Sept. 12, 1944. R. A. PHILLIPS 2,357,907

RETRACTABLE CORE TAKING DEVICE

Filed May 6, 1940

FIG. 1.

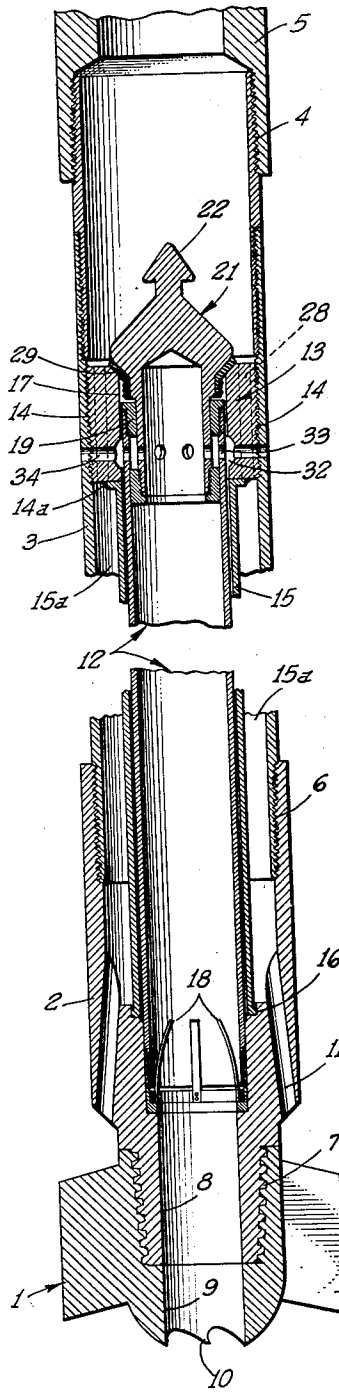


FIG. 2.

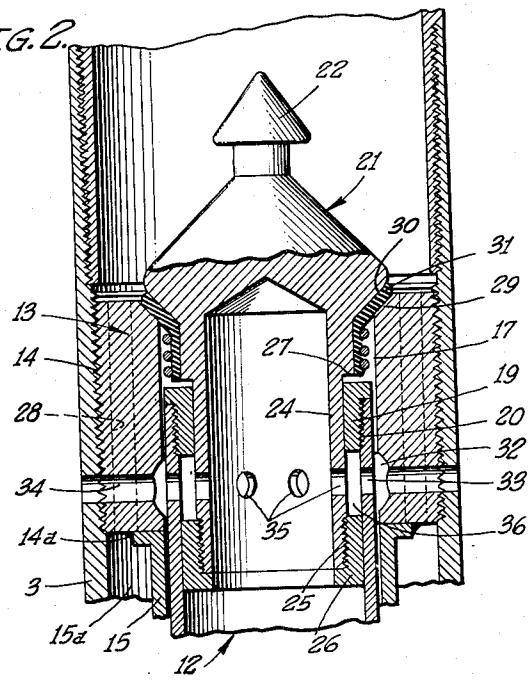
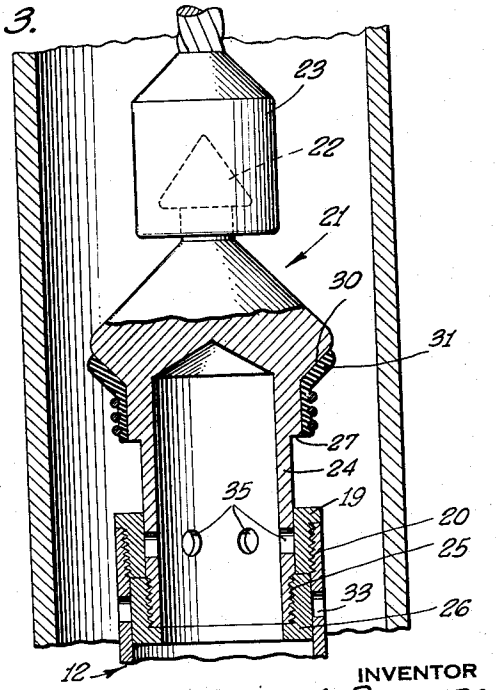


FIG. 3.



INVENTOR
RALPH A. PHILLIPS.
BY Harold W. Mattingly
ATTORNEY.

