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W. L. CHILDS ET AL

APPARATUS FOR WELL DRILLING

Filed May 24, 1921

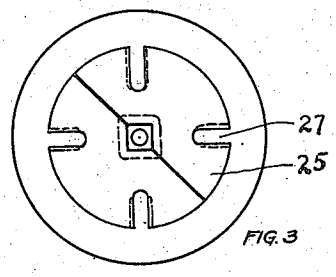


FIG. 3

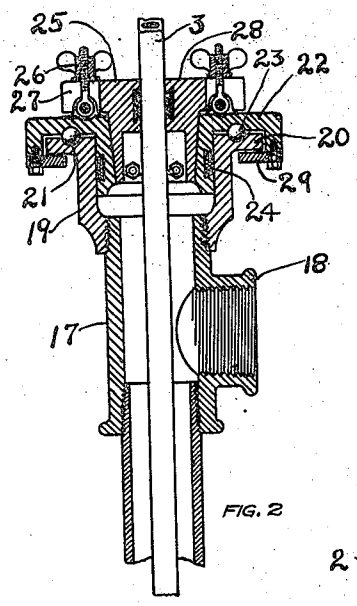
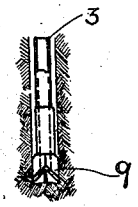


FIG. 2

FIG. 1



W. L. CHILDS
L. A. GODBOLD } INVENTORS

BY Jesse R. Stone

their ATTORNEY.

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UNITED STATES PATENT OFFICE.

WILLIAM L. CHILDS AND LOUIS A. GODBOLD, OF HOUSTON, TEXAS, ASSIGNORS TO HUGHES TOOL COMPANY, OF HOUSTON, TEXAS, A CORPORATION OF TEXAS.

APPARATUS FOR WELL DRILLING.

Application filed May 24, 1921. Serial No. 472,114.

To all whom it may concern:

Be it known that we, WILLIAM L. CHILDS and LOUIS A. GODBOLD, citizens of the United States, residing at Houston, Harris County, Texas, have invented a certain new and useful Improvement in Apparatus for Well Drilling, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to well drilling and has particular reference to a system of fluid circulation to be used with rotary earth boring drills in drilling wells for oil, water, gas, sulphur, etc.

An object of our invention is to cause a circulation of flushing fluid in the drilling of wells which will most efficiently raise the cuttings upwardly away from the drill and discharge the same at the surface.

Another object is to provide an apparatus for directing the circulation of fluid for flushing the cuttings from the well in the direction desired, and to reverse the direction by simply manipulating the valves in the circulating pipes.

The apparatus by means of which these objects are accomplished is shown in the accompanying drawing wherein Fig. 1 is a side elevation, partly in section, showing somewhat diagrammatically the arrangement of the apparatus in our device. Fig. 2 is a longitudinal section through a swivel which may be used at the upper end of the well casing, and Fig. 3 is a top plan view of the casing shown in Fig. 2 with certain parts removed.

We have found that in deep well drilling, the apparatus ordinarily used to flush the cuttings away from the drill will not properly function to return the cuttings. This is due to the fact that the material cut away and disintegrated by the drill is washed away in the strata in which the drilling is operating to such an extent that the flushing fluid will bring back to the surface only a very small portion of the disintegrated material. In the apparatus which we have shown in the drawing the flushing fluid may be forced downwardly outside of the drill stem and return upwardly through the drill stem contrary to the usual custom. The apparatus by which this is done is shown in Fig. 1. In this apparatus we have shown a derrick platform 1 upon which is mounted a rotary, the table of which is shown at 2. The upper end of the drill stem is shown as projecting upwardly through the rotary in the usual manner, the means by which the drill stem is gripped being omitted. The part 3 of the drill stem projecting through the rotary is shown as square in cross section so that the same may be more efficiently held by the rotary. This part is ordinarily termed the grief stem. It is hollow as is the ordinary pipe and is supported at its upper end by swivel block 4 which is itself supported by means of a bail 5 through a cable in the derrick not shown. During the rotation of the drill stem, flushing fluid is pumped downwardly through the same under ordinary circumstances by means of a hose 6 connected to the pipe 7 leading to the pump 8. This flushing fluid flushes downwardly through the drill stem and is discharged through the bit 9 at the bottom of the hole against the cuttings which are carried upwardly in suspension with the flushing fluid and is discharged through a branch pipe 10 at the surface of the ground. This arrangement already described is well known and in ordinary use.

We, however, have so designed the connections in this apparatus that the direction of the circulation may be reversed. In the carrying out of this idea we have shown a discharge pipe 11 located above the pump and between the same and the hose 6. This pipe may be closed by means of a hand valve 12. We also place in the outlet pipe 10 a hand controlled valve 13 so that the outlet may be thus closed when desired. There is also another valve 14 arranged in the pipe between the pump and the pipe 10, the connection between the pipe leading from the pump to the pipe 10 being so arranged that the valve 13 is outside or beyond the said connection. The valve 30 closes the pipe above the pump below the outlet 11.

