

Oct. 8, 1940.

B. W. SEWELL

2,216,962

PRESSURE CORING DEVICE

Filed Nov. 25, 1938

3 Sheets-Sheet 1

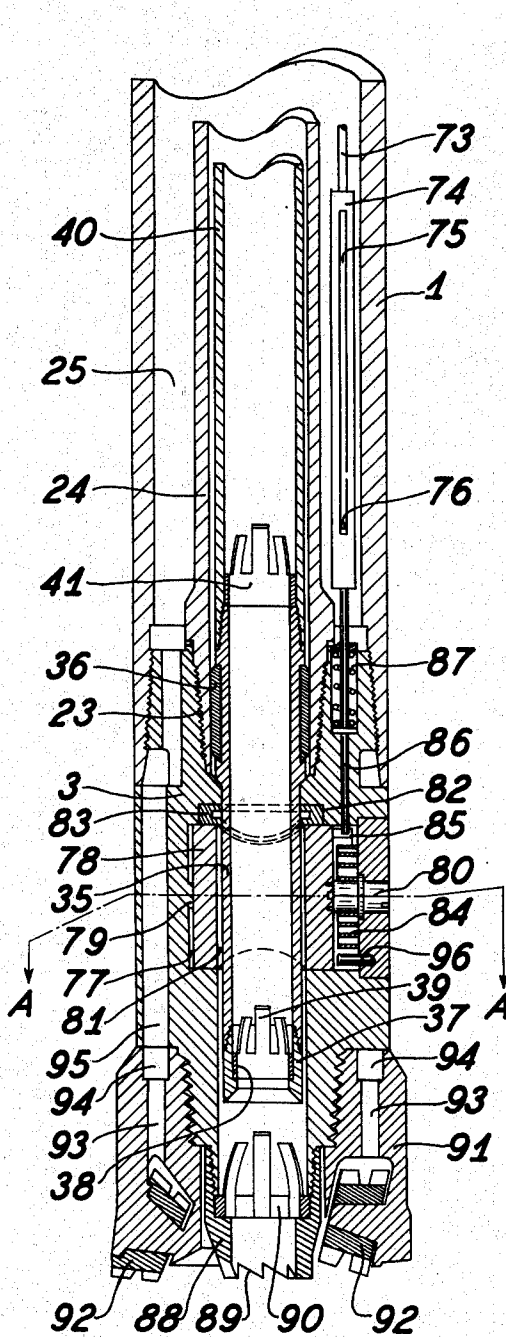


FIG. 1

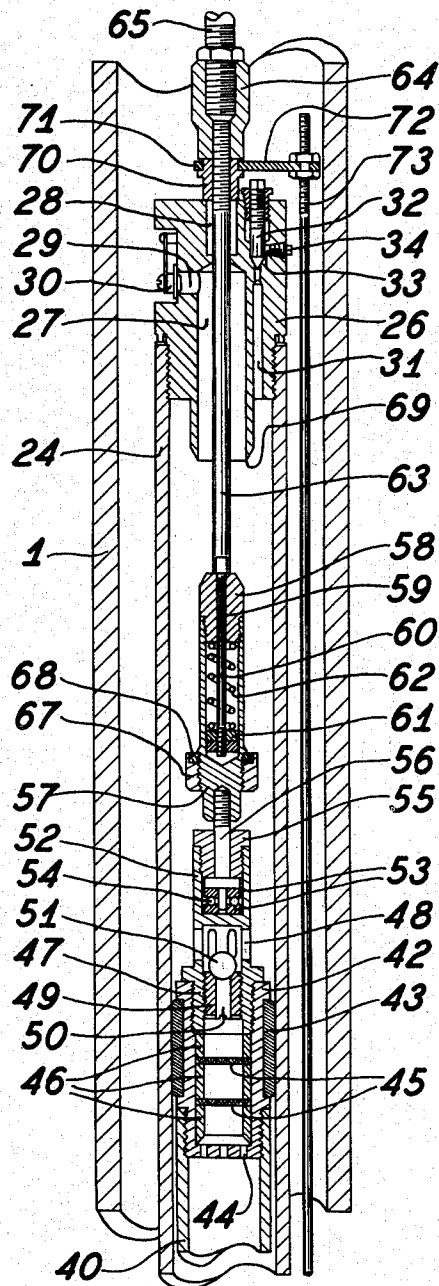


FIG. 2

INVENTOR.

