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CORE BARREL

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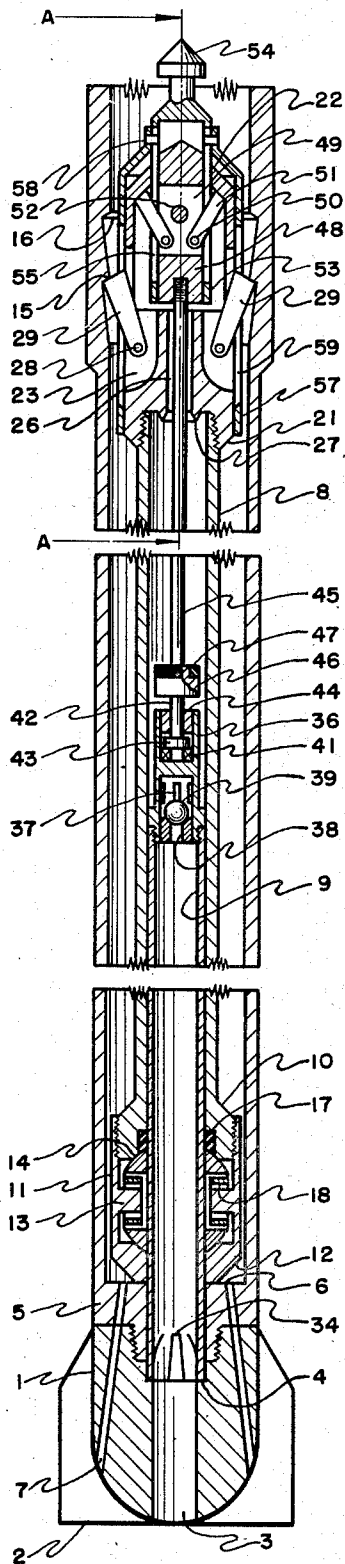


FIG. 1.

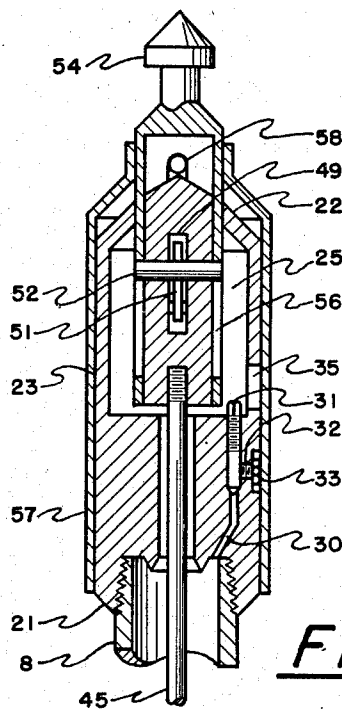


FIG. 2.

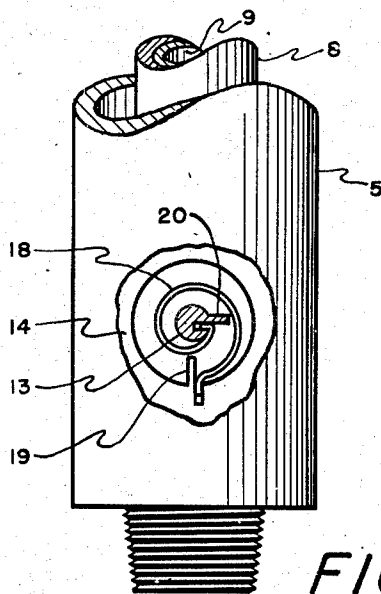


FIG. 3.

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CORE BARREL

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15 Claims. (Cl. 255—72)

The present invention relates to retractable core barrels formed to be dropped through the drill stem to a seat in a core bit and to take a sample of the formation. After a core has been taken, it may be sealed under the pressure of the formation and the core barrel withdrawn, leaving the drill stem and the drill in the bore hole.

It is an object of the present invention to provide a pressure core barrel which may be dropped down the drill stem and which will be latched in place when it is seated.

It is a further object of the present invention to provide a device having both an outer pressure barrel and an inner barrel so provided with latches that the inner barrel may be unlatched and drawn within the pressure barrel before the pressure barrel is unlatched from its seat.

