Nov. 8, 1938. J. C. STOKES 2,135,737

CORE DRILL

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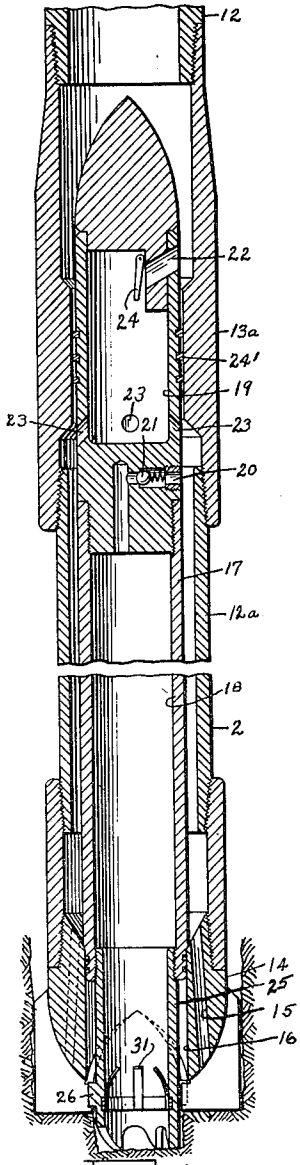


FIG 1.

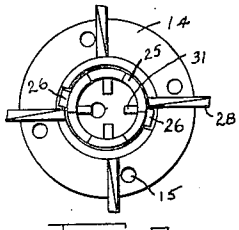


FIG 2.

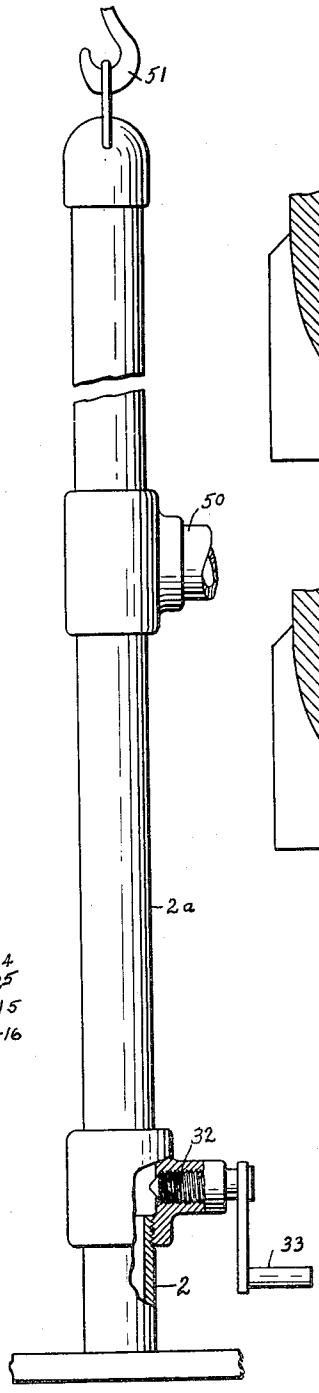


FIG 3.

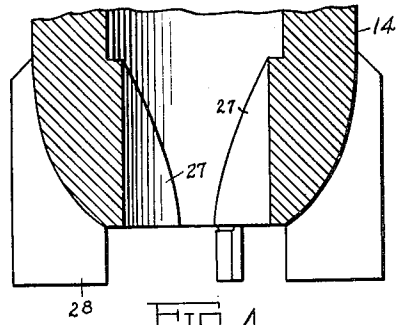


FIG 4.

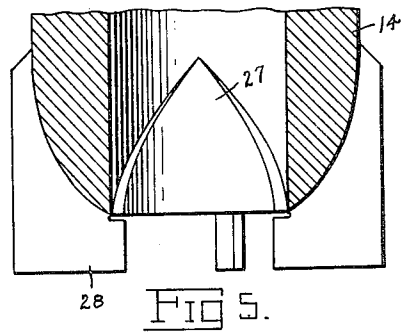


FIG 5.

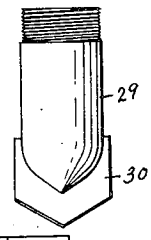


FIG 6.