BY *Benjamin W. Sewell*
P. L. Young ATTORNEY.

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B. W. SEWELL

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3 Sheets-Sheet 2

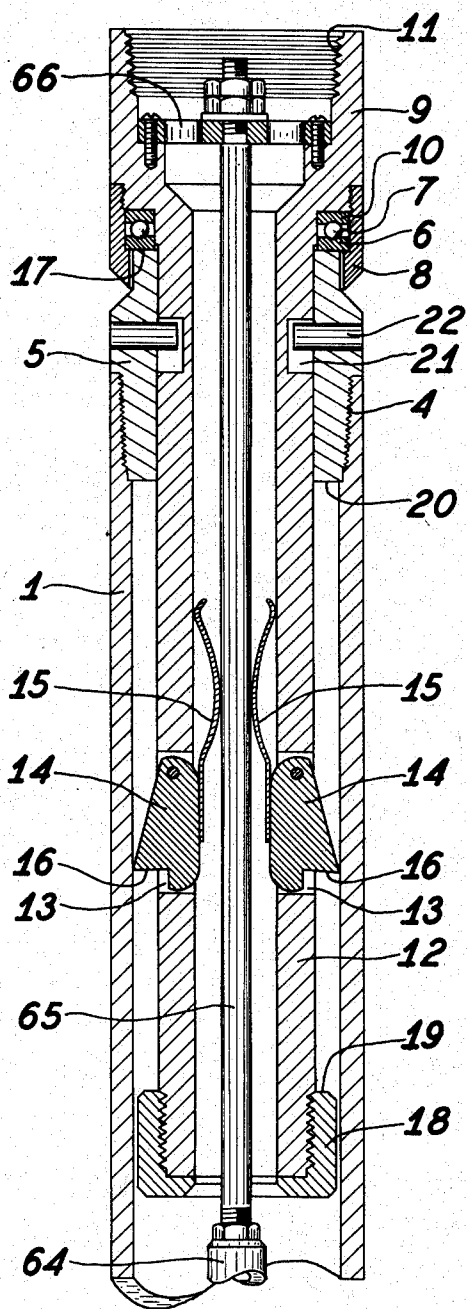


FIG. 3_

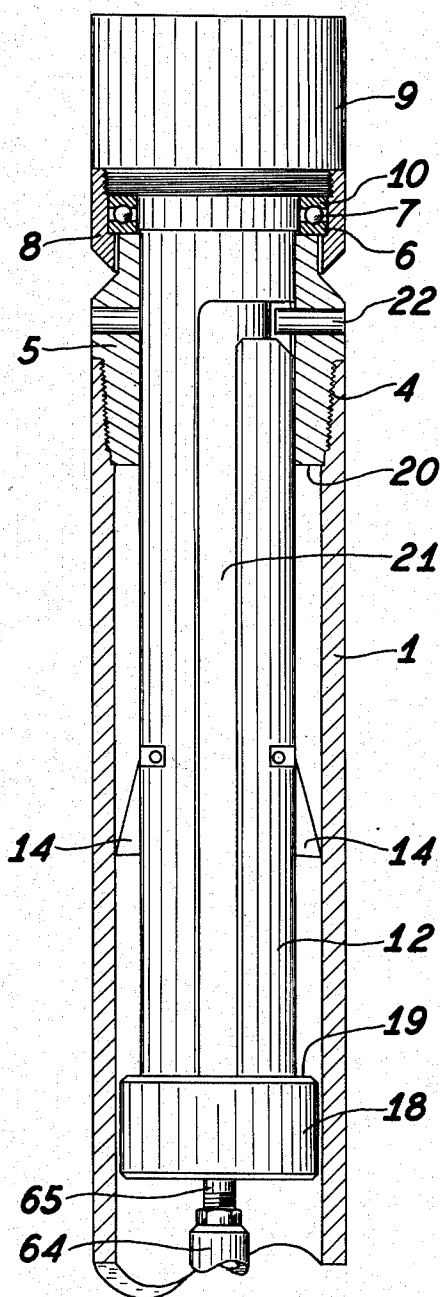


FIG. 4_

INVENTOR.
Benjamin W. Sewell
BY *P. Young* ATTORNEY.