Another object of the present invention is to provide a pressure core barrel having upper and lower valves and arranged so that after it has been latched in place in a drill stem the lower valve may be closed before the device is unlatched from the drill stem and the upper one may be closed after it is unlatched from the drill stem.

A further object of the present invention is to provide a core barrel which may be dropped down a drill stem and which is locked in place when it strikes a seat at the lower end of the drill stem. The device is so arranged that, when a conventional type overshot attached to a wire line is dropped down the drill stem, it will fasten to a spear-shaped head on the upper end of the core barrel. A pull upwardly on the wire line will withdraw an inner barrel causing a valve in the lower end of the pressure barrel to close and a continued pull will unlatch the device from the drill stem and then close a valve in the upper end of the pressure barrel, so effectively sealing a core in the barrel at the pressure of the formation.

Other objects and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawing in which

Fig. 1 is a cross sectional view through a core drill with a preferred modification of the device of the present invention installed therein;

Fig. 2 is a cross sectional view along the line A—A of Fig. 1; and

Fig. 3 is a fragmentary view of a lower portion of the device, taken at 90° to the view shown in Fig. 1 and with parts broken away to show details of construction.

Referring to the drawing in detail, numeral 1 designates a conventional core bit head provided

with conventional fish tail cutting edges 2—2 and a central passage 3. The lower portion of the central passage 3 in drill head 1 has a smaller diameter than the upper portion and forms a ledge 4 within the passage.

Core bit head 1 is held in threaded engagement with the lower end of a collar 5, the upper end of the collar being provided with threads (not shown) for engagement with a conventional tool joint. The lower end of the collar is provided with a ledge 6 pierced by central passage 3. Located on each side of central passage 3 are smaller passages 7—7 which also extend through both ledge 6 and the bit head. Collar 5 is also provided with circumferential grooves 15 and 16 located at a proper distance above ledge 6, as will hereafter be explained.

Positioned within collar 5 is the pressure core barrel. An outer cylinder 8 having sufficient wall thickness to resist a large pressure differential has arranged within it a concentric cylinder 9. The lower end of cylinder 8 is upset to provide a threaded shoulder 10 to which is attached cylindrical sleeve 11 which has an inwardly projecting shoulder 12 at its lower end. Sleeve 11 is provided with inwardly projecting stub shafts 13—13. Mounted on the stub shafts for rotation within the space defined by shoulders 10 and 12 and the interior of sleeve 11 is a steel ball 14. Steel ball 14 is provided with a transverse circular opening adapted to receive inner cylinder 9. Shoulders 10 and 12 are suitably cut away to conform with the shape of steel ball 14 and, in addition, shoulder 10 is recessed just above the cut-away portion to receive a packing ring 17 which is of such configuration as to form a fluid-tight seal with surface of the ball.

Stub shafts 13—13 carry springs 18—18 and are provided with stops 20 which cooperate with projecting studs 19 carried by steel ball 14 to limit the angular motion of said ball to 90°. The upper end of cylinder 8 is provided with screw threads and attached thereto by mating threads is a cylindrical block 21. Block 21 is in the form of a cylinder with outside portions of its upper end milled away to leave a circular shoulder 22 having ribs 23—23 joined thereto. Shoulder 22 is provided with a central passage 25 and has its under-portion bevelled for reasons which will later appear. A passage 26 of smaller diameter than the interior of cylinder 8 extends longitudinally from the lower end of block 21 to the cut-away portions thereof and has a knife edge 27 formed on the lower end thereof. Attached to ribs 23—23 by means of rivets 28—28 are dogs

29—29. The cylindrical block 21 is also provided with a laterally offset longitudinal passage 30 controlled by a needle valve 31 and when opened making connection with a lateral passage 32 provided with a plug 33 for the purpose hereafter specified. Access to needle valve 31 is provided by a slot 35 milled in block 21.