Patented Sept. 12, 1944 2,357,907

UNITED STATES PATENT OFFICE

2,357,907

RETRACTABLE CORE TAKING DEVICE

Ralph A. Phillips, Hawthorne, Calif., assignor of one-half to Mort L. Clopton, Los Angeles County, Calif.

Application May 6, 1940, Serial No. 333,549

4 Claims. (Cl. 255—72)

My invention relates to a well drilling apparatus and has particular reference to a core taking device of the retractable type.

In the drilling of deep wells, such as oil wells, it is common practice to take samples or cores of the formation through which the well is being drilled, these samples being taken at periodic intervals to permit the obtaining of the geological data necessary to the proper drilling of the well. These cores may vary in length from one or two feet up to ten or fifteen feet and must be removed from the well after the desired length of core has been cut. Inasmuch as present day well drilling bits are capable of drilling many more feet of hole than is represented by the length of one of these cores before the bit becomes sufficiently dulled to merit its removal from the bore, it is highly desirable that the core which has been cut be removed from the well in such manner as to obviate the necessity of also removing the drilling bit.

There has accordingly been developed a number of core taking devices which are known as the retractable type and which comprise a core barrel adapted to be held in cooperative relation with a standard coring bit and which are also adapted to be removed from the well upwardly through the interior of the drill pipe by means of a wire line. The coring aperture which is provided in the coring bit may be filled with an auxiliary cutting tool during such times as a core is not being taken. Both the auxiliary cutting device and the retractable core barrel are adapted to be inserted into the bit and removed therefrom by means of a wire line extended from the ground surface through the interior of the drill string.

These retractable devices must, during the time they are placed in operative relation with the bit, be held against upward movement relative to the bit and for this purpose it has been the common practice to employ mechanical latching devices. These devices have not been entirely satisfactory for the reason that the latch parts wear with use and for the further reason that these devices must operate while they are surrounded by a drilling fluid, such as oil well mud, and this fluid tends to impair the movement of the parts and to inhibit their operation.

It is also necessary that the fluid which is contained within the retractable core barrel be permitted to escape from the core barrel as the core which is being cut is gradually projected into the barrel. Passage of drilling fluid into and downwardly through the core barrel must, however, be prevented both during the time the core is being cut and also during the time the core barrel, together with the core contained therein is being hoisted to the ground surface for the reason that such flow of fluid through the core barrel rapidly washes and erodes away the core which has been cut so that by the time the core barrel is removed to the ground surface the core is so badly eroded as to be substantially worthless.

It is therefore an object of my invention to provide a retractable core taking device which overcomes the above noted disadvantages.

It is also an object of my invention to provide a retractable core taking device which includes a means responsive to flow of fluid in a string of drill pipe for securing a core barrel portion against upward movement relative to a core taking bit.

It is a still further object of my invention to provide a retractable core taking apparatus of the character set forth in the preceding paragraph which includes a means for producing a fluid pressure differential tending to hold the core barrel down, thus avoiding the use of mechanical latching devices.

It is an additional object of my invention to provide a retractable core taking device of the character set forth hereinbefore which includes a means for establishing a fluid interconnection between the interior of a retractable core barrel and the exterior of the drill string to permit fluid within the barrel to be displaced by the reception within the barrel of a core being taken.

It is also an object of my invention to provide an apparatus of the character set forth hereinbefore which includes a valve means responsive to a lifting of the core barrel for closing off the fluid interconnection and prevent drilling fluid from washing through the barrel during the time the barrel is being hoisted to the ground surface.

Other objects and advantages of my invention will be apparent from a study of the following specifications, read in connection with the accompanying drawing, wherein:

Fig. 1 is a longitudinal sectional view of one form of retractable core taking device of my invention showing the positions occupied by the various parts during the time a retractable core barrel is mounted in operative relation with a coring bit;

Fig. 2 is an enlarged sectional view of the apparatus illustrated in the upper half of Fig. 1; and

Fig. 3 is a sectional view similar to Fig. 2 but illustrating the relative positions of the parts during the time the retractable core barrel is being hoisted to the ground surface.

