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WIRE LINE PRESSURE RETAINING CORE BARREL

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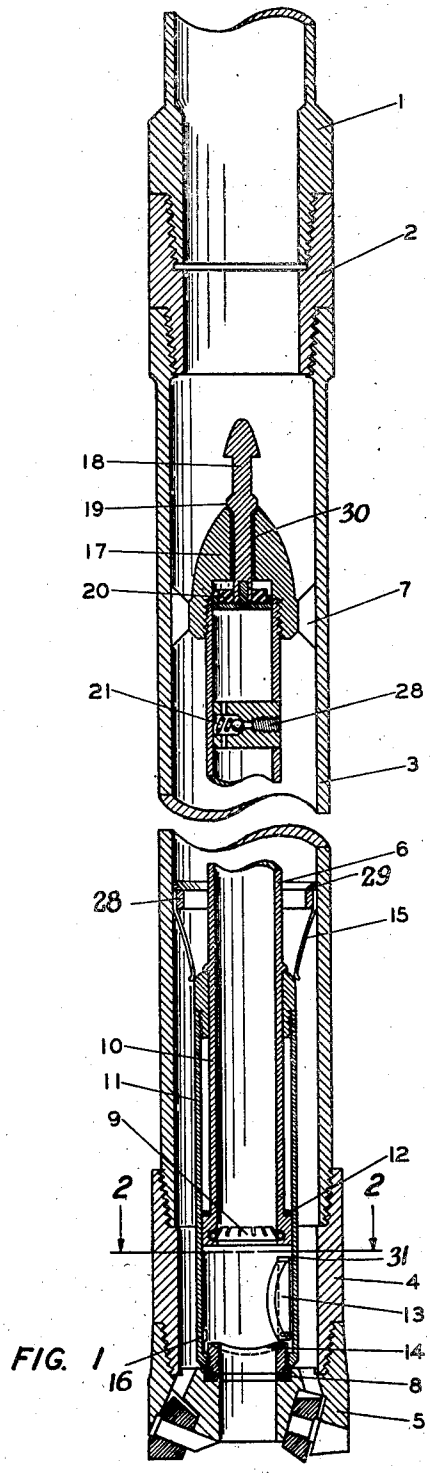

FIG. 1

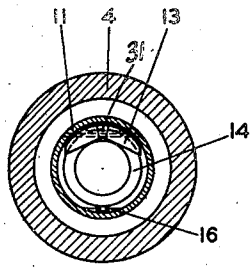

FIG. 2

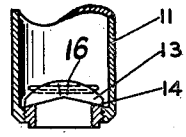

FIG. 3

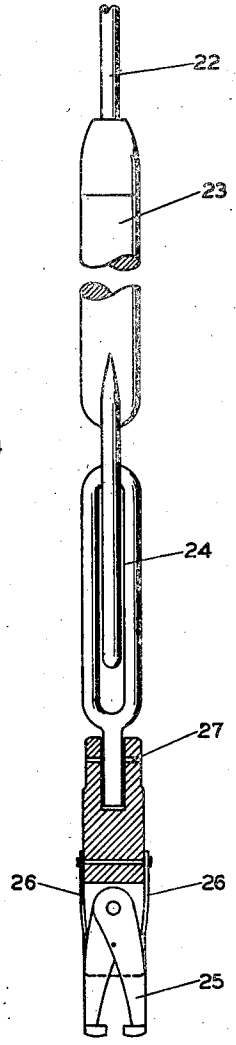

FIG. 4

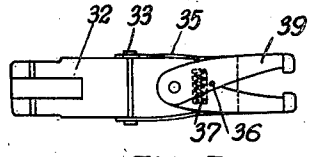

FIG. 5

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WIRE LINE PRESSURE RETAINING CORE BARREL

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10 Claims. (Cl. 255—72)

This invention relates to a device for taking core samples from drill holes in the drilling of oil wells through the drill pipe and more particularly relates to devices which will take a core under the formation pressure and retain the core under the formation pressure until brought to the surface of the ground and removed from the device.