Positioned within the pressure barrel is inner cylinder 9 provided at its lower end with a core catcher 34 and having a cylindrical valve head 36 attached to its other end by means of suitable screw threads. The valve head is provided around its circumference with slots 37 below which is arranged a seat 38 for a ball valve 39. The upper end of the valve head is provided with a recess in which thrust bearings 41 are arranged. A bolt 42 has its head 43 resting on thrust bearings 41, the bolt being held in place by a screw cap 44 carried by the upper end of the valve head. A stud 45 is screwed into cap 46 which, in turn, is screwed to the upper end of bolt 42. Upon the upper face of cap 46 is arranged a disk of resilient material 47 which is of such dimensions as to form a seat for the knife edge 27 attached to the lower face of cylindrical block 21.

The stud 45 is screwed into a cylindrical block 48. The central portion of block 48 is provided with a slot 49 and attached within slot 49 by rivets 50—50 are dogs 51—51. Block 48 is also provided with laterally projecting pin 52. Fitting slidably over block 48 is a sleeve 53 provided with a spear head 54 and having its center portion provided with slots 55—55 and 56—56. Slots 55 are so arranged that the upper ends of dogs 51 may extend outwardly through them when sleeve 53 is resting in its lowermost position in which the upper ends of slots 56 rest on pin 52.

An outer sleeve 57 fits slidably over cylindrical block 21. The upper end of sleeve 57 is provided with pins 58—58 which project into the slots 55—55 of sleeve 53. Sleeve 57 is additionally provided with slots 59—59 placed so that the upper ends of dogs 29—29 may extend outwardly through them when sleeve 57 is resting upon cylindrical block 21 in its lowermost position.

The above described device may briefly be said to comprise a heavy pressure barrel provided with valves at its upper and lower ends and an inner barrel slidably arranged within the pressure barrel. When the device is ready for taking a core, locking means lock the inner barrel against longitudinal movement with respect to the pressure barrel, its lower end protruding from the lower end of the pressure barrel and other locking means, in turn, lock the pressure barrel in the lower end of the drill stem provided with a core bit. The lower end of said inner barrel projects into the head of the core bit in order to receive a core. When a core has been received by the inner barrel, a pull on the upper end of the device unlocks said inner barrel and retracts it within the pressure barrel to allow the valve in the lower end of the pressure barrel to close. A continued pull on the upper end of the device next unlocks the pressure barrel from the drill stem and then closes the valve in the upper end of the pressure barrel to hermetically seal the core within the pressure barrel.

The device is prepared for taking a core by having the longitudinal axis of the opening in steel ball 14 in line with the longitudinal axis of outer cylinder 8, the lower end of cylinder 9 being extended through the opening in steel ball 14 and then projected a predetermined distance beyond it. It will be apparent that cylinder 9

is the sole means for opposing the rotative force applied to the ball by springs 18—18 and hence the only means for retaining the opening in the steel ball in line with the axis of cylinder 8. In the upper end of the device, upper ends of dogs 29—29 and 51—51 are momentarily retained inwardly in order to allow sleeves 53 and 57 to assume their lowermost positions, and are afterwards allowed to fall outwardly. When this occurs, relative longitudinal movement between cylinders 8 and 9 will be prevented because cylinder 8 is attached to block 21 while cylinder 9 is attached to block 48 through stud 45, and since block 48 rests on a face of block 21 it cannot move downwardly and upward movement is prevented by dogs 51—51 resting against that part of block 21 which forms shoulder 22.

With the inner and outer barrel locked together as described in the preceding paragraph, the device is ready to be lowered into a drill stem in order to take a core. A drill stem having at its lower end a collar and core bit head as shown in Fig. 1 may be in position in a bore hole with the cutting edges of the bit at the point in the hole at which it is desired to obtain a core. The core barrel may then be placed within the drill stem and allowed to fall under the force of gravity. If there is no obstruction within the drill stem, shoulder 12 will strike the ledge 6 of the collar and the device will then be locked in this position by dogs 29—29 which fall outwardly and engage notch 15, as shown in Fig. 1. If there is a small obstruction between ledge and shoulder 12, shoulder 12 will rest on this obstruction and the device will be locked in position by engaging notch 16. In either event the lower end of cylinder 9 will project within passage 3 for the purpose of receiving a core. After the device has been locked in place, the drill stem may be rotated and drilling fluid forced down the drill stem and out through passages 7—7 into the bore hole in the conventional manner. As the drill stem rotates, cutting edges 2—2 will cut a core which enters central passage 2 and hence cylinder 9.