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CORE DRILL

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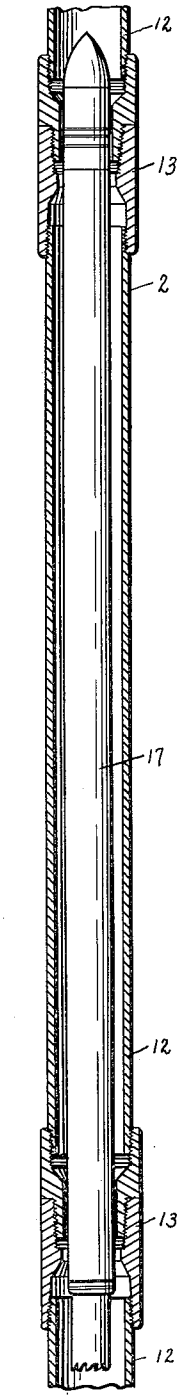


FIG 9.

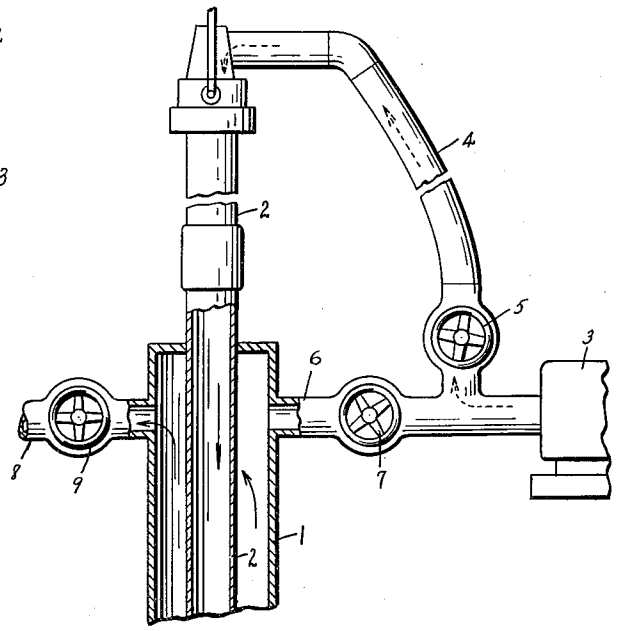


FIG 7.

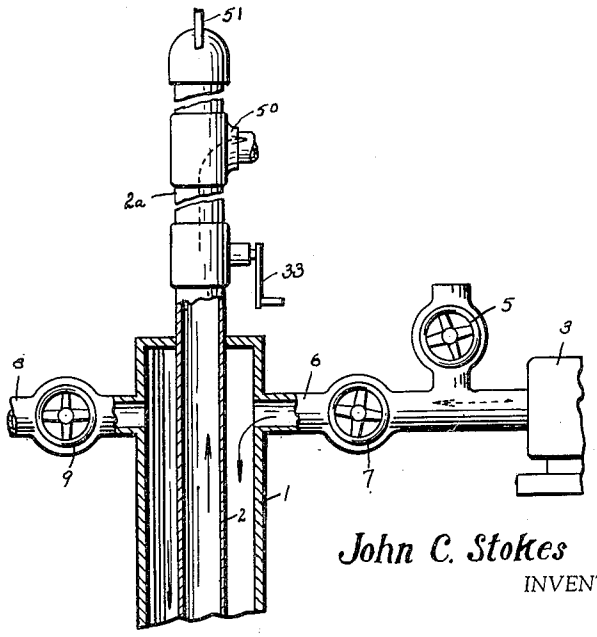


FIG 8.

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Patented Nov. 8, 1938 2,135,737

UNITED STATES PATENT OFFICE

2,135,737

CORE DRILL

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Application April 15, 1933, Serial No. 666,265

3 Claims. (Cl. 255—72)

This invention relates generally to deep well apparatus and will be found particularly useful in core drilling.

One conventional core drill includes a drill stem having a bit attached to the lower end thereof and a core barrel that is either dropped into core receiving position in the drill stem adjacent the bit or lowered into said position by means of a cable, and removed upwardly through the drill stem by the cable after the core has entered it. The removal of the core barrel by means of a cable is an expensive and time-consuming task because it is necessary to have a reel for the cable and power means to drive it and the cable must be lowered into the drill stem until the overshot on the lower end thereof engages the core barrel and then drawn upwardly from the drill stem to effect the removal of the core barrel.

It is customary, during drilling operations, to pump a mud-laden fluid called "slush" downwardly through the drill stem. The slush keeps the bit cool and, moving upwardly in the space between the drill stem and the wall of the well, carries the cuttings of the bit to the surface of the earth.

This invention has for its specific object the provision of new and improved means whereby the slush may be pumped through the drill stem and bit during drilling operations while the core barrel is in core receiving position and the circulation of the slush may then be reversed and the core barrel thereby pumped upwardly through the drill stem, without using a cable and reel or the like.

