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RETRIEVING CORE BARREL

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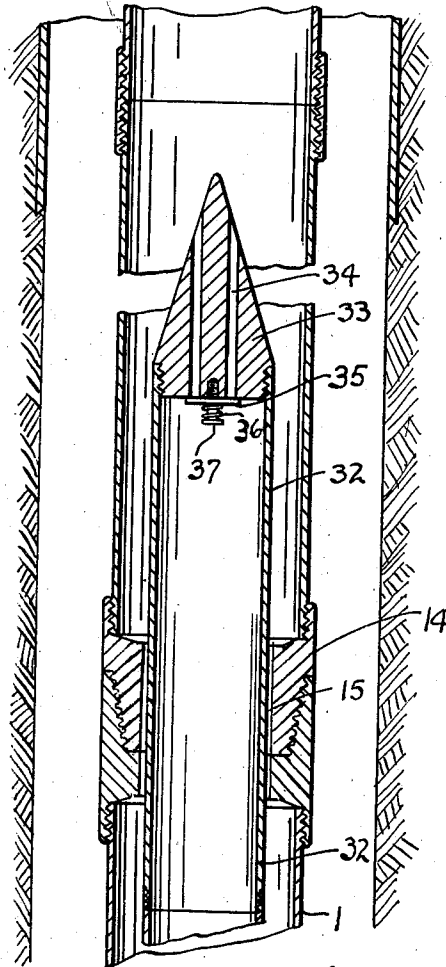
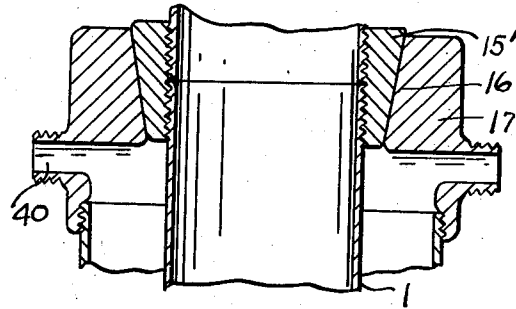
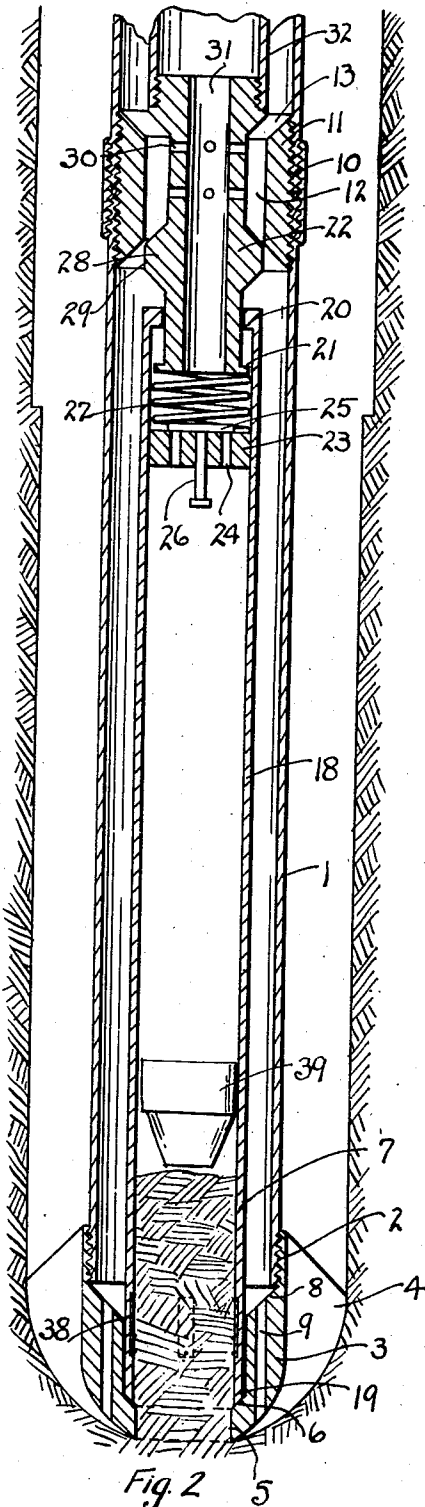


Fig. 1

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RETRIEVING CORE BARREL

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42 Claims. (Cl. 255-72)

My invention relates to core barrels for use with core drills employed in deep well drilling where a sample of the formation being drilled is contemplated.