It will be evident that the rotary movement of inner cylinder 9 will be independent of the rotary movement of the drill stem and the outer cylinder 8 because cylinder 9 is connected to these other members through the thrust bearings 41. As the core enters cylinder 9, drilling fluid will be displaced upwardly through ball valve 39 and out through slots 37.

When a core of the desired length has been cut by the bit, the rotation of the drill stem may be stopped and an overshot attached to a wire line dropped down through the drill stem and allowed to engage with spear head 54. Since such overshots are conventional to the art, this device in itself forms no part of the present invention and, hence, is not illustrated in the drawing. An upward pull on the wire line attached to the overshot lifts sleeve 53 until the lower portions of slots 55 strike dogs 51, pulling them inwardly, thereby unlocking cylinder 8 with respect to cylinder 9. A continued pull upwardly on sleeve 53 causes pins 52 to rest on the lower ends of slots 56, transmitting the pull to stud 45 which retracts cylinder 9 within steel ball 14 and allows springs 18—18 to rotate the steel ball to 90° to close off the lower end of cylinder 8. Continuing the pull on sleeve 53 causes the bottoms of slots 55 to strike pins 58 and pull sleeve 57 upwardly to disengage dogs 29 from notch 15. All the pull is now transmitted directly through block 48 to

stud 45 which causes disk 47 to seat against knife edge 27, sealing off the upper end of cylinder 8 and allowing the force to be transmitted to cylinder 8 in order to withdraw the entire device from the bore hole.

When the device is withdrawn to the surface of the earth with a core under formation pressure in barrel 8, the gaseous components of the sample may be collected by removing plug 33 from block 21 and attaching a conduit from passage 32 to a suitable device for containing these components. Needle valve 31 may next be opened to allow the gaseous constituents to be withdrawn from the core barrel to the sample container, thereby relieving the pressure in the core barrel. The core barrel may then be dismounted to obtain the core and the core barrel then reassembled and arranged to take another core in the manner previously described.

While I have disclosed a specific modification of the present invention it is obvious that various changes in the shape, size and arrangement of the parts may be made without departing from the scope of the invention. For example, the number and shape of the locking dogs used in the device may be altered, other means may be used for withdrawing the gaseous constituents from the sample chamber and other types of core bits may be used. I therefore do not intend to be limited to the above described modification.

I claim:

1. A retractable core barrel adapted to fit slidably within a string of drill pipe and to be locked against longitudinal movement when it strikes a ledge at the lower end of said string of pipe comprising an outer casing, an inner casing fitting slidably within said outer casing, means for sealing both ends of said outer casing in a pressure-tight manner, releasable means carried by said inner casing for locking it against longitudinal movement with respect to said outer casing, and releasable means carried by said outer casing for locking it against longitudinal movement with respect to said string of drill pipe.

2. A retractable core barrel comprising a first cylinder, a second cylinder adapted to be concentrically arranged within said first cylinder, a block adjacent an end of said first cylinder and connected to said second cylinder by means of a rod, a first sleeve arranged concentrically around said block, a second sleeve arranged concentrically around said first sleeve and the said end of the first cylinder, and means for locking said block to said first sleeve.

3. A retractable pressure core barrel comprising an outer cylinder and a second cylinder of less length than said outer cylinder concentrically arranged within said outer cylinder, a first block attached to said second cylinder by means of a rod, a second block directly connected with said outside cylinder, dogs attached to said first block and arranged to press against said second block to prevent relative longitudinal movement between said blocks, and dogs attached to said second block arranged for locking the device against longitudinal movement when it is positioned within a drill collar.

4. In a retractable pressure core barrel a cylindrical block provided with laterally extending pins and provided with a slot, dogs arranged in said slot and attached to said block, a sleeve arranged concentrically around said block, said sleeve being provided with a slot to correspond to each of said pins and dogs, and further provided with a spear head, a second sleeve arranged

concentrically around said first sleeve and provided with a plurality of longitudinal slots and with members which project within the slots provided in said first sleeve for said dogs.