Referring to the drawing, I have illustrated in Fig. 1 the preferred embodiment of my invention as including a coring bit head 1 which may be attached by means of an adaptor 2 to an outer barrel 3, which outer barrel is adapted to house the various instrumentalities comprising the retractable core taking device of my invention and at the same time serve as a means for rotating the bit head 1 for the purpose of drilling the well bore. The outer barrel 3 is accordingly provided at its upper end with screw threads 4 to which may be attached one half 5 of a standard tool joint to permit connection of the outer barrel 3 to a standard string of drill pipe. The adaptor 2 may be secured to the lower end of the working barrel 3 as by means of screw threads 6 and the bit head 1 may be secured to the lower end of the adaptor 2 as by means of threads 7. The adaptor 2 and the bit head 1 are each provided with aligned core receiving apertures 8 and 9, the aperture 9 in the bit head 1 being surrounded by cutting elements 10 and 11 which operate to drill the well bore as the bit 1 is rotated. Lubrication of the cutting elements 10 and 11 during the drilling operation may be obtained by providing a plurality of jet-like wash openings 11*a* which are extended through the adaptor 2 in such direction as to supply drilling fluid from the interior of the outer barrel 3 to each of the aforementioned cutting elements.

As drilling progresses the formation through which the bore is being extended is cut away in an annular fashion to leave a central bore which is extended upwardly through the bores 8 and 9. I prefer to removably support an inner retractable core barrel 12 above the adaptor 2 in a position axially aligned with the core receiving bores 8 and 9 so that as the drilling progresses the core which is cut by the bit head 1 will be received within the inner core barrel 12. The inner core barrel 12 may be supported in such position by providing a spider 13 which is secured in the upper end of the outer barrel 3 as by means of screw threads 14, the spider 13 having secured to its under side, as by welding 14*a*, a downwardly extending sleeve 15, the lower end of which is held in axial alignment with the adaptor 2 as by engaging the lower end of the sleeve 15 with an annular recess 16 formed in the upper surface of the adaptor 2. The exterior diameter of the sleeve 15 is made somewhat smaller than the interior diameter of the outer barrel 3 so as to provide an annular circulating passage 15*a* to serve as a conduit for drilling fluid. The spider 13 is provided with a central bore 17 which forms a continuation of the interior of the sleeve 15 so that the inner core barrel 12 may be inserted into the interior of the sleeve 15 from above through the opening 17.

The inner core barrel 12 preferably carries at its lower end a core catcher 18 by means of which the core may be broken from the formation and raised to the ground surface at the time the core barrel 12 is hoisted to the ground surface. Provision for hoisting the inner core barrel 12 may readily be made by means of a construction such as that illustrated in Fig. 2. As shown therein the upper end of the inner core barrel 12 is fitted with a bushing 19 which may be threadedly engaged with the upper end of the core barrel 12 as by means of screw threads 20. The bushing 19 is provided with an internal bore adapted to receive a lifting member 21 which carries on its upper end a head 22 adapted to be received within and engaged by an overshot 23 which may be lowered through the interior of the drill string.

The lifting member 21 is preferably provided with a downwardly depending tubular portion 24 having an outside diameter of such size as to be slidably received within the interior of the bushing 19. The lower end of the tubular portion 24 may be threaded as indicated at 25 and have affixed thereto a lower bushing member 26 which has an outside diameter of such size as to be slidably received within the interior of the core barrel 12. It will thus be seen that a lifting force applied to the lifting member 21 will operate to slide the sleeve portion 24 upwardly relative to the core barrel 12 until the lower bushing member 26 engages the upper bushing member 19, at which time the lifting force will be transmitted to the core barrel 12 so as to move it upwardly out of the sleeve 15.

It is necessary that the core barrel 12 be held against upward movement during the time drilling operations are being performed for the purpose of taking a core. I accordingly provide a shoulder 27 on the lifting member 21 which extends radially outward over the top of the bushing 19 so as to prevent upward movement of the core barrel 12 relative to the lifting member 21. In order that a fluid pressure differential may be developed by the flow of drilling fluid through the interior of the outer barrel 3 for the purpose of holding the lifting member 21 down, I provide a plurality of circulating passages 28 which extend longitudinally through the spider 13. The cross sectional area of these passages is so adjusted as to provide for a considerable pressure drop along their length so that the fluid pressure exerted on the upper surface of the spider 13 is considerably greater than the fluid pressure exerted on the lower surface of this spider.