In well drilling for oil, gas, sulphur and the like it is desirable to obtain samples of the formation being drilled wherever there is reason to believe that a producing stratum has been encountered. In fact it is becoming quite common to obtain a complete log of the formation encountered in the well from the top to the bottom thereof and the use of core drills whereby samples of the formation may be obtained is becoming more and more common.

The common type of core drill employs a tubular bit having a central passage thru which a core may be projected upwardly into the core barrel as the drill advances. When the sample is to be brought to the surface for inspection it is necessary to withdraw the drill with the core barrel to the surface. In deep wells particularly this is a long and laborious operation, necessitating removing the drill stem section by section to bring the drill to the surface so that the core may be removed. Each time a core is to be obtained this process must be repeated.

It is an object of my invention to provide a core barrel which may be employed with any ordinary type of core drill and to so construct and arrange the drill and core barrel that the core barrel with the sample therein may be removed while the drill is in position in the bottom of the well and without necessitating the withdrawal of the drill.

I aim to provide a core barrel to be employed with the usual type of core bit, which may be introduced into position in the core drill to obtain a sample therein, and held in place while the sample is being taken by hydraulic pressure. I also contemplate the removal of the core barrel with its sample therein to the surface by hydraulic means without the necessity of any other apparatus to be inserted into the well.

I also desire to provide means in connection with the core barrel to indicate to the driller when the core barrel has been properly seated and is ready for operation.

The invention resides in the particular construction and arrangement of the core barrel and its connection with the drill and drill stem and a fuller understanding thereof will be obtained thru the more detailed specification which follows:

Referring to the drawing herewith,
Fig. 1 is a central longitudinal section thru the

upper end of the well and of my device inserted therein, the upper end thereof being shown in this view.

Fig. 2 is a similar section showing the lower end of the well with my apparatus therein.

In the drawing I have shown the lower end of the drill stem at 1 in Fig. 2, said drill stem being connected at its lower end to the core bit 2. The bit shown herewith is an ordinary type of scraping drill having a body 3, with laterally extending blades 4 to cut the clearance at the bottom of the hole. The drill head 3 has a circular opening 5 at the lower end to receive the core. Above this opening the central passage thru the head of the bit is enlarged somewhat to provide a tapered seat or shoulder at 6 to receive the lower end of the core barrel 7. Above the socket provided to receive the core barrel the inner portion of the head is beveled outwardly at 8 and longitudinal passages 9 thru the head allow for the discharge of flushing fluid onto the forward ends of the cutting blades.

The lower section 1 of the drill stem has, at a point suitably spaced from the lower end, a coupling 10. An inner bushing 11 is screwed within the meeting ends of the pipe at this point to provide a somewhat constricted passage 12 of sufficient size to make a close sliding contact with the core barrel which is adapted to pass there-thru. The upper and lower ends of the bushing 11 are tapered, as shown at 13, to guide the parts of the core barrel into the passage 12.

Above the coupling 10 the sections of the drill stem are provided at intervals with tool joints 14, said tool joints having the passage 15 therethru of sufficient size to allow the movement there-thru of the core barrel. The upper end of the drill stem is of ordinary construction but I contemplate in the taking of the core that I may mount upon the drill stem at its upper end a special coupling member or bushing 15', adapted to fit within the tapered seat 16 in the casing head 17. It is to be understood that this coupling member will have to be mounted upon the drill stem when the core barrel is to be removed. In place of this particular coupling a special packing member may be inserted between the drill stem and the casing head to form therewith a fluid tight closure about the drill stem as is necessary in the removing of the core barrel, as will be later noted.

The core barrel comprises a lower section 18, which is formed with a downwardly tapered bevel at 19 to fit against the shoulder 6 in the head of the bit. This core barrel will be of sufficient length to receive a sample of the desired length

in the use of the device. The upper end of the barrel is provided with an inwardly extending flange 20 to engage over a radial flange 21 upon a head 22. Below the said head a transverse partition 23 is provided in the barrel, said partition being rigidly mounted in the barrel by welding or by means of set screws or the like. Said partition has a plurality of longitudinal openings 24 therein to allow the passage of fluid. The said openings are normally closed at their upper ends by means of an upwardly opening valve 25. Said valve has a downwardly extending stem 26 which serves to guide the valve and to limit its upward movement. Above the valve is a compression spring 27, which bears against the lower end of the head 22 and tends to normally hold the flange 21 against the flange 20.

