July 21, 1953 J. M. REYNOLDS 2,646,128

DRILLING EQUIPMENT

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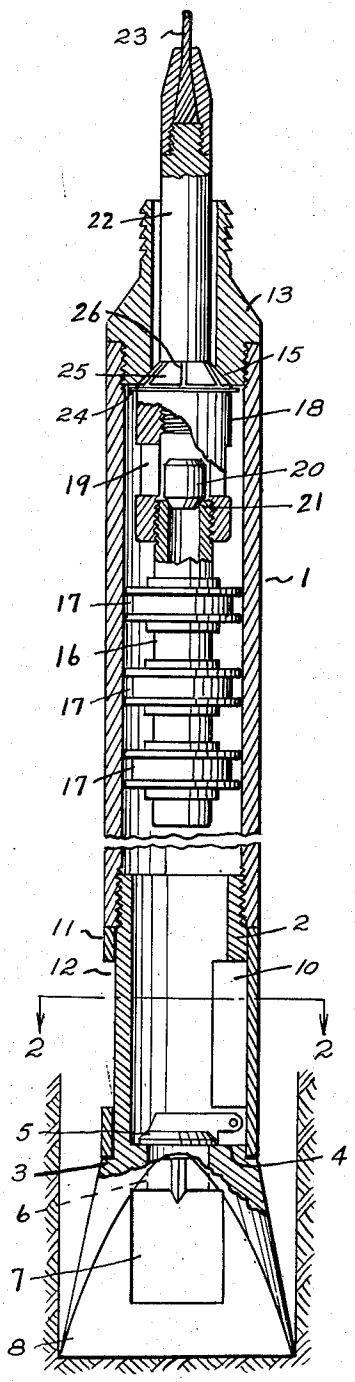


Fig. 1.

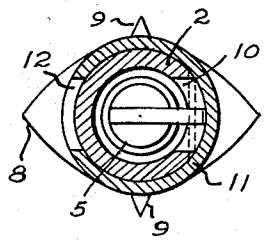


Fig. 2.

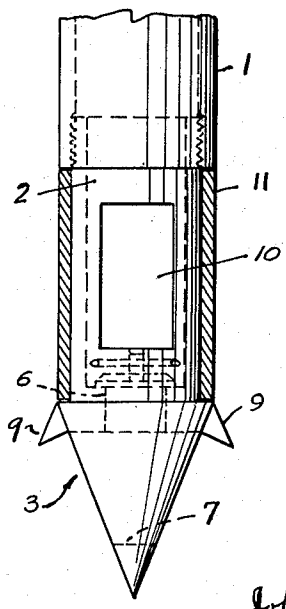


Fig. 3.

Inventor

John M. Reynolds

By E. V. Hardway.

ATTORNEY.

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DRILLING EQUIPMENT

John M. Reynolds, Shreveport, La.

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1 Claim. (Cl. 166—19)

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This invention relates to drilling equipment.

An object of the invention is to provide cable operable equipment whereby the well bore may be formed and the cuttings removed by the same tool.

The equipment is particularly useful in the completion of rotary drilled wells; in deepening wells; in drilling out bridged areas; in drilling out cement and plastic plugs in wells and in other similar types of drilling in wells, particularly deep wells such as oil or gas wells.

A more particular object of the invention is to provide drilling equipment embodying a barrel with a plunger therein and a drill on the lower end of the barrel and which may be lowered into the well and manipulated to disintegrate the formation, or other matter to be removed, at the bottom of the bore and from time to time to draw a load of the disintegrated material into the barrel and trap the same therein for removal to the ground surface.

It is another object of the present invention to provide drilling equipment of the character described which may be readily operated from the ground surface through a cable and which will not only disintegrate the material within the bore hole but by means of which the disintegrated material may be entrapped and removed.

The invention includes not only a drill for disintegrating the material in the bore hole but also a bailer for entrapping the disintegrated material and periodically removing accumulations thereof from the well.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawings, wherein:

Figure 1 is a side elevation of the equipment, partly in section.

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1 and

Figure 3 is a side view, partly in section, of the lower end of the equipment taken at right angles to the view shown in Figure 1.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a tubular barrel which may be made of any desired length and attached to the lower end of which there is the tubular drill collar 2 which forms also a valve cage and on the lower end of the drill collar and preferably formed integrally therewith there is a drill 3.

The lower end of the drill collar, or valve cage 2, is provided with a valve seat 4 and this valve

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seat is normally closed by an upwardly opening flap valve 5 which is pivoted to one side of the drill collar, as shown in Figure 1.

This valve 5 controls an inlet opening 6 extending axially through the drill into the cage, or collar, 2. The lower end of this opening 6 merges into a transverse inlet opening 7 through the drill.

This drill may be any preferred form of percussion type such as commonly used in cable tool drilling; as shown it is formed with a wide downwardly extended downwardly tapering blade 8 and the side cutters 9, 9 extending laterally beyond the exterior surface of the barrel above the edge of the blade and terminating opposite said opening and below the upper end thereof, although any other selected type of drill may be used which is suitable for the purpose.

The valve cage 2 is provided with a side discharge opening 10 which may be opened and closed by a sleeve valve 11 which is mounted to rotate about the cage and which has a side opening 12 adapted to be brought into and out of registration with the opening 10.

This valve 11 is confined against longitudinal movement between the lower end of the barrel 1 and the upper end of the drill 3, as shown in Figures 1 and 3.