Oct. 8, 1940.

B. W. SEWELL

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3 Sheets-Sheet 3

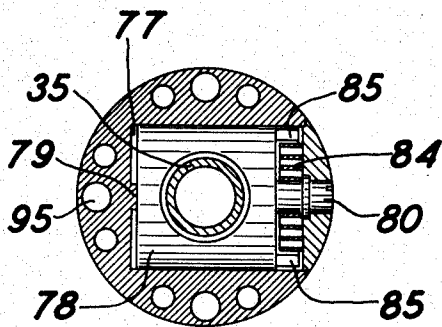


FIG. 5_

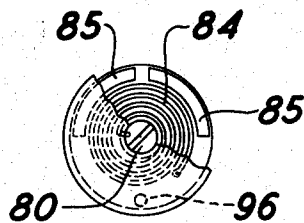


FIG. 6_

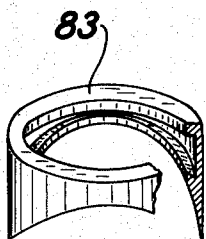


FIG. 7_

INVENTOR.
Benjamin W. Sewell
BY *R. L. Young* ATTORNEY.

UNITED STATES PATENT OFFICE

2,216,962

PRESSURE CORING DEVICE

Benjamin W. Sewell, Tulsa, Okla., assignor to
Standard Oil Development Company, a corporation of Delaware

Application November 25, 1938, Serial No. 242,211

16 Claims. (Cl. 255—72)

The present invention is directed to a coring device for securing a core of a substratum under the pressure obtaining in the substratum.

The principal object of the present invention is the provision of a barrel adapted to be used in conjunction with a coring bit and provided with mechanism which makes possible the securing of a core of a substratum and the delivery of that core to the surface under the pressure obtaining in the substratum.

Another object of this invention is the provision of a device of the character described in which means actuated by reversing the direction of rotation of the core drill is provided for drawing the core barrel containing its core up into the drill stem and for sealing off both ends of the core barrel so that it can be delivered to the surface without any release of pressure of the formation from the sample taken from the formation.

An additional object of the present invention is the provision in a device of the character described of means for permitting the discharge of drilling mud from the core barrel and for the prevention of the return of drilling mud to the interior of the core barrel.

Still another object of the present invention is the provision in a device of the character described of means for holding the core barrel in its retracted position after the recovery of a core.

Further objects and advantages of the present invention will appear from the following detailed description of the accompanying drawings in which—

Figures 1, 2 and 3 constitute together a vertical section of a core barrel according to the present invention, said figures being arranged in sequence beginning with the bottom of the core barrel;

Figure 4 is a view similar to Figure 3 with the innerbarrel shown in full;

Figure 5 is a cross-section along line A—A of Fig. 1;

Figure 6 is an end view of the structure shown in Figure 5 with a portion of the cover plate cut away; and

Figure 7 is a perspective view of a rubber packer constituting one element of the present invention.

Referring to the drawings in detail, numeral 1 designates the outside wall of the core barrel proper which is interiorly threaded at its lower end to receive a cylindrical block 3 which carries a valve mechanism and will hereinafter be more specifically described. The upper end of wall 1 is provided with interior threads at 4 to receive a

nipple 5. Resting on the upper edge of nipple 5 is a ring 6 which forms the lower track for a bearing 7, the whole of which is carried by a ring 8 the lower end of which fits loosely over the upper end of nipple 5 and the upper end of which is threaded to a tubular member 9 which has a face bearing on ring 10 which is the upper track of the aforesaid bearing. The upper end of tubular member 9 is cylindrical in shape and is interiorly threaded at 11 to receive the end of a drill stem. Below ring 8, the tubular member 9 has a portion 12 of reduced diameter, this portion having an outside diameter such as to form a sliding fit with the interior face of nipple 5. Intermediate its ends, section 12 of tubular member 9 is provided with diametrically opposed, longitudinal slots 13, in each of which is pivoted a dog 14 which is normally pressed outwardly by a spring 15. Each dog is provided with a shoulder 16 which is adapted to seat on the upper edge 17 of nipple 5 when tubular member 9 is suitably elevated. The lower end of section 12 is open and is provided with a perforated cap 18, having a flat inner-edge 19 which is adapted to butt against the lower edge 20 of nipple 5 and limit the outward movement of tubular member 9. Section 12 of tubular member 9 is provided on its outer surface with grooves 21 extending for the greater portion of the length of section 12 and turned at right angles at their outer ends so as to simulate the letter L. Nipple 5 is provided with pins 22 which are adapted to ride freely in these grooves. Since nipple 5 and tubular member 9 are mounted for free relative rotation, counterclockwise movement of tubular member 9 from the position shown in Figure 5 will cause pins 22 to be moved to the longitudinal section of grooves 21 when nipple 5 together with outer casing 1 will slide freely over section 12 for the purpose hereinafter specified.