The head 22 is a tubular member and between its ends is formed an enlarged portion 28, the outer periphery of which is cylindrical at 29 and adapted to fit closely within the passage 12 thru the bushing 11. Above the enlarged portion the head is provided with radial openings 30, leading to the central passage 31 in the head, so as to allow an outlet for liquid therethru. The upper end of the head is enlarged and threaded to engage with the upper section 32 of the core barrel. Said upper section 32 of the barrel is extended a sufficient distance to reach from one tool joint to another within the drill stem, it being desired that some portion of the outer surface of the core barrel shall be extending thru one tool joint in the drill stem at all times.

The upper end of the extension 32 is closed by a guide plug 33, which is tapered upwardly and has longitudinal passages 34 therein for fluid. These passages are closed at the lower end of said plug within the barrel by a valve plate 35 held normally in closed position by a spring 36 upon a stationary stem 37, secured within the plug.

I contemplate the use with the core barrel 18 of a core-engaging member 38 at the lower end thereof and this core engaging member may be of any desired construction. I have shown a plurality of spring arms mounted in recesses on the inner surface of the core barrel and adapted to move inwardly at the upper ends to engage the core. These core-engaging members serve also to support a pilot or guide member 39 while the device is going into the hole. Said pilot or guide may be a plug of wood or other light material tapered at the lower end, the upper end being cylindrical and adapted to engage with the spring arms 38 of the core-engaging device and be thus held in position, preventing the entrance of mud or other foreign material to the core barrel, while it is being inserted into the hole. Said plug may be moved upwardly ahead of the core, however, thru the pressure of the core as it is formed.

In the operation of the device the core drill may be operated without the use of the core barrel, if desired. When it is desired to take a core, however, the core bit will be raised from the bottom of the hole and flushed free of any material which may be therein during the drilling of the hole. After being thus cleared of material and the bottom of the hole being washed clean the bit will be lowered to position at the bottom of the hole and the core barrel assembled as shown in the drawing will be inserted into the upper end of the drill stem and the flushing fluid will then be pumped downwardly to force the core barrel into position at the bottom of the hole. As the core barrel moves downwardly thru the drill stem the spring 27 will hold the core barrel 18 and the head

22 in extended position with the flanges 20 and 21 in engagement. When the device reaches the bottom of the hole and the tapered end 19 engages upon the shoulder 6 in the drill, the enlarged portion 28 of the head 22 will be in position midway of the bushing 11 and the circulation of the flushing fluid will be shut off. The pressure of the flushing fluid upon the upper end of the section 32 will be sufficient to force the upper end downwardly, carrying the head 22 therewith, compressing the spring 27 and moving the enlarged portion 28 of the head downwardly to open the passage 12 thru the bushing 11, and thus permitting the flushing fluid within the section 32 of the core barrel to pass out thru the openings 30 and from there thru the passage 12 to the lower end of the drill stem.

The pressure of the flushing fluid will hold the upper end downwardly against the action of the spring 27 during the cutting of the core and the pressure of the flushing fluid will thus hold the core barrel 18 firmly in position within the core drill while the core is being taken.

When a sufficient sample has been obtained the drilling will be stopped and some means, such as the bushing 15', may be mounted upon the drill stem and employed to close the space between the casing head and the drill stem. The connections with the pump may then be changed so as to force the flushing fluid inwardly thru one of the inlet ports 40, and the upper end of the drill stem will be arranged to allow the discharge therethru of the flushing fluid. The passage of the flushing fluid downwardly in the well will discharge upwardly thru the drill stem. The drill stem may be slightly raised to break off the core at the lower end and if necessary the drill may be bumped against the bottom of the hole to loosen the core and core barrel, so that the force of the flushing fluid will move the core barrel and the core upwardly thru the drill stem to the upper end. The full force of the pump may be exerted against the lower end of the core barrel and the core, due to the fact that the core barrel fits fairly close within the passage thru the tool joints and one portion at least of the barrel will be extending thru one of the tool joints at all times. The core barrel and its load will thus be forced upwardly thru the drill stem and discharged at the upper end for examination. When the core barrel has been thus removed the drill may proceed as before or the core barrel may be emptied and again pumped to the bottom of the hole ready for the taking of another core. When the circulation is reversed the connections at the upper end of the well will, of course, have to be again changed to the usual and ordinary type of installation.

