

Jan. 12, 1954

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2,665,885

APPARATUS FOR OFFSHORE CORING

Filed Oct. 25, 1948

2 Sheets-Sheet 1

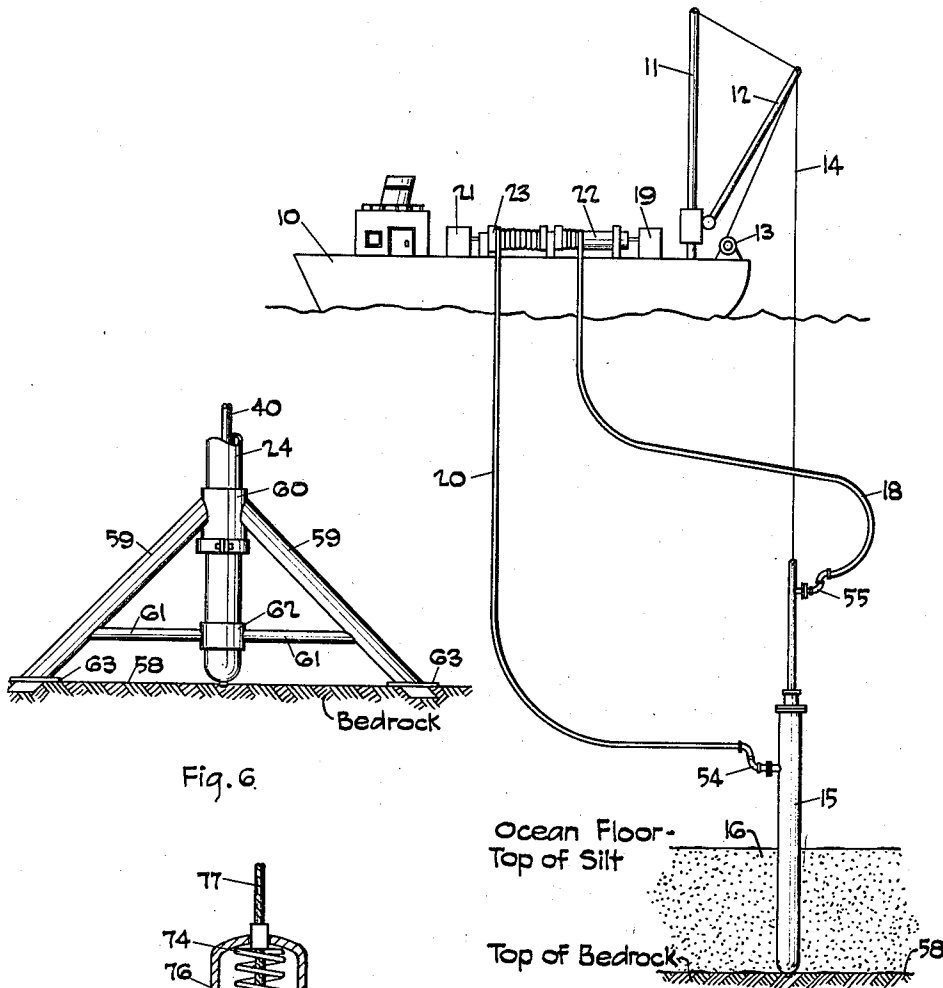


Fig. 6

Fig. 1

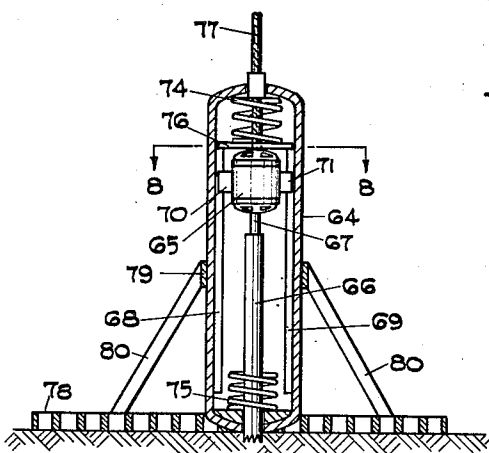


Fig. 7

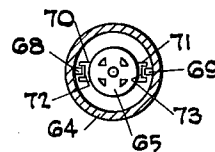


Fig. 8

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2 Sheets-Sheet 2

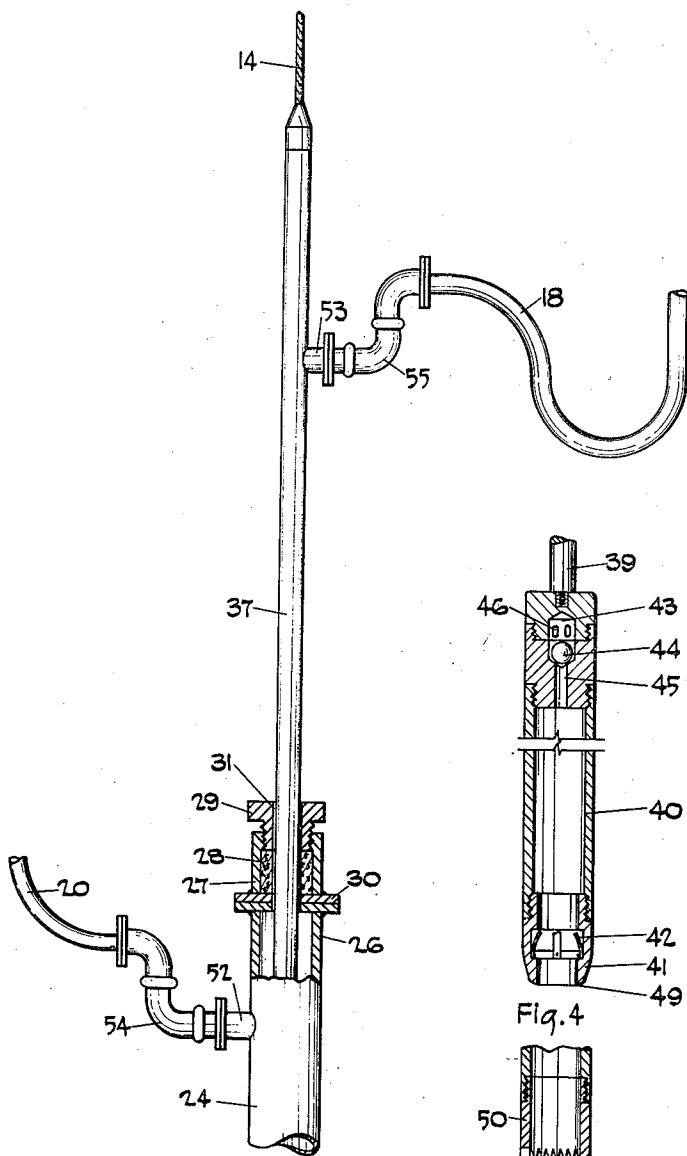


Fig. 2

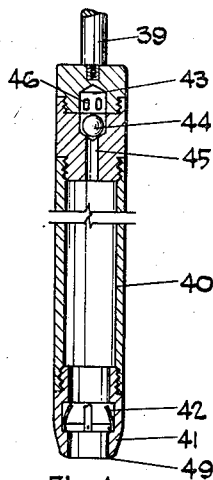


Fig. 4

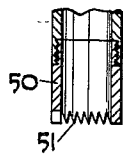


Fig. 5

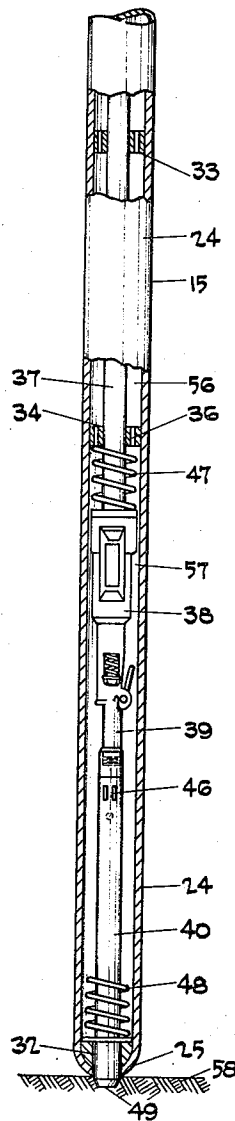


Fig. 3

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UNITED STATES PATENT OFFICE

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APPARATUS FOR OFFSHORE CORING

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4 Claims. (Cl. 255-1.4)

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This invention pertains to a method and apparatus for obtaining formation cores from terrain submerged under bodies of water such as lakes, shallow coastal waters, etc., and pertains more particularly to a wire line coring apparatus, and to a method for obtaining cores in offshore drilling operations.

It is the primary object of the present invention to provide a coring apparatus adapted to be lowered by a wire line to the formation to be cored, said coring apparatus carrying means for removing or penetrating a layer of silt or sediment whereby the apparatus may be positioned in direct contact with the formation.

Another object of this invention is to eliminate the need of securely anchoring a barge in an accurately determined position during coring operations by providing a coring apparatus adapted to be lowered by a wire line to said submerged formation and to be operatively positioned thereon, independently of the barge, said apparatus being connected to the barge during coring operations by flexible anchoring and power transmission lines.

These and other objects of this invention will be understood from the following description of preferred embodiments of the apparatus of the present invention as shown in the accompanying drawing wherein:

Figure 1 is a view showing one embodiment of the present coring apparatus in position for coring submerged formations, with auxiliary coring equipment carried on an accompanying barge.