5. A core barrel comprising a tubular member, a core receiving chamber within said member in communication with the lower end of said member by means of a central passage, means arranged in said barrel to hermetically seal said core receiving chamber, and means mounted on said member to releasably anchor it to the lower end of a drill stem.

6. A core drill assembly including a core drill, and a drill collar connected thereto, a core barrel disposed within said assembly, means to anchor said core barrel releasably to said assembly, a central passage defined by said assembly adapted to receive a core of the formation being drilled, a chamber arranged in said barrel in communication with said passage, and means arranged in said barrel for hermetically sealing said chamber under the pressure of the formation.

7. A pressure core barrel comprising a casing, a core receiving chamber within said casing in communication with the exterior of said casing by means of a central passage through the lower portion of said casing, sealing means arranged in said casing to close said passage in a fluid tight manner, and means mounted on said casing arranged to releasably anchor it to the lower end of a drill stem.

8. A pressure core barrel in accordance with claim 7 having the sealing means arranged to close the passage before the anchoring means is released.

9. A pressure core barrel comprising a casing having a central core receiving passage leading to its lower end and a second passage provided with fluid communication between the upper end of said central passage and the exterior of said casing, means mounted on said casing arranged to releasably anchor it to the lower end of a drill stem, means arranged in said casing to close the lower end of said central passage in a fluid tight manner, and means arranged in said casing to close said second passage in a fluid tight manner whereby said chamber is hermetically sealed.

10. A pressure core barrel in accordance claim 9 having the means for closing the central passage arranged to seal it before the anchoring means is released, and the means for closing the second passage arranged to seal it after said anchoring means has been released.

11. A core drill assembly including a core drill, and a drill collar, a core barrel disposed within said assembly, said barrel being provided with a central passage to receive a core cut by said drill, means mounted on said barrel to releasably anchor it to said assembly, means arranged in said barrel for sealing the upper and lower ends of said core receiving passage, said sealing means being arranged to close the lower end of said passage before said anchoring means is released.

12. A core drill assembly including a core drill and a drill collar, a core barrel disposed within said assembly comprising an elongated casing having a central passage extending to its lower end, said casing being arranged to be supported by said assembly, releasable means arranged on said casing to anchor it to said assembly against upward movement, a member telescopically arranged in the passage in said casing, and provided with a sample receiving cavity in its lower portion, said member being arranged to have its lower end extend below said casing when in

sample receiving position and to be within the casing in retracted position, means mounted on said member to aid in retracting it, and means mounted on said casing arranged to seal the lower end of said passage in a fluid tight manner upon the retraction of said member.

13. A wire line core barrel assembly comprising a casing having a central bore, a tubular member telescopically arranged in the bore of said casing for receiving a core, a means arranged at each end of said casing for sealing the ends of said bore in a fluid tight manner, and means mounted on said casing to releasably anchor it to the lower end of a drill stem.

14. A core drill assembly including a core drill and a drill collar, a core barrel disposed within said assembly comprising a first cylinder arranged to be supported by said assembly, releasable means arranged on said cylinder to anchor it to said assembly against upward movement, a second cylinder telescopically arranged in said first cylinder, said second cylinder being arranged to have its lower end extend below said first cylinder when in core taking position and to be within said first cylinder in retracted position,

means mounted on said second cylinder to cooperate in retracting it within said first cylinder, and means mounted on said first cylinder for hermetically sealing the ends thereof upon the retraction of said second cylinder.

15. A borehole tool arranged to be anchored to a drill collar and to be retracted by a wire line comprising a tubular member, a chamber within said member in communication with the exterior thereof by two outlets, means mounted on said member to anchor it to said drill collar, said anchoring means being arranged to be released by upward tension on a wire line attached thereto, means arranged on said tool for sealing each of said outlets in a fluid tight manner, said anchoring means and said sealing means being cooperatively arranged whereby one of said passages is sealed before the anchoring means is released, by tension exerted through said line, and the other passage is sealed after said anchoring means is released but before the tubular member is moved upwardly by continued tension exerted through said line.

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