Screwed onto the upper end of the barrel there is a tubular head 13 whose lower end is formed into a downwardly opening flared valve seat 15.

There is a tubular plunger rod 16 in the barrel and mounted on this rod are the piston rings 17, 17, 17 whose outside diameter is slightly smaller than the inside diameter of the barrel 1 so as to provide clearance between the rings and the barrel to reduce the wear caused by sand and grit in the material drawn into the barrel.

Attached to the upper end of the plunger rod 16 there is a valve cage 18 which has the side openings 19 and located in this cage there is a valve 20. The upper end of the rod 16 is formed with an upwardly flared seat 21 and the lower end of the valve 20 is tapered to fit said seat.

Screwed into the upper end of the cage 18 there is a stem 22 whose upper end is provided with a cable socket for the attachment of an operating cable 23 thereon.

The numeral 24 designates an annular flexible valve which is clamped against the upper end of the cage 18 by the clamp nut 25.

This clamp nut is screwed onto the stem 22 and its upper side tapers to conform to the taper of the seat 15 and it is provided with the ex-

ternal grooves 26 for a purpose to be hereinafter explained. The margin of the valve 24 is free and extends out almost, but not quite, to the inside wall of the barrel as is shown in Figure 1. The valve 24 is preferably formed of rubber although it may be formed of any other flexible material. When the plunger is in its upper position the tapering portion of the nut 25 will seat against the seat 15, as shown in Figure 1, and the valve 24 will be spaced a short distance beneath the lower end of the head 13 and the grooves 26 will remain open unless there is a greater pressure inside the barrel than outside the barrel in which case the valve 24 will close.

However, it is to be noted that the specific type of bailing mechanism hereinabove described is not essential but any other suitable type of cable operated bailing equipment may be substituted for that specifically described above.

In use the sleeve 11 is turned to close the openings 10 and 12, as shown in Figure 1.

The drilling equipment is then lowered into the well, as also shown in Figure 1, until the drill lands on bottom or at the bridged area or adjacent the plug to be drilled out. The equipment may then be elevated and dropped in the customary manner employed in cable tool drilling and by means of the same well known equipment at the ground surface. The material against which the drill is thus operated will be gradually disintegrated in the usual manner and from time to time during the drilling operations the cable 23 will be slacked off allowing the plunger to move downwardly to the lower end of the barrel 1, any liquid in the barrel beneath the plunger passing upwardly around the plunger but mainly through the hollow plunger rod 16 lifting the valve 20 and passing out through the openings 19.

The stem 22 will pass down into the barrel 1 when the plunger moves to its lowermost position. The plunger is then pulled upwardly, the liquid above it passing on through the tubular head 13 and the suction drawing into the barrel the cuttings produced by the drill, said load of cuttings passing upwardly through the openings 7 and 6 and past the valve 5. Thereupon the valve will close to trap said contents in the barrel.

When the stem enters the passageway through the head 13 said passageway will be greatly restricted thus, temporarily, trapping the liquid in the barrel between the plunger and the lower end of the head 13 thus forming a fluid cushion so that the stroke of the upper end of the tapering nut 25 against the seat 15 will be relieved. The plunger may be reciprocated up and down one or more times, if necessary, to secure a full load and the drilling equipment may be then withdrawn from the well.

The tapering nut 25 will contact the seat 15 upon upward movement of the plunger. If there is well pressure at the bottom of the well, that is if the well is a "live" well the pressure fluid will be drawn into the barrel but since the pressure on the outside of the equipment is the same as that on the inside of the barrel the valve 24 will remain open, as shown in Figure 1. However, as the drilling equipment is elevated the pressure outside gradually decreases and eventually during the upward movement of the drilling equipment the pressure fluid within the barrel will exceed that outside the barrel sufficiently to force the valve 24 against the lower end of the head 13 to completely close the ducts 26 and retain sufficient pressure within the barrel for unloading purposes.

When the drilling equipment has reached the ground surface the valve 11 may be opened and the pressure in the barrel will force the load out through the opening 10. Should there be no pressure in the well, that is should the well be "dead" the load may be drawn in as before but it will not be under pressure and the valve 24 will remain at all times open. In this case when the drilling equipment reaches the ground surface and the valve 11 is opened air may readily enter the upper end of the barrel through the ducts 26 so as to prevent the formation of a vacuum or partial vacuum therein, thus allowing the load to freely discharge itself from the barrel through the opening 10.

Broadly, the invention embodies drilling equipment which includes a drill of the cable tool type together with a bailer by means of which the drill cuttings may be at intervals trapped and withdrawn to the ground surface.

What I claim is:

Drilling equipment of the cable tool type comprising, a barrel having a chamber provided with an inlet and outlet, entrapping means controlling the inlet, a drill on the lower end of the barrel for disintegrating material in a well bore, said drill having a downwardly extending downwardly tapering blade having a transverse opening therethrough in communication with said inlet and cutters extending from the opposite sides of said blade above the edge thereof and terminating opposite said opening and below the upper end thereof a plunger reciprocable in the chamber and having a passage therethrough, valve means controlling the flow of fluid through said passage and operative upon movement of said plunger away from said inlet to close said passage, whereby said plunger is adapted to draw a load of the disintegrated material into the chamber past the entrapping means, a cable connected to the plunger whereby the drilling equipment may be operated in the well bore and whereby the plunger may be independently operated to draw the disintegrated material into the chamber and valve means controlling the outlet to allow the discharge of said load.

JOHN M. REYNOLDS.

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