Cylindrical block 3 is provided at its upper end with a screw threaded socket 23 which receives a tube 24 which extends inside of casing 1 to a point below the lower end of section 12 of tubular member 9 and is of such a diameter as to form with casing 1 an annular space 25. The upper end of tube 24 is fitted with cylindrical plug 26 which has a central recess 27 extending for a portion of its length and terminating in a bore 28 of smaller diameter. Fluid communication between recess 27 and the outside of plug 26 is provided through a lateral passage 29 covered by a spring valve 30 which is adapted to open only outwardly. Spaced laterally from recess 27 in plug 26 is a second longitudinal bore 31 which is

closed at its upper end by a needle valve 32 and is provided above the seat for this valve with a lateral outlet 33 which carries a plug 34.

Slidably arranged in the lower end of tube 24 is a short cylinder 35 which makes frictional contact with the inner-face of tube 24 through bushing 36. To the lower end of cylinder 35 is threaded a nipple 37 which carries in its interior a ring 38 provided with upwardly extended, inwardly directed spring fingers 39, the purpose of which is to grip the cylindrical sample which will be obtained. Threaded to the upper end of cylinder 35 is a tube 40 which extends for a considerable distance up into tube 24, this distance being regulated by the length of the core which it is desired to recover. It will be understood that this tube is the actual sample holding tube. At its lower end it is provided with a core retainer 41 similar to retainer 38 described above.

To the upper end of tube 40 a small cylinder 42 is threadably connected. This cylinder is provided with an external bushing 43 which has a sliding fit with tube 24. The lower wall of cylinder 42 is provided with passages 44 and in its interior cylinder 42 is provided with screens 45 held in spaced relation by rings 46. The upper end of cylinder 42 carries a second cylinder 47. Intermediate its ends, the wall of cylinder 47 is provided with longitudinal slots 48 below which in the interior of cylinder 47 is fixed a nut 49 having a central passage 50 on the upper end of which a ball 51 is adapted to seat. Above the slotted portion, cylinder 47 is provided with a transverse partition 52 into which are nested bearing tracks 53 on which ride bearings 54. The upper end of cylinder 47 is closed by a perforated cap 55 through which extends a stud 56, the lower end of which rests on the upper bearing track 53 and the upper end of which carries a barrel 57. The end of this barrel is provided with a cap 58 having a central opening 59 through which extends a rod 60, the lower end of which carries a nut 61. Encircling the rod 60 between nuts 61 and cap 58 is a spring 62. Rod 60 is an extension of rod 63 which passes upwardly through the central bore of plug 26 and into one end of sleeve 64, into the other end of which is screwed a second rod 65 which terminates at a cross piece 66 fixed in tubular member 9.

Intermediate its ends, barrel 57 carries an external nut 67 which is provided on its upper face with a ring 68 of resilient material of such diameter as to form a seat for a circular knife edge 69 formed at the mouth of recess 27 in plug 26.

Between sleeve 64 and plug 26 is arranged a collar 70 which carries a ring 71, said ring having a laterally extending arm 72 to the end of which is secured a rod 73. Rod 73 extends nearly to the lower end of tube 24 where it terminates in the sleeve 74 which is provided with a longitudinal slot 75 adapted to receive a pin 76 carried by rod 73.