In the drawing we have shown the casing 15 as fitting in the upper end of the well and extending downwardly for a certain distance therein, the rest of the well being unprovided with casing. At the upper end

of the casing 15 is a casing head 16 through which the rotary drill stem projects. In our improvement we contemplate substituting for the ordinary casing head 16 the improved casing head 17, shown in Fig. 2. This casing head has connection at 18 for the pipe 10, but has the upper end thereof secured to a swaged seat 19, the upper end of which is extended laterally to provide a flange 20, the upper surface of which is grooved to provide an annular ball race 21. The swivel support 22 is shaped to fit over the upper end of the flange 20 and has a cooperating groove 23 to receive the ball race 21, previously described. The lower portion of the swivel member fits closely against the inner walls of the support 19 and has an annular packing ring 24 bearing against the said surface to provide a rotatable fluid tight connection. A stuffing box 25 is fitted about the grief stem 3 and seated within the swivel member 22 and clamped firmly therein by means of clamping screws 26, which are pivotally connected to the swivel member 22 and received within radial slots 27 in the upper porton of the stuffing box. As shown particularly in Fig. 3, the stuffing box 25 is divided into two sections so that it may be readily adjusted about the grief stem when the apparatus is assembled. A packing ring 28 on the inner surface of the stuffing box provides a fluid tight connection with the grief stem 3. The swivel member 22 is secured against removal upwardly from its seat in the support 19 by means of an inwardly projecting annular flange 29 removably secured to the outer edge of the swivel 22, as shown in the drawing.

In operating our device to cause the fluid to circulate upwardly out of the drill stem and through the hose 6 and the pipe 11, we fit the upper end of the casing 15 with the casing head shown in Fig. 2 connecting the pipe 10 within the joint 18. The valve 13 in the pipe 10 is then closed, the valves 12 and 14 being open. When the pump is then operated fluid will be pumped downwardly through the pipe 10 and the casing 15 into the well and will be prevented from escape at the upper end of the casing by means of the special type of swivel, shown in Fig. 2 and previously described. It will thus be directed downwardly outside the drill stem to the drill 9. The inner portion of the drill is hollowed out to about the size of the drill stem and will furnish an outlet for the flushing fluid and the cuttings. This fluid will find a passage upwardly through the drill stem, the hose 6 and the pipes 7 and 11, and be discharged at the surface. Due to the constricted passage provided through the drill stem as compared with the larger volume of the space outside the drill stem through which the fluid is discharged downwardly, the fluid will be forced out from the well with increased velocity and will thus carry with it cuttings which might otherwise be lost.

This operation may proceed as the well is being drilled, and while thus proceeding, the rotation of the grief stem 3 will cause to rotate with it the stuffing box 25 and the swivel 22, the ball race 23 thus acting to prevent excessive friction where the weight is largely supported. When the drill is withdrawn the detachment of the clamping screws 26 will allow the stuffing box to be removed and the drill stem and drill released.

As will be seen from the drawing, this apparatus may be used as is the ordinary flushing device by the manipulation of the valves in the pipes leading from the pump to the well. When it is desired to reverse the circulation the valve 13 will be opened and the valves 12 and 14 will be closed.

The particular advantage of this reverse arrangement of the water circulation is that a more forcible discharge of the cuttings may be obtained by means of our improvement, thus also preventing the loss of the cuttings in the strata. It will assure the driller that all of the matter being disintegrated by the drill is discharged at the surface for his inspection. The further advantages of this construction will be obvious to one skilled in the art without further description.

What we claim as new, and desire to protect by Letters Patent, is:

1. In a drilling apparatus the combination of a well casing, a drill stem rotatable therein and having a fluid tight fit with the upper end thereof, a pump, a connecting pipe between said pump and said casing, another connecting pipe between said drill stem and said pump, a valve controlled outlet in each of said pipes and further valves in said pipes whereby the fluid may be circulated from said pump through said drill stem in either direction for the purpose described.

2. In a drilling apparatus the combination of a well casing, a hollow drill stem rotatable therein, and having a fluid tight fit with the head of said casing, a pump, pipes connecting said casing and said drill stem with said pump, and valves in said pipes whereby the fluid from said pump may be circulated through said drill stem in either direction.

3. In a drilling apparatus, a casing, a casing head thereon, a polygonal drill stem rotatable in said casing head, a ball race on said casing head, a swivel member rotatable on said ball race and fitting fluid tight with said casing head, and a stuffing box fitting fluid tight with said swivel and said drill stem and removably clamped to said swivel member.

4. In a drilling apparatus, the combination of a well casing, a drill stem rotatable therein, a fluid tight connection between said casing and drill stem comprising a stuffing box on said drill stem and a rotating bearing between said stuffing box and said casing, a pump, a pipe connecting said pump and casing, and an outlet pipe connected with the upper end of said drill stem, whereby said pump may force fluid downwardly through the casing and upwardly out of said drill stem.

In testimony whereof, we hereunto affix our signatures, this the 13th day of May, A. D. 1921.

WILLIAM L. CHILDS.
LOUIS A. GODBOLD.