as the drill works its way down, the cylinder and connected parts are free to move down with the drill rod: that the drill cylinder is weighted to absorb the reaction of the impulses imparted to the drill rod: that a flow of water under pressure is delivered through the drill rod from a connection below the connection of the steam cylinder piston rod to the drill rod to avoid condensation in the cylinder, the manner of delivering being such that a continuous supply of water is maintained during the endwise and rotary movement imparted

to the rod: that this water is delivered to the lower end of the drill hole and passes upward to wash the detritus through the aperture in the casing tube above the level of the rock bottom: that the casing tube is suspended from above water and is telescopically slidable to maintain its seat on the rock bottom around the edge of the drill hole irrespective of the rise and fall of the water level: and that the vessel is not supported on spuds but is moored to anchorages in a manner to facilitate withdrawal and return to the place of drilling.

Having now particularly described my invention, I hereby declare that what I claim as new and desire to be protected in by Letters Patent, is:

1. A subaqueous drill, comprising the combination with a hollow drill rod to which an endwise reciprocating and a rotational movement may be imparted, a tubular casing surrounding the drill rod and drill, the lower end of which casing is seated on the ground around the hole being drilled, means for delivering water through the drill rod during its movement, and means for delivering the water from the casing tube above its seat on the ground.

2. A subaqueous drill, comprising the combination with a hollow drill rod to which an endwise reciprocating and a rotational movement may be imparted, an axially apertured drill removably secured to the lower end of the rod, a casing tube through which the drill rod and drill are endwise movable, the lower end of said casing tube being seated on the surface of the ground surrounding the drill hole, means for delivering water to the drill rod during its movement, said water delivery means being below the operating means by which movement is imparted to the drill rod, and means for delivering the water from the tubular casing above the contact of the same on the ground.

3. A subaqueous drill, comprising the combination with a hollow drill rod, an axially apertured drill removably connected to said rod, means for imparting an endwise reciprocating movement to the drill, the means by which said reciprocating means is applied being weighted to absorb the reaction of the impulses imparted to the drill rod and drill, means for suspending the drill operating means, said suspending means including a weighted block and a slide-way in which said block is vertically movable, and means for lowering the drill operating means to follow the progress of the drill.

4. A subaqueous drill, comprising the combination with a hollow drill rod to which an endwise reciprocating and rotational movement may be imparted, an axially apertured drill removably connected to the lower end of said rod, a telescopically slidable casing tube through which the drill rod and drill are endwise movable, said casing tube being suspended from above water with its lower end seated on the surface of the ground in which the drill is to operate, means for delivering water to the drill rod, and means for delivering the water and the detritus from the drill through an aperture in the casing tube above the contact of the same on the ground.

5. A subaqueous drill, comprising the combination with a derrick on a floatable vessel, said derrick having a vertically disposed slideway, a weight vertically movable in the slideway, a steam cylinder secured to the weight, said cylinder having a piston and rod to which an endwise reciprocating and a rotational movement may be imparted, means for suspending the weight and cylinder by a wire rope passing around a sheave at the upper end of the derrick, a tubular drill rod removably connected to the piston rod, a chamber secured to the slidable weight through which chamber the tubular drill rod passes gland-packed at each end, means for delivering water under pressure to within this chamber and for admitting it to the tubular rod through an aperture in the rod within the length of the chamber, an axially apertured drill removably connected to the lower end of the tubular rod, said drill being axially bored to be in communication with the hollow of the rod, a telescopically slidable casing tube suspended from the vessel on which the derrick is mounted to concentrically enclose the drill rod and drill and through which the drill rod and drill are endwise movable, the lower end of said casing tube adapted to seat on the ground in which the drill is to operate and having an aperture a short distance above its lower end, through which aperture the water circulated through the drill rod and drill may discharge with the detritus from the drill.

In testimony whereof I affix my signature.

WILLIAM D. GRANT.