It is the customary practice in the drilling of an oil well to take core samples from time to time as drilling proceeds to better determine the different structures through which the drilling advances and also for further knowledge as to the geological make-up of the sub-structure. When the drilling encounters a sand or lime area which gives a showing of oil or gas, it is always the practice to take a sample or samples of the structure and test these cores to determine the oil content of the structure. Other valuable data is collected from the cores and correlated which assists in the production of the well. Cores have been taken of structure passed through in drilling wells for practically as long as wells have been drilled. Coring apparatus has been developed which not only takes longitudinal cores but lateral core shooting has reached a high state of development. Up to the present time, no coring device has been developed which takes a core at the pressure which exists in the area where the core is located. This is desirable in that it gives a true picture of existing conditions in the oil well. If the well hole is bailed dry, the volatile constituents will have a chance to escape up the well bore. If the drilling mud is allowed to remain in the hole, it may exert a pressure greater than the formation exerts and some of the drilling mud may go into the formation. The desirable mode of operation is to balance the formation pressure against the pressure exerted by the drilling mud. When the pressures are equal a truly representative core may be had which will show the natural conditions in the formation.

The advantages of the present invention over known methods are many and possessed of utility. By all conventional methods of core taking, the core is raised to the surface of the ground under a diminishing pressure, until at the top of the hole the core is at atmospheric pressure only. Volatile constituents of the core's contents are thus lost, unless they happen to be stable at atmospheric pressure.

The present novel core barrel has the advantage of bringing a core up, along with all of its original contents, and at bottom hole pressure. A sample of the bottom hole fluid may also be recovered. A further advantage is the feature enabling the core barrel to be retrieved through the drill stem. By this method, no round trip with the drill pipe is necessary. Cores taken by this method will give more information concerning the structure than those taken by the usual means.

It is an object of the present invention to provide a means whereby core samples may be recovered from an underground formation under the same pressure as exists in the formation.

A further object is the removal and recovery of all materials which were in the core at the time it was drilled and a sample of the fluid present in the drilling structure.

A still further object is to provide receptacle means which are dropped down within the drill stem to receive the core being drilled, which receptacle is pressure tight during coring and after the core is in the receptacle; the receptacle is removed through the drill stem without pulling the drill stem from the hole.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing, forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a central vertical longitudinal section through the bottom of the drill stem and coring receptacle,

Figure 2 is cross-sectional view taken through the line 2—2 of Figure 1,

Figure 3 is a detailed view of the end of the receptacle showing the valve in closed position,

Figure 4 is a view partly in side elevation, partly in section, showing the fishing assembly to remove the core barrel from the drill tubing, and

Figure 5 is a view, partly in side elevation and partly in section, showing the wire line assembly to enter the core barrel into the bottom of the drill tubing.

In the drawing, wherein for the purpose of illustration is shown a preferred embodiment of our invention, the numeral 1 represents the landing sub on the end of the bottom section of the drill stem. Connected to the landing sub 1 by means of the adaptor 2 is the barrel member 3 which barrel member is approximately the same diameter as the drill stem tubing. Connected to the lower end of the barrel member 3 by means of the adaptor 4 is the core bit 5. Applicants lay no claim to novelty for the core bit 5 and it may be of conventional design or any of a number of

bits now in use for this purpose. Mounted within the outer barrel 3 and adapted to be raised or lowered therein, is the core barrel 6. The core barrel 6 is guided and supported within the barrel member 3 by the guide vanes 7 and rests on the wear ring 8 on top of the bit 5. The core barrel 6 is equipped with the conventional core catcher 9 which is a series of spring fingers which normally extend inwardly and are flexed outwardly to allow the core to pass into the core barrel. After the core is broken, the core catcher 9 holds the core within the core barrel 6.

The core barrel 6 is made in two sections 10 and 11 with the two sections telescoping. The section 11 seats against the gasket 12 when the sections are in fully extended relation. Mounted in the bottom part of the section 11 is the flap valve 13 which valve 13 folds completely out of the tube bore of the section 10 when open and seats against the curved face 14 when closed. The spring fingers 15 hold the barrel 11 down while barrel 10 is being raised to allow the core to enter the tubing 11. The spring fingers 15 are mounted on ring 28 which is rigidly secured to the tubing 3 by means of the weld 29. With the sections 10 and 11 in collapsed relation, the flap valve 12 will still open when a core is drilled, being forced open by the core entering the core barrel. When the core barrel is withdrawn from the drill stem, the section 10 is telescoped upwardly within the section 11 thus breaking off the core and drawing the same upwardly within the section 11. When the two sections are fully extended, a slight jerk on the upper section 10 will allow the lower section 11 to pass through the spring finger 15. The valve 13 is guided squarely on its seat by the taper faces 16 which tapered faces 16 mounted on the section 11 of the barrel and the valve 13 has a projection 31 which rides in the tapered faces 16 to seat the valve 13 on the surface 14, which is all clearly shown in the Figures 1, 2 and 3.