The advantages of this construction will be clear from the description which has been given. The core barrel is adapted to receive the core in the same manner as with the usual core barrel. The fluid, if any, which accumulates above the core while it is being taken, may pass upwardly past the valve 25 and from thence to the outside of the core barrel. Also it is to be noted that the driller will receive an indication of the arrival of the core barrel into its seat in the core drill, by the fact that the circulation will be momentarily cut off when the head 22 arrives at its position, choking the passage 12 thru the bushing 11. The continued circulation of the flushing fluid will build up the pressure above the core barrel and telescope the head within the lower section thereof and the circulation will again proceed. When the driller thus notices that the core barrel is in

position he will be enabled to start rotating so as to cut the core.

When the core barrel is removed to the surface thru the force of the current of the flushing fluid the pressure of the fluid below the core will assist in retaining the same within the core barrel and the sample will be discharged at the surface in the same condition as it was at the bottom of the hole. I am thus enabled to obtain a sample of the formation without removing the drill stem and without the wasting of any material amount of time in obtaining the sample. The device is adapted to be quickly inserted into position to take a core and the core may be thereafter removed with very slight loss of time in the drilling of the well. No cables or latching means or other complicated apparatus are required in the operation of my device and there is very little wear upon the apparatus and little danger of damage to the drilling apparatus during the obtaining of the sample.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a core drill, a drill bit having a seat therein to receive a core barrel, a drill stem thereon having constricted passages therethru, in combination with a core barrel assembly adapted to move freely in said drill stem from one end to the other thereof, and to fit upon said seat and to be moved in either direction in said drill stem by fluid pressure.

2. In a core drill, a drill bit having a seat therein to receive a core barrel, a drill stem thereon in combination with a core barrel assembly adapted to move freely in said drill stem from one end to the other thereof, and to fit upon said seat and to be moved in either direction in said drill stem by fluid pressure.

3. In a core drill, a drill bit having a seat therein to receive a core barrel, a drill stem thereon, tool joints in said drill stem, in combination with a core barrel assembly adapted to move freely in said drill stem from one end to the other thereof, and to fit upon said seat and to be moved in either direction in said drill stem by fluid pressure, said assembly being of a length equal to at least the distance between said tool joints.

4. In a core drill, a drill bit having a seat, a drill stem thereon, a core barrel adapted to move longitudinally of said drill stem from one end to the other thereof and shaped to fit within a seat in said drill bit, and fluid pressure operated means to move said core barrel upwardly from said drill bit thru said drill stem.

5. In a core drill, a drill bit having a seat, a drill stem thereon, a core barrel adapted to move longitudinally of said drill stem from one end to the other thereof and shaped to fit within the seat in said drill bit, a casing, and connections on said casing for circulation of fluid in either direction thru said drill stem to move said core barrel to and from position in said drill bit.

6. In a core drill, a drill bit having a seat, a drill stem thereon, a core barrel adapted to move longitudinally of said drill stem and shaped to fit within the seat in said drill bit, a casing through which fluid may circulate and thru said drill stem in either direction to move said core barrel to and from position in said drill bit, and means responsive to the circulation of said fluid to indicate when said core barrel has reached its seat in said drill bit.

7. In a core drill having a seat, a drill bit, a drill stem connected therewith, a core barrel adapted to move longitudinally in said drill stem and seat

in said drill, said drill stem being connected to circulate flushing fluid to move said core barrel to said seat in said drill, and means to temporarily cut off circulation of said flushing fluid when said barrel is moved downwardly into contact with said seat.

8. In a core drill, a drill bit having a seat, a drill stem connected therewith, a core barrel adapted to move longitudinally in said drill stem and seat in said drill bit, said drill stem being connected to circulate flushing fluid to move said core barrel to said seat in said drill bit, and means to temporarily cut off circulation of said flushing fluid when said barrel is moved downwardly into contact with said seat, said circulation being again opened thru the pump pressure upon said flushing fluid.

9. In a core drill, a core bit, a drill stem connected therewith, a core barrel movable freely in said drill stem, a seat for said barrel in said drill, said drill stem having a constricted passage above said drill, means on said core barrel engaging in said passage to close the same when said core barrel moves into said seat, said means being adapted to move to open said passage responsive to fluid pressure.

10. In a core drill, a core bit, a drill stem connected therewith, a core barrel movable freely in said drill stem, a seat for said barrel in said bit, said drill stem having a constricted passage above said drill, means on said core barrel engaging in said passage to close the same when said core barrel moves into said seat, a telescopic joint in said barrel below said means adapted to allow said means to move downwardly to open said passage.