Intermediate its ends, cylindrical plug 3 is provided with a cylindrical cavity 77 with its axis perpendicular to the axis of plug 3. Mounted for rotation in said cylindrical cavity is a cylinder 78, one end of which is arranged on a stud 79 and the other end of which is carried by a stub shaft 80. The cylinder 78 is provided with a transverse circular opening 81 adapted to receive cylinder 35. Communicating with the upper side of cylindrical cavity 77 is a cylindrical cavity 82 having its axis perpendicular to the axis of cavity 77. Fitted into a cavity 82 is a rubber packer 83 of the configuration shown in perspective in Figure 6.

The stub shaft 80 carries a spring 84. Cylinder 78 is provided with axial flanges 85 which are concentric with the stub shaft 80 and are outside of spring 84. An opening is provided between these axial flanges suitable for receiving a bolt 86 which is affixed to sleeve 74 and which is normally pressed downwardly by spring 87.

The lower end of cylindrical plug 3 carries a collar 88 the lower edge of which is provided with serrations 89. At its inner-end this collar also carries a core retainer 90 similar to retainer 38 heretofore described. Threaded to the end of plug 3 is a drilling head 91 provided with conical cutters 92. This cutting head is provided with longitudinal passages 93 which establish fluid connection between the cutters and an annular trough 94 arranged in said head. The cylindrical plug 3 is also provided with longitudinal passages 95 which establish fluid connection between trough 94 and annular space 25.

With the parts in the position shown in the drawing, mud circulates down through the drill pipe through annular space 25, passages 95 and 93 to the cutters, and then up between the casing 1 and the wall of the borehole. It will be understood that the interior of the barrel is filled with mud. As the core is cut it will enter cylinder 35 in the form of a bar of circular cross section. In its upward movement through cylinder 35 the core will force drilling mud out of this cylinder through opening 50 in nut 49 into the interior of tube 24 from which the drilling mud can escape through passage 29 into the mud stream inside of outer casing 1.

When sufficient core has been cut, the drill stem is lifted to break off the core at the bottom. The drill stem is then lowered again until the cutters rest at the bottom of the borehole. The direction of rotation of the drill stem is then reversed and it is again lifted to provide sufficient space for the following movement of the parts to operate cylindrical valve 78. When the direction of rotation of the drill stem is reversed, while sufficient friction is provided by the cutters to hold the casing 1 stationary, pins 22 ride in grooves 21 to its longitudinal portion. Then when the drill stem is lifted, the weight of the drill head and the outer casing 1 causes these parts to remain on bottom and tubular member 9 moves upwardly with the drill stem. This causes rod 65, and in turn rod 63 and tube 40, to move upwardly. At the same time rod 73 is moving upwardly. Upon sufficient upward motion, knife edge 69 seats in resilient ring 68, thereby sealing the interior of tube 24 from annular space 25. By suitable proportioning of parts, further upward motion of rod 65 brings pin 76 on rod 73 against the upper end of slot 75 and causes bolt 86 to be withdrawn from the space between flanges 85 thereby enabling spring 84 to turn cylinder 78 through 90°. This movement of cylinder 78 is limited to 90° by a stop 96 arranged in the path of flange 85. This closes off the bottom of the chamber formed by tube 24. It is also to be noted that the upward movement of tubular member 9 will have brought dogs 14 to seating position on the upper edge of nipple 5; thus, the inside of tube 24, in which is contained the subsurface sample, is sealed. It may be mentioned here that spring 61 is provided so that after knife edge 69 is seated on ring 68 there can still be sufficient longitudinal movement of rod 63 to trip the bolt 86 and release spring 84.

When the core barrel with its enclosed sample is brought to the surface plug 34 is removed and

a suitable connection is made with a receiving vessel which may be provided with suitable fractionating and condensing equipment. The needle valve 32 is then opened and the volatile constituents of the subsurface sample allowed to discharge into the receiving apparatus. When the interior of tube 24 is thus reduced to atmospheric pressure the barrel may be opened by removing cylindrical plug 3 and the core removed therefrom for further examination.

It is to be understood that the above described mechanism represents only a single embodiment of the present invention and is not intended to define the limits of the present invention. It will be apparent that many changes can be made in the size, shape and arrangement of parts without departing from the fundamental principles underlying the present invention. All such changes as may be within the province of the skilled artisan are contemplated by the appended claims in which it is intended to claim the present invention as broadly as the prior art permits.