The upper end of the core barrel 6 is closed by a plug member 17 through which passes the fishing neck 18. The weight of the fishing neck seats the shoulder 19 on the top of the plug 17 and keeps the core chamber closed. When the fishing neck 18 is pulled upwardly, the gasket 20 seals off the core chamber. There is a space 30 between the fishing neck 18 and a plug member 17 which allows any gas or liquid collected in the coring chamber to pass upwardly and out of the chamber when the core enters the coring barrel. Relieving pressure in the core barrel is accomplished through the valve 21 by screwing an outlet connection into the threads 28. The outlet connection has a prong which depresses the spring loaded ball valve 21 allowing internal pressure to escape into a receiving vessel.

The fishing device employed is shown in Figure 4 and comprises a wire line 22, an inertia member 23, jars 24 and hook means 25. The hook means 25 are normally held in closed position by the leaf springs 26. When the hook means 25 contact the head portion 18, the arms spread outwardly until they have passed over the head portion and then the springs 26 make the connection secure. The core barrel 6 then is pulled upwardly through the drill tubing to the surface of the ground.

To enter the coring assembly into the drill tubing, the same wire line 22, inertia member 23 and jars 24 are used and have connected thereto the head portion 32 which is attached to the lower jar member by means of pin 33. Hook means 34 are attached to the head portion 32 and are pivoted thereon. The hook portions 34 are held in closed position by frangible pin 36 and leaf springs 35. When the core barrel is in place in the bottom of the drill stem, the wire line is pulled upwardly and the assembly is jarred sufficiently to break the frangible pin 36. When this occurs, the coil spring 37 is of sufficient strength to force the hook means 34 outwardly against the action of the leaf springs 35, and release the hook means 34 from the fishing neck 18.

In operation, the core barrel 6 is on the surface of the ground or the derrick floor. The hooks 34 on wire line 22 are hooked into the fishing neck 18 and the core barrel made ready to lower into the drill stem. The core barrel is lowered into the drill stem until it reaches the outer barrel 3. In the outer barrel 3, guides 7 tend to center the core barrel and the lower section 11 seats on the wear ring 8. By its own weight, the inner section 10 tends to telescope within the outer section 11 until the core barrel is in fully collapsed position. Spring fingers 15 contact the upper end of the lower section 11 and tend to hold the core barrel in place and prevent upward movement of the section 11 when the barrel is in collapsed position.

The core drilling is performed in the usual manner by rotating the drill stem, passing drilling fluid down through the drill stem and having the core cut by bit 5 pass up through the center of the core bit 5. The core enters the core barrel 6, thereby raising the flap valve 13 and is retained in the core barrel by the core catcher 9. As the core enters the core barrel 6, any fluid remaining in the core barrel is displaced upwardly and may escape from the barrel through the passage 30 by slightly raising the fishing neck 18. In normal or closed position the fishing neck valve prevents driling fluid from entering the core barrel and washing through.

After the core is cut, the drill stem may be swabbed, if desired, to cause a sample of the bottom hole fluid to enter the core barrel. The fishing assembly shown in Figure 4, is now run into the drill stem and the hooks 25 grasp the fishing neck 18 and the coring assembly is ready to be pulled from the drill stem. As the core barrel 6 is lifted upwardly, the fishing neck 18 is also lifted upwardly so that gasket 20 seats and closes off the interior of the core barrel. The section 10 moves with respect to the section 11 until gasket 12 seats and seals off the joint between the two sections. Continued upward movement pulls the lower section 11 through the spring fingers 15. The movement between the sections 10 and 11 is necessary so that no matter where the core breaks off, it will draw clear of the valve 13 and allow it to drop into closed position. The whole assembly now in extended relation is pulled upwardly and removed from the drill stem. After relieving the pressure through valve 21 as previously described, plug 17 is removed and the core is taken from the core barrel.

It is to be understood that the form of our invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of our invention, or the scope of the subjoined claims.

Having thus described our invention, we claim:

1. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation, comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal

drilling operations, a seat on the lower end of the drill tubing to support the barrel, a bit having a passage in the center thereof attached to the end of the drill tubing to cut the core, the core when cut passing upwardly through the passage in the bit and into the lower end of the barrel member, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed, valve means in the upper and lower portions of the barrel, the upper valve means being opened during coring by gas pressure and the lower valve being opened by the core entering the barrel, the upper valve closing by upward movement thereof relative to the barrel and said lower valve closing in response to the upward movement of the barrel member to make the barrel pressure tight.

2. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operation, said barrel member being made in sections to telescope one within the other, a seat in the lower end of the drill tubing to support the barrel, the telescoping sections of the barrel being completely telescoped when the barrel is seated in the drill tubing, a bit attached to the end of the drill tubing to cut the core having a passage in the center thereof, the core when cut passing upwardly through the passage in the bit into the upper telescoped section of the barrel member, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed, the upper telescoped section of the barrel having a core catcher and moving upwardly within the lower section upon an upward pull of the lifting means thus breaking off the core from the formation and means in the barrel responsive to the upward pull of the lifting means and independent of the drill tubing to make the barrel pressure tight.

3. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, the barrel member being made in sections to telescope one within the other, a seat on the lower end of the drill tubing to support the barrel, the telescoping sections of the barrel being completely telescoped when the barrel is seated in the drill tubing, a bit attached to the end of the drill tubing to cut the core having a passage in the center thereof, valve means in the upper and lower portions of the barrel member which are open during coring, the core when cut passing upwardly through the passage in the bit into the upper section of the barrel member, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed, the upper section of the barrel having a core catcher and moving upwardly within the lower section upon an upward pull of the lifting means, thus breaking off the core from the formation and the valves in the upper and lower portions of the core barrel being closed in response to the lifting pull to make the barrel pressure tight.

4. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, the barrel member being made in sections to telescope one within the other, a seat on the lower end of the drill tubing to support the barrel, a bit attached to the end of the drill tubing to cut the core having a passage in the center of the bit, the telescoping sections of the barrel being completely telescoped when the barrel is seated in the drill tubing, valve means in the upper and lower portions of the barrel member which are open during coring operations, the upper valve means being opened during coring by its own weight and the lower valve being opened by the core passing upwardly into the upper section of the barrel member through the passage in the drill bit, means on the core barrel to receive lifting means lowered with the drill tubing to lift the core barrel completely out of the drill tubing when coring is completed, the upper section of the barrel member having a core catcher and moving upwardly within the lower section of the barrel member upon an upward pull of the lifting means thus breaking off the core, the upper valve member in the barrel being closed in response to the upward pull of the lifting means and the lower valve closing when the upper section is fully extended within the lower section to make the barrel pressure tight.

5. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation, comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, a bit, having a passage in the center thereof attached to the end of the drill tubing to cut the core, the core when cut passing upwardly through the passage in the bit and in the lower end of the core barrel, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed and means associated with the barrel independent of the drill tubing to make the barrel pressure tight.

6. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation, comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, a seat on the lower end of the drill tubing to support the barrel, a bit, having a passage in the center thereof, attached to the end of the drill tubing to cut the core, the core when cut passing upwardly through the passage in the bit and into the lower end of the barrel member, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed and means associated with the barrel independent of the drill tubing to make the barrel pressure tight.

7. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation, comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, a seat on the lower end of the drill tubing to support the barrel, a bit having a

passage in the center thereof attached to the end of the drill tubing to cut the core, the core when cut passing upwardly through the passage in the bit and into the lower end of the barrel member, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed and valve means associated with the upper and lower portions of the barrel independent of the drill tubing to make the barrel pressure tight.

8. A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation, comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, a seat on the lower end of the drill tubing to support the barrel, a bit having a passage in the center thereof attached to the end of the drill tubing to cut the core, the core when cut passing upwardly through the passage in the bit and into the lower end of the barrel member, means on the core barrel to receive lifting means lowered within the drill tubing to lift the core barrel completely out of the drill pipe when coring is completed and valve means associated with the upper and lower portions of the barrel independent of the drill tubing closed by the upward movement of the barrel to make the barrel pressure tight.

9. In a retractable core taking device, the combination of: a retractable core receiving barrel adapted to be moved to the ground surface through the wash opening of a string of drill pipe and having an opening near its upper end extending between the interior and the exterior of said barrel; lifting means on the upper end of said barrel for connection to a hoisting device for moving said barrel to the ground surface; closure means on said lifting means movable to close said opening; and means responsive to a hoisting force applied to said lifting means for moving said closure means to a closing position and to hold said closure means in said position.

10. In a retractable core taking device, the combination of: a retractable core receiving barrel adapted to be moved to the ground surface through the wash opening of a string of drill pipe and having an opening near its upper end extending between the interior and the exterior of said barrel; a lifting means on the upper end of said barrel for connection to a hoisting device for moving said barrel to the ground surface; means mounting said lifting means for limited movement axially of said barrel between an upper and lower position; and means carried by said lifting means in such position as to close said opening when said lifting means is in its uppermost position and to open said opening when said lifting means is in its lowermost position.

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