11. In the recovery of cores from well drills, the improvement comprising pumping the core barrel downwardly to engage the well drill and take a core and then causing a reverse liquid circulation to move said core barrel back to the surface with said core.

12. In the recovery of cores from well drills the method of placing the drill upon the well bottom, causing the flight of the core barrel to said drill to receive the core, and causing a liquid circulation to return said core barrel to the surface.

13. A core drill, a drill stem attached thereto, a seat in said drill within said drill stem, and a core barrel in said drill stem movable to and from the well surface to said seat by the circulation of liquid in said drill stem.

14. A core drill, a drill stem attached thereto, said drill stem and drill being arranged to permit the circulation of flushing fluid in either direction, tool joints in said stem, a seat in said drill within said drill stem, and a core barrel in said drill stem movable the full length thereof to and from said seat by the circulation of liquid in said drill stem.

15. In a core drill having a drill stem thereon, the combination of a core tube actuated in movement in either direction in said drill stem the full length thereof by the circulation of liquid in said drill stem, said circulation acting also to assist in the drilling of the well.

16. In a core drill, a drill stem adapted to rotate while liquid is circulated therethrough, and a core-containing tube movable by fluid pressure in said drill stem to and from the lower and upper ends of said drill stem while said drill stem is being rotated.

17. In a core drill, a tubular drill stem, a coring bit at its lower end, and an inner tube slid-

ably actuated in flight by means of fluid circulation through said tubular drill stem in both directions the full length of said stem.

18. In the recovery of cores from a well, a core cutting means, a drill pipe, an inner core receiving tube, means for placing said inner core receiving tube in position for receiving core at the bottom of the well, said core-receiving tube being movable from the cutting means to the upper end of said pipe responsive to fluid circulation.

19. In a core drilling device for use in a well for retrieving core samples without removing drill pipe, an inner tube movable within the drill pipe from end to end thereof by slush circulation and while the drill pipe is being rotated.

20. In combination with a drill socket member, a drilling pipe extending upwardly therefrom, and a core cutting bit in the socket; of a core receiver adapted to be lowered through said pipe into said socket member and in register with the bit, and means whereby the core receiver may be pumped up to the top of the bore with the core enclosed in it.

21. In combination with a drill socket member, a drilling pipe extending upwardly therefrom, and a core cutting bit in the socket; of a core receiver adapted to be lowered through said pipe into said socket member and in register with the bit, and means whereby the core receiver may be pumped up to the top of the bore with the core enclosed in it, said means comprising a plunger fitting the drilling pipe above the receiver.

22. In combination with a drill socket member, a drilling pipe extending upwardly therefrom, and a core cutting bit in the socket; of a core receiver adapted to be lowered through said pipe into said socket member and in register with the bit, and means whereby the core receiver may be pumped up to the top of the bore with the core enclosed in it, said means comprising a plunger fitting the drilling pipe above the receiver, and means whereby said plunger will yield downwardly to pass water downwardly through the drilling pipe to the socket member and bit.

23. A core drill, a core barrel adapted to fit within said drill, a drill stem on said drill, said core barrel shaped to move freely in said drill stem from end to end thereof and arranged to be moved by hydraulic pressure in both directions in said drill stem, and a seat in said drill to limit the downward movement of said barrel.

24. In a core drill a jointed drill stem having constrictions therein at said joints, an inner tube slidable longitudinally of said drill stem and through said constrictions the full length of said drill stem, the said inner tube being longer than the distance between said constrictions whereby fluid may act on said tube to move the same longitudinally of said drill stem.

25. In a core drill, a drill pipe, a drill bit thereon, and a core receiving tube within said pipe, said tube being movable by fluid circulation from said drill bit to the upper end of said drill pipe, said drill bit limiting the movement of said tube in a downward direction.

26. In a core drilling device for use in deep wells, an inner tube for retrieving core samples without removing the drill pipe from the well, said tube being movable upwardly in said drill pipe responsive to fluid circulation in the well bore.

27. 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, of a core barrel movable downwardly in said drill stem and into a core receiving position adjacent said bit; means to hold said core barrel in said position; 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.

28. 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, of a core barrel movable downwardly in said drill stem and into a core receiving position adjacent said bit; means to hold said core barrel in said position; 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 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.

29. The combination with a drill stem and a bit secured to the lower end of said drill stem, of a core barrel movable downwardly in said drill stem and into a core receiving position adjacent said bit; means to hold said core barrel in said position; said core barrel having a core receiving chamber and a fluid chamber above and separated from 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.