This pressure differential may be employed for holding the lifting member 21 down against the spider 13 by providing in the upper surface of the spider 13 a conical seat 29 adapted to be engaged by a similarly shaped conical portion 30 of the lifting member 21. Suitable packing 31 may be interposed between the conical portion 30 and the seat 29 to provide a fluid seal at this point. It will be observed that since the fluid pressure above the spider 13 is greater than the pressure below the spider and also greater than the fluid pressure within the core barrel 12, the differential in pressure will operate to hold the lifting member 21 down into secure engagement with the top of the spider 13 so as to in turn hold the core barrel 12 in its lowermost position during the time the drilling operation is being performed.

As has been mentioned hereinbefore, it is necessary that any drilling fluid which is contained within the core barrel 12 be displaced therefrom as the core which is cut is gradually projected into the core barrel. For this purpose an annular recess 32 may be provided extending circumferentially around the bore 17 through the spider 13 in such vertical location as to register with a plurality of ports or apertures 33 provided in the upper end of the core barrel 12 when the core barrel 12 is placed in its lowermost position. One or more discharge ports 34 are preferably extended between the recess 33 and the exterior of the outer barrel 3 so as to permit any

fluid which is passed through the ports 33 and into the annular recess 32 to be discharged to the exterior of the barrel 3.

Fluid interconnection between the interior of the core barrel 12 and the recess 32 may be obtained by providing a plurality of ports or openings 35 through the tubular portion 24 of the lifting member, these openings being so positioned as to lie in substantially the same horizontal plane as that occupied by the openings 33 when the core barrel 12 and the lifting member 21 are disposed in their lowermost positions, respectively. This relative positioning of parts is illustrated in Fig. 2 wherein it will be readily observed that any fluid which is contained within the core barrel 12 and which is displaced by the projection of a core into the core barrel will flow outwardly through the openings 35 and 33 into the annular recess 32 and be conducted from there through the passages 34 to the exterior of the outer barrel 3.

This structure provides for the displacement of the fluid contained within the core barrel 12 without permitting circulating fluid to be washed downwardly through the core barrel. It is necessary that this washing of the fluid downwardly through the core barrel be prevented also during the time the core barrel is being hoisted to the ground surface. For this purpose each of the bushings 19 and 26 is preferably made with an axial length greater than the diameter of the openings 33 and 35 and the length of the tubular portion 24 is so adjusted as to provide an annular space 36 between the lower edge of the bushing 19 and the upper edge of the bushing 26 which is approximately equal in length to the axial length of the bushings. This construction provides for the closing of the openings 35 and 33 during the time the core barrel 12 is being hoisted to the ground surface for the reason that the application of a lifting force to the lifting member 21 first operates to move the lifting member 21 upwardly relative to the core barrel 12 so as to bring the bushing 26 into engagement with the bushing 19 so as to transmit the lifting force to the core barrel 12.

The relative positions occupied by the parts at this time is illustrated in Fig. 3 wherein it will be observed that the openings 35 have been moved upwardly relative to the bushing 19 to a position such that the bushing 19 closes these openings. Similarly, the bushing 26 has been moved upwardly relative to the openings 33 to such a point that the bushing 26 closes the openings 33. It will thus be seen that the fluid interconnection which is provided from the interior of the core barrel 12 through the openings 33 and 35 during the time the core barrel 12 is in its lowermost or core taking position is closed during the time the core barrel is being hoisted to the ground surface to thus prevent any washing of the drilling fluid downwardly through the core barrel.

From the foregoing it will be observed that I have provided a core taking device of the retractable type which is adapted to be removably positioned in operative relation with a core taking bit and held in that operative position during the taking of a core through use of the pressure of the drilling fluid which is circulated through the drill string during a drilling operation.

It will be furthermore observed that the device of my invention provides for the ready discharge from the core barrel of any drilling fluid which may be trapped between the upper end of a core being cut and the closed upper end of the core barrel and that this discharge of drilling fluid is accomplished without subjecting the core which is being taken to any washing action by virtue of drilling fluid flowing downwardly through the core barrel.

It will also be observed that the above described device of my invention provides for the complete sealing off of the core barrel during the time the barrel is being hoisted to the ground surface to prevent any drilling fluid from entering the upper end of the core barrel and flowing downwardly alongside of the core so as to prevent any washing of the core during the time the core taking device is being hoisted to the ground surface.