I claim:

1. A pressure coring device comprising a casing, a barrel movably mounted in said casing and adapted to assume a forward position and a retracted position, a cutting head carried by said casing having cutters defining a central passage adapted to receive a core and communicating directly with said barrel when the latter is in its forward position, a valve mounted to close communication between said passage and said barrel when the latter is in its retracted position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for closing said valve.

2. A pressure coring device comprising a casing, a barrel movably mounted in said casing and adapted to assume a forward position and a retracted position, a cutting head carried by said casing having cutters defining a central passage adapted to receive a core and communicating directly with said barrel when the latter is in its forward position, means for holding said barrel in its forward position during the coring operation, a valve mounted to close communication between said passage and said barrel when the latter is in its retracted position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for closing said valve.

3. A pressure coring device comprising a casing, a barrel movably mounted in said casing and adapted to assume a forward position and a retracted position, a cutting head carried by said casing having cutters defining a central passage adapted to receive a core and to be in direct communication with said barrel when the latter is in its forward position, means for holding said barrel in its forward position during the coring operation, a valve for closing communication between said passage and said barrel when the latter is in its retracted position, means for retracting said barrel when the coring operation is completed, means for holding said barrel in its retracted position, and means set into operation by the retraction of said barrel for closing said valve.

4. A pressure coring device comprising a casing, a barrel movably mounted in said casing and adapted to assume a forward position and a retracted position, said barrel having an open forward end, a valve in the rear end of said barrel adapted to permit the flow of fluid only outwardly through said rear end, a cutting head carried by

said casing having cutters defining a central passage adapted to receive a core and communicating directly with said barrel when the latter is in its forward position, a valve mounted to close communication between said passage and said barrel when the latter is in its retracted position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for closing said valve.

5. A pressure coring device comprising an outer casing, an inner casing concentric with and spaced from said outer casing, a barrel mounted in said inner casing, a cutting head carried by said outer casing having cutters defining a central passage in alignment with said barrel, a valve mounted between said passage and said inner casing and means for closing said valve when the coring operation is completed said means being operable by relative movement between said barrel and said inner casing.

6. A pressure coring device comprising an outer casing, an inner casing concentric with and spaced from said outer casing, a barrel slidably mounted in said inner casing, a cutting head carried by said outer casing having cutters defining a central passage adapted to receive a core, said passage being in alignment with said barrel, a valve situated between said passage and said barrel when the latter is in a retracted position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for closing said valve.

7. A pressure coring device comprising an outer casing, an inner casing concentric with and spaced from said outer casing, a barrel slidably mounted in said inner casing and adapted to assume a forward position and a retracted position, a cutting head carried by said outer casing having cutters defining a central passage adapted to receive a core and communicating directly with said barrel when the latter is in its forward position, a valve mounted to close communication between said passage and said barrel when the latter is in its retracted position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for closing said valve.

8. A pressure coring device comprising an outer casing, an inner casing spaced from said outer casing and in fluid communication therewith, a barrel slidably mounted in said inner casing and adapted to assume a forward position and a retracted position, a cutting head carried by said outer casing having cutters defining a central passage adapted to receive a core and to be in direct communication with said barrel when the latter is in its forward position, a valve for closing communication between said passage and said barrel when the latter is in its retracted position, means carried by said barrel for closing communication between said inner casing and said outer casing when said barrel is in its retracted position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for closing said valve.

9. A pressure coring device comprising an outer casing adapted to be connected to the end of a drill stem and to be in fluid connection therewith, a cutting head carried by said casing having cutters defining a central passage adapted to receive a core, an inner casing concentric with said outer casing having one of its ends connected to said passage, a valve on the other end

of said casing adapted to restrain the flow of fluid from said outer casing into said inner casing while permitting the reverse flow, a barrel slidably mounted in said inner casing and adapted to assume a forward position and a retracted position, the forward end of said barrel being open to receive a core through said passage, a valve at the rear end of said barrel adapted to prevent the flow of fluid from said inner casing into said barrel while permitting the reverse flow, means carried by said barrel adapted to seal said inner casing from the outer casing when said barrel is in its retracted position, means for holding said barrel in its forward position during the coring operation, means for retracting said barrel after the coring operation is completed, a valve arranged between said passage and said inner casing, and means set into operation by the retraction of said barrel for closing said last mentioned valve.