Other objects of the invention will hereinafter appear.

The preferred embodiment of the invention is illustrated by the accompanying drawings, wherein Fig. 1 is a fragmentary sectional elevation showing the lower end of the drill with the core barrel in core receiving position; Fig. 2 a bottom plan view thereof; Fig. 3 a partly sectional elevation of a device that may be employed to support the core barrel after it has been pumped upwardly through the drill stem; Figs. 4 and 5 detail views illustrating the interengaging means of the bit whereby the core barrel is held in place and caused to rotate with the drill stem; and Fig. 6 a view of the plug that may be employed in place of the boring tool on the core barrel when no cores are desired. Fig. 7 is a diagrammatic view illustrating the circulation of fluid during the drilling operation; Fig. 8 is a diagrammatic view illustrating the circulation of fluid during the core taking operation; and Fig. 9 is a diagrammatic view illustrating the core barrel in an intermediate position in the drill stem.

Referring to Fig. 7 the casing is indicated at 1, the drill stem at 2 and the pump at 3. The pump is connected by the hose 4 to the drill stem 2 and the passage of slush through the hose 4 is controlled by a valve 5. The pump 3 is connected to the casing 1 by the pipe 6 and the passage of fluid through the pipe 6 is controlled by the valve 7. The outlet pipe of the casing 1 is indicated at 8 and it has a valve 9 therein. It will be obvious that during drilling operations fluid may be pumped through the hose 4 downwardly through the drill stem 2 and upwardly through casing 1 out of the outlet 8. The connection of the pump 3 to the casing 1 by the pipe 6 permits fluid to be pumped downwardly in the casing 1 and upwardly in the drill stem 2 after the device shown by Fig. 3 has been attached to the upper end of the drill stem 2 (see Fig. 8).

As shown by Fig. 9 the drill stem 2 comprises a number of pipe sections 12 connected together by tool joints 13. The internal diameter of the tool joints 13 is less than the internal diameter of the pipe sections 12. This is a conventional construction. The core barrel 17 is of a length greater than the distance between the tool joints 13 and of a diameter to snugly fit in the tool joints.

On the lower end of the drill stem 2 is mounted a bit 14 (Fig. 1) having slush ducts 15 therein and having a central bore 16 for the reception of the core barrel as will hereinafter appear. The pipe section 12 is connected to the pipe section 12*a* by the tool joint 13*a*.

The core barrel is indicated at 17. It has in its lower end a core receiving chamber 18 and in its upper end a fluid chamber 19. At a point adjacent the upper end of the core receiving chamber 18 it is connected to the interior of the drill stem by a port 20 having therein a relief valve 21 to permit the escape from said chamber into said drill stem of fluid that would otherwise be trapped as the core rises in said chamber and to prevent the entrance of fluid from the drill stem 2 into the chamber 18. The fluid chamber 19 is connected to the interior of the drill stem 2 by vertically spaced ports 22 and 23. The core barrel 17 may be sealed by the packing 24' to the tool joint 13*a* of the drill stem 2 at a point between the ports 22 and 23. The valve 24 serves to permit the passage of fluid from the interior of the drill stem 2 above the core barrel 17

through the fluid chamber 18, ports 23 and ducts 15 and to prevent the passage of fluid from the fluid chamber 18 to the interior of the drill stem 2 above the core barrel 17. And so fluid may be pumped downwardly through the drill stem 2 past the core barrel 17 but it cannot be pumped upwardly through the drill stem 2 past the core barrel 17.

Any suitable means may be employed to releasably hold the core barrel 17 in core receiving position in the drill stem 2 and to cause it to rotate with the drill stem 2. Figs. 1, 2, 4 and 5 illustrate such means. It will be noted that the core barrel 17 has on its lower end a boring tool 25 that extends through the bore 16 in the bit 14 when the core barrel is in core receiving position. The boring tool 25 has oppositely disposed external lugs 26 that slide downwardly on the inclined internal trackways 27 in the bit 14 when the core barrel 17 is dropped into place and that move underneath the lower end of the bit 14 and against the blades 28 when the drill stem 2 is rotated. The plug 29 illustrated by Fig. 6 and adapted to be screwed into to form a part of the core barrel 17 in place of the boring tool 25 has a cutting blade 30 to engage the tracks 27 and to be driven by the drill stem to penetrate the formation.

The numeral 31 illustrates a device known as a core catcher that functions to trap the core in the core receiving chamber 18.