Figures 2 and 3 are views, partly in longitudinal cross section, of an embodiment of the present coring apparatus, Figure 3 showing the lower part of the device of Figure 2.

Figures 4 and 5 are longitudinal cross-sectional views of coring barrels used with the present coring apparatus.

Figure 6 is a perspective view of one embodiment of a support means.

Figure 7 is a view, partly in cross section, of another embodiment of the present coring apparatus.

Figure 8 is a cross-sectional view taken along the line 8-8 of Figure 7.

Referring to Figure 1 of the drawing, numeral 10 represents a barge or other suitable vessel equipped with suitable derrick and hoisting means such as a mast 11, boom 12, power-driven winch 13 and a cable or wire line 14. The boom is of a length sufficient to swing a load over one side or end of the vessel 10 whereby it may be lowered into the water. As illustrated in Figure 1, the

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present coring apparatus 15 is secured to the end of the wire line 14 by which it may be lowered to the ocean floor 16, being positioned thereon in a substantially vertical position.

In a preferred embodiment of the present apparatus, a suitable flexible power transmission line or conduit 18 (either electrical, pneumatic or hydraulic) may be in communication between the apparatus 15 and a suitable power source 19 (such as a generator, compressor or pump) on board the vessel 10. A second flexible conduit 20 may be in communication between a pump 21 on the vessel 10 and the apparatus 15 for supplying a flushing fluid thereto. Suitable hoisting means 22 and 23, such as power winches, may be carried by the vessel 10 for reeling in the conduits 18 and 20, respectively, when the coring apparatus is withdrawn from the water.

A preferred embodiment of the present coring apparatus, as shown in Figure 2, has a longitudinal outer casing 24 preferably provided with a closed lower end 25 and closed at its upper end 26 by a stuffing box 27 containing suitable packing material 28 and a packing gland, or nut, 29. The stuffing box 27 may be secured to the outer casing in any suitable manner, as by flanges 30, screw threads, or the like. The packing gland 29 and the closed lower end 25 of the outer casing 24 have axial bores 31 and 32 therethrough, respectively. One or more tubing guides 33 and 34 may be fixedly secured in spaced relationship with each other within the outer casing 24 in any suitable manner, as by welding, pinning, crimping, or the like. The guide means 33 and 34 are normally supplied with openings 35 which serve as fluid conduit means.

The axial bores of the packing gland 29 and tubing guides 33 and 34 are of equal diameter being adapted to mount, for vertical sliding movement therein, a tubing member 37 having a length sufficient to extend from below the lowermost tubing guide 34 to a considerable distance above the stuffing box 27. A cable or wire line 14 is secured to the closed upper end of the tubing member 37 for hoisting the apparatus to the barge 10 (Figure 1).

A prime mover means 38 is fixedly secured, as by screw threads, to the lower end of the tubing member 37 and is slidably movable therewith within the outer casing 24. Since the prime mover means 38 is lowered as the coring operation progresses, the coring unit may be described as one of the advancing-motor type. Any suitable electrical, hydraulic or pneumatic prime mover means may be used, said means

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being either of the rotating or reciprocating type. Preferably, an electric motor of the rotating type or an air operated hammer of the reciprocating type is used. The mechanism of such prime mover means, forming no part of this invention and being well known in the art in connection with the use of pneumatic hammers, hydraulic drills, etc., will not be described here.

The prime mover means 38 is diagrammatically shown for illustration purposes as an air operated pavement breaker having a downwardly extending shaft 39 to which a core barrel 40 is secured in any suitable manner, as by screw threads.

A preferred embodiment of the core barrel 40 is shown in Figure 4, having a detachable cutting nosepiece 41 threaded to the lower end thereof. A core catcher 42, of any type well known to the art, is affixed to the inside of said nosepiece 41 or said core barrel 40 to retain a core as it is forced up said barrel. The upper end of the core barrel 40 may have one or more fluid ports 46 through the wall thereof. Preferably, a valve cage 43 having a ball valve 44 therein, inlet port means 45 and outlet port means 46, is secured to the top of the barrel. Thus, as a core is forced upward into said barrel 40, any water therein is forced through the inlet and outlet port means 45 and 46, respectively. If desired, compression springs 47 and 48, or any other suitable type of shock absorber, may be mounted above and below the prime mover means 38, spring 48 being housed in the closed lower end 25 of the outer casing 24. Preferably, the lower tubing guide 34 serves as upper stop means for limiting the upward travel of the prime mover means 38 within the outer casing 24. The closed lower end of casing 24 serves as lower stop means.