30. The combination with a drill stem having a bit secured to the lower end thereof, of a core barrel movable downwardly in said drill stem into a core receiving position adjacent said bit and means to permit the passage of fluid downwardly through said drill stem past said core barrel and to prevent the passage of fluid upwardly through said drill stem past said core barrel so that fluid may be pumped downwardly through said drill stem during drilling operations and said core barrel may be pumped upwardly through said drill stem.

31. The combination with a drill stem, of a core barrel movable downwardly in said drill stem into a core receiving position, and means to permit the passage of fluid downwardly through said drill stem past said core barrel and to prevent the passage of fluid upwardly through said drill stem past said core barrel so that fluid may be pumped through said drill stem during drilling operations and said core barrel may be pumped upwardly through said drill stem.

32. The combination with drill stem, of a core-receiving instrument movable downwardly in said drill stem into a core-receiving position and means to permit the passage of fluid downwardly through said drill stem past said instrument and to prevent the passage of fluid upwardly through said drill stem past said instrument so that fluid may be pumped through said drill stem during drilling operations and said instrument may be pumped upwardly through said drill stem.

33. 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 interrupting the flow of fluid upon said upward movement of the core barrel.

34. In drilling wells by the rotary method, the method of operation including the steps of introducing a core-receiving instrument into the upper end of the drill stem and moving it downwardly to operative position at the lower end of said drill stem by fluid circulation, operating said drill stem to take a sample into said instrument of the formation being drilled, and then reversing the fluid circulation and forcing said instrument with said core back through the drill stem to the surface.

35. In drilling wells by the rotary method, the method of operation including the steps of introducing a core-taking instrument into the upper end of the drill stem and causing said instrument to move downwardly to operative position at the lower end of said drill stem, operating to take into said instrument a core of the formation being drilled, and then reversing the fluid circulation and employing said circulation to force said instrument with said core back through the drill stem to the surface.

36. The method of placing a core barrel in and removing the same from a tubular drill stem in

the taking of an earth sample, which comprises pumping mud into the drill stem behind the core barrel to force the same into working position in the lower end of the stem, and pumping mud into the lower end of the stem from the outside of the latter and beneath the core barrel to effect the movement upwardly of the latter after an earth core has been taken thereby.

37. The herein described method of core drilling wells which consists in feeding a cutting element into the formation being encountered so as to define a core; feeding a core retainer in consonance with the advance of the cutting element to cause the newly formed core to be received within the core retainer; furnishing a circulating pressure fluid to the immediate region of the cut being made to carry off the newly created cuttings and then upon congestion within the core retainer or the filling of the core retainer causing a substantial and noticeable variation in the pressure of such fluid so that the core drilling may be temporarily halted for the removal of the core retainer.

38. In well drilling apparatus including a tubular drill stem and bit, an earth core taking device comprising an elongated tubular body open at one end, a valve controlled opening at the other end of the body, said body being movable from the surface through the stem with the open end thereof disposed in the lower part of the tubular bit, plug means connected with the upper end of the tubular body, and means facilitating the pumping of fluid into the stem beneath the plug means to effect raising of the tube to the surface.

39. In the recovery of cores from well drills, the method which comprises, causing the flight of the core barrel into the said drill to receive the core, and causing a liquid circulation to return said core barrel to the top of the well.

40. In a core drilling assembly, a drill stem, a drill bit thereon, a core barrel including a lower core receiving section to seat adjacent said bit, an upper section mounted thereon, and interfitting means in said drill stem and on said upper section to cut off the flow of liquid through said stem when interfitting, said upper section on said core barrel being movably mounted on said lower section to slide out of interfitting position where-by circulation is re-established.

41. In a core drilling assembly, a drill stem, a drill bit thereon, a core barrel including a lower core receiving section to seat adjacent said bit, an upper section mounted thereon, interfitting means in said drill stem and on said upper section to cut off the flow of liquid through said stem when interfitting, and said upper section on said core barrel being movably mounted on said lower section to slide out of interfitting position whereby circulation is re-established, said upper section having a liquid passage there-through.

42. In a core drill assembly including a drill stem, a drill bit, a core barrel movable in said stem to seat adjacent said bit, a head on said core barrel, an area in said stem to receive said head, and spring means in said barrel supporting said head but yieldable to allow movement of said head to a position below said area in response to liquid pressure through said drill stem upon said head.

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