Fig. 3 illustrates the device 2a that is attached to the upper end of the drill stem 2. This device includes a set screw 32 actuated by the crank 33 to engage the lower end of the core barrel and hold it in the device 2a.

The operation of the device is as follows: When it is desired to take a core of the formation, the core barrel 17 may be dropped into the drill stem 2. It will move downwardly into core receiving position. When the drill stem is rotated the lugs 26 will move underneath the lower end of the bit 14 and engage the blades 28 so that the core barrel 17 will be held in place and caused to rotate with the drill stem 2. When the drill stem is rotated to penetrate the formation, slush is pumped downwardly through the drill stem 2 and upwardly through the casing 1 to keep the bit 14 cool and to remove the cuttings thereof, the valve 7 being then closed and the valves 5 and 9 opened. The fluid passes by the core barrel 17 in the drill stem 2 by entering port 22, passing valve 24, passing through port 23 and finally through ducts 15 (Figs. 7 and 1).

After the core has entered the core receiving chamber 18 the rotation of the drill stem 2 may be reversed to move the lugs 26 to a position between the tracks 27. Then the conventional upper part of the drill stem 2 is removed and the device 2a connected to said drill stem as shown by Figs. 3 and 8. The valves 5 and 9 having been closed, and the valve 7 having been opened, fluid is then pumped downwardly through the casing 1 and upwardly through the drill stem 2 and device 2a out of the outlet 50. As the valve 24 (Fig. 1) closes to prevent the passage of the fluid upwardly past the core barrel 17, the core barrel 17 is moved upwardly into the device 2a. The set screw 32 may be thereupon moved underneath the core barrel 17 to hold it in the device 2a. The device 2a may then be disconnected from the drill stem 2 and the core barrel may then be removed therefrom. A convenient method of removing the core barrel consists in elevating the device 2a by means of an elevating device indicated at 51 after the device 2a has been disconnected from the drill stem 2, and swinging the device 2a away from the drill stem 2, and then retracking the set screw 32 to permit the core barrel to fall out of the device 2a.

It will be obvious that when the plug 29 is substituted for the boring tool 25 that the operation will be as above set forth except that no core will be taken.

The invention is not limited to the preferred embodiment herein disclosed. Various changes may be made without departing from the scope of the following claims.

I claim:

1. The combination with a drill stem comprising pipe sections connected together by tool joints the internal diameter of which is less than the internal diameter of said pipe sections, and a bit secured to the lower end of said drill stem and having a central bore, of a core barrel movable downwardly in said drill stem and into a core receiving position in the bore of said bit; said core barrel having a boring tool on its lower end extending below said bit when said core barrel is in said position; means to hold said core barrel in said position; said means being rendered active and inactive by rotation of said drill stem; said core barrel being of a length greater than the distance between said tool joints and of a diameter to snugly fit in said tool joints; said core barrel having a core receiving chamber and a fluid chamber above and separated from said core receiving chamber; a port connecting said core receiving chamber and the interior of said drill stem at a point adjacent the upper end of said core receiving chamber; a relief valve in said port to permit the escape of fluid from said core receiving chamber into said drill stem and to prevent the entrance of fluid from said drill stem into said core receiving chamber; a pair of vertically spaced ports connecting said fluid chamber and the interior of said drill stem; means to seal the space between said core barrel and said drill stem when said core barrel is in said position, at a point between said vertically spaced ports; and a fluid valve in one of said vertically spaced ports to permit the passage of fluid from the interior of said drill stem above said core barrel through said bit and to prevent the passage of fluid from said bit to the interior of said drill stem above said core barrel; so that fluid may be pumped downwardly through said drill stem and bit during drilling operations, and said core barrel may be pumped upwardly through said drill stem.

2. A core taking apparatus including a tubular drill stem, a core barrel adapted to be supported in said stem for upward movement in the stem under upward pressure, means for introducing fluid under pressure through said stem, and means associated with the core barrel for causing the flow of fluid to be reduced but to be continuous at the reduced rate upon said upward movement of the core barrel.

3. A core taking apparatus including a tubular drill stem having a fluid conduit, a core barrel adapted to be supported in said stem and retained therein by hydraulic pressure, means for introducing fluid under pressure to said conduit, and means actuated by upward pressure on the core barrel for causing the flow of fluid to be reduced but to be continuous at the reduced rate through the conduit to increase the pressure of the fluid and indicate that the core barrel has been elevated.

JOHN C. STOKES.