10. In a pressure coring device comprising a casing and a barrel movably mounted in said casing and adapted to assume a forward and a retracted position, means for holding said barrel in each of these positions and for permitting relative longitudinal movement of said barrel and said casing, comprising a cylindrical member secured to said barrel for movement therewith, an L-slot on the outer surface of said cylindrical member having its long axis arranged longitudinally thereof, a pin carried by said casing and adapted to ride in said slot whereby, when said pin is at the end of the short arm of said L-slot, said cylindrical member is restrained from longitudinal movement, and when said pin is in the long arm of said L-slot, said cylindrical member is free to move longitudinally relative to said casing, and cooperating means carried by said cylindrical member and said casing for preventing the reversal of said relative longitudinal movement after it has proceeded a predetermined amount.

11. A pressure coring device comprising a casing, a barrel movably mounted in said casing and adapted to assume a forward position and a retracted position, a cutting head carried by said casing having cutters defining a central passage coaxial with said barrel and adapted to receive a core, a cylinder mounted between said casing and said passage having its axis intersecting the axis of said passage at right angles, a diametrical bore in said cylinder adapted to receive said barrel when the latter is in its forward position, means for retracting said barrel when the coring operation is completed, and means set into operation by the retraction of said barrel for turning said cylinder so as to seal said passage.

12. A pressure coring device comprising a casing, a barrel movably mounted in said casing and adapted to assume a forward position and a retracted position, a cutting head carried by said casing having cutters defining a central passage coaxial with said barrel and adapted to receive a core, a cylinder mounted between said casing and said passage having its axis intersecting the axis of said passage at right angles, a diametrical bore in said cylinder adapted to be aligned with said passage and to receive said barrel when the latter is in its forward position, spring means for actuating said cylinder, restraining means for

said spring, means normally holding said cylinder with its bore in aligned position, means for retracting said barrel when the coring operation is completed, and means carried by said barrel for withdrawing said restraining means when said barrel is retracted, whereby said bore is moved out of alignment with said passage.

13. A pressure coring device comprising an outer casing, an inner casing concentric with and spaced from said outer casing, a plug carried by the upper end of said inner casing and provided with a central fluid passage to said outer casing, a nipple defining said passage depending from said plug and provided with a knife edge, a barrel slidably mounted in said inner casing and adapted to assume a forward position and a retracted position, a ring of resilient material carried at the upper end of said barrel to form a seat for said knife edge when said barrel is in its retracted position, a cutting head carried by said casing having cutters defining a central passage adapted to receive a core and to communicate directly with said barrel when the latter is in its forward position, a valve adapted to close communication between said passage and said barrel when the latter is in its retracted position, means for holding said barrel in its forward position during the coring operation, and means for moving said barrel to its retracted position upon completion of the coring operation.

14. A pressure coring device comprising an outer casing, an inner casing concentric with and spaced from said outer casing, a plug carried by the upper end of said inner casing and provided with a central fluid passage to said outer casing, a nipple defining said passage depending from said plug and provided with a knife edge, a barrel slidably mounted in said inner casing and adapted to assume a forward position and a retracted position, a ring of resilient material carried at the upper end of said barrel to form a seat for said knife edge when said barrel is in its retracted position, a cutting head carried by said casing having cutters defining a central passage adapted to receive a core and to communicate directly with said barrel when the latter is in its forward position, a valve adapted to close communication between said passage and said barrel when the latter is in its retracted position, means for holding said barrel in its forward position during the coring operation, and means for moving said barrel to its retracted position upon completion of the coring operation, and means operated by the retraction of said barrel for closing said valve.

15. A pressure coring device according to the preceding claim in which the means for closing said valve includes a rod secured to said barrel through a spring, said rod extending through the plug of said casing, the parts being so proportioned that the barrel moves with said rod until the knife edge is seated on the resilient ring and the rod then moves further with respect to said barrel to actuate the closing mechanism for said valve.

16. A device in accordance with claim 10 provided with means for hermetically sealing said barrel when said predetermined amount of longitudinal movement has taken place.

BENJAMIN W. SEWELL.