While I have shown and described the preferred embodiment of my invention, I do not desire to be limited to any of the details of construction shown or described herein, except as defined in the appended claims.

I claim:

1. In a retractable core taking device, the combination of: a retractable core barrel having an open upper end and an aperture near said upper end extending between the exterior and the interior of said barrel; a core barrel bushing carried by the upper end of said core barrel having an opening therethrough of a diameter smaller than the diameter of said core barrel; a lifting member for connection to a hoisting device including a downwardly extending sleeve portion having a closed upper end and slidably received in said opening for movement between a raised and a lowered position, said sleeve portion having an aperture extending between the interior and the exterior thereof disposed in such location as to be aligned with the aperture in said core barrel member when said sleeve portion is in its lower position; and an exterior bushing carried on the lower end of said sleeve portion having an exterior diameter substantially equal to the interior diameter of said core barrel, said apertures and said bushings being so located relative to each other as to permit said core barrel bushing to close the aperture in said sleeve portion and said exterior bushing to close the aperture in said core barrel, whereby fluid communication between the exterior and interior of said core barrel is closed off by raising said lifting member to its upper position.

2. In a retractable core taking apparatus for attachment to the lower end of a string of drill pipe adapted to supply a drilling fluid to a coring bit carried on the lower end thereof, the combination of: an outer barrel interposed between said drill string and said coring bit; a retractable core receiving barrel having a closed upper end and having a laterally extending opening formed near its upper end, said core receiving barrel being movable through said drill string from the ground surface to a position adjacent said bit aligned with a coring aperture therein; means defining a wash passage outside said core receiving barrel and within said outer barrel; support means carried by said outer barrel for encircling the upper end of said core barrel at a point near said opening to hold said core barrel in said position; and conduit means extended laterally through said support and said outer barrel in such position as to establish a fluid interconnection between said opening and the exterior of said outer barrel wholly isolated from said wash passage, whereby fluid displaced by

the projection of a core into said core barrel is conducted to the exterior of said outer barrel.

3. In a retractable core taking apparatus for attachment to the lower end of a string of drill pipe adapted to supply a drilling fluid to a coring bit carried on the lower end thereof, the combination of: an outer barrel interposed between said drill string and said coring bit; a retractable core receiving barrel having a laterally extending bleeder port formed near the upper end thereof, said core receiving barrel being movable through said drill string from the ground surface to a position adjacent said bit aligned with a coring aperture therein; means defining a wash passage outside said core receiving barrel and within said outer barrel; inwardly extending flange means carried by said outer barrel and having an opening for receiving said core barrel; head means on said core barrel for closing said opening in said flange; and a conduit extended laterally through said flange means from the opening therein to the exterior of said outer barrel in such position as to establish a fluid interconnection between said bleeder port and the exterior of said outer barrel wholly isolated from said wash passage when said core barrel is moved to said position adjacent said bit, whereby fluid displaced by the projection of a core into said core barrel is conducted to the exterior of said outer barrel.

4. In a retractable core taking apparatus for attachment to the lower end of a string of drill pipe adapted to supply a drilling fluid to a coring bit carried on the lower end thereof, the combination of: an outer barrel interposed between said drill string and said coring bit; a retractable core receiving barrel having an opening near the upper end thereof and movable through said drill string to a position engaging said bit aligned with a coring aperture therein; means defining a wash passage outside said core receiving barrel and within said outer barrel; support means carried by said outer barrel for encircling the upper end of said core barrel near said opening to hold said core barrel centered in said outer barrel; head means on said core barrel for engaging said support means; coacting means on said head means and on said support means for establishing a fluid seal between said support means and said core receiving barrel; a conduit extended through said support means and through said outer barrel in such position as to establish a fluid interconnection between said opening and the exterior of said outer barrel wholly isolated from said wash passage when said core barrel is moved to said position adjacent said bit, whereby fluid displaced by the projection of a core into said core barrel is conducted to the exterior of said outer barrel; means coacting with said head means for normally closing said opening; and means responsive to engagement of said head means with said support means and engagement of said core receiving barrel with said bit for opening said opening.

RALPH A. PHILLIPS.