With the prime mover means 38 at its uppermost position within the outer casing 24, the cutting edge 49 of the core barrel 40 may extend slightly below the casing. If a rotary prime mover means is used, a core barrel 50 having cutting teeth 51 in its cutting edge is employed, as shown in Figure 5. One or more fluid port means through the closed end 25 of the casing may be in communication between the annular space 56 (i. d., the space between the tubing member 37 and the outer casing 24) and the outside of said casing. Preferably, the axial bore 32 through the closed lower end 25 of the outer casing 24 is larger in diameter than the outside diameter of the core barrel 40 whereby annular fluid port means are formed between said barrel 40 and casing end 25 for discharging, in a downwardly direction, any fluid pumped through said casing. It is evident, however, that a plurality of openings drilled in the closed lower end 25 of the casing could readily be substituted as the fluid outlet means.

Secured in any suitable manner, as by welding, to the outer casing 24, preferably near the upper end thereof is a fluid inlet port 52. Secured to the tubing member 37 in a similar manner, at or near the upper end thereof, is a similar fluid inlet port 53. Connected to the fluid inlet ports 52 and 53 are conduits 20 and 18, respectively, made of a flexible material such as rubber, canvas, rubberized canvas or the like. Preferably, the conduits 20 and 18 are connected to a universal-joint conduit means such as double swivel joints 54 and 55 which may be flanged to the fluid inlet ports 52 and 53, respectively. Thus the flexible conduit 18, double swivel joint 55 and tubing member 37 form power transmission conduit means in communication between

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the power source 19 on the barge 10 and the prime mover means 38 secured to the lower end of the tubing member 37. In a like manner, the flexible conduit 20, the double swivel joint 54, the annular space 56 between the tubing member 37 and the outer casing 24, the annular space 57 between the prime mover means 38 and the outer casing 24, and the auxiliary openings 36 through the tubing guides 33 and 34, all form fluid conduit means in communication with a pump or compressor 21 on the barge 10 whereby fluid under pressure may be forced through said conduit means and discharged through the axial bore 32 in the closed lower end 25 of the outer casing 24 with a jetting action.

In coring operations, the present coring apparatus 15 is transported by the barge 10 to the desired location where the barge may be anchored. The assembled coring apparatus 15, having the flexible conduits 18 and 20 attached thereto, is lowered by means of the winch 13 and cable 14 to the ocean floor 16 (Figure 1). Since the ocean floor 16 may comprise a layer, several feet thick, of silt, sand, or other relatively loose material above the bedrock 58, it is necessary to force the coring apparatus through this layer of silt until the cutting edge of the core barrel 40 is in contact with the bedrock 58, as shown in Figure 1.

To accomplish this, the pump or compressor 21 on the barge 10 is started so that water, for example, is pumped down through conduit 20, double swivel joint 54, the annular spaces between the outer casing 24 and the tubing member 37, prime mover means 38 and core barrel 40, and out the annular discharge fluid port means between the core barrel 40 and the lower end 25 of the outer casing 24. The fluid, which is discharged downwardly with a strong jetting action, washes or forces any loose material away from the lower end 25 of the outer casing 24, thus permitting the coring apparatus 15 to sink or be lowered to the bedrock 58. As the apparatus 15 is lowered to the bedrock 58, the loose material washed away settles about the outer casing 24 to support the apparatus in a substantially vertical position.

In the event that the ocean floor is substantially free of loose material such as sand, silt, etc., the coring apparatus 15 may be supported in a substantially vertical position by the use of removable support or leg means, as shown in Figure 6. The leg means may be of any suitable construction having, for example, three or more legs 59 secured in any suitable manner, as by welding, to a collar 60 and extending downwardly and outwardly therefrom. The collar 60 may be removably secured to the outside of the casing by bolting. If desired, the legs 59 may be reinforced by cross braces 61 secured to a second collar 62 which is positioned coaxially with regard to collar 60. Also, bearing plates 63 may be secured, as by welding, at or near the lower ends of the legs 59 to prevent said legs to be forced into the ocean floor during coring operations. It is obvious that when the leg means are used to position the coring apparatus 15 on the bedrock 58, the flushing water conduit 20 may be disconnected and the apparatus 15 may be lowered into position having only the power transmission conduit and the cable attached thereto.

When the coring apparatus is positioned against the bedrock 58, as shown in Figure 1, the flow of flushing water is discontinued by shutting off the pump 21 on the barge. The power

source 49, for example, an air compressor, is turned on and compressed air passes through the conduit 24, double swivel joint 55 and tubing member 37 to the prime mover means 33 which, in this case, is a reciprocating air hammer. The reciprocating action of the air hammer 33 forces the core barrel 40 into the bedrock 58 whereby a core is forced upwardly into the barrel, forcing any water therein out through the fluid passages 45 and 46. At the same time that the core barrel 40 is forced into the bedrock, the action of the prime mover means 33 causes it, and the tubing member 27 attached thereto, to slide downward within the tubing guides 33 until the prime mover means contacts the spring 48. At this point the coring barrel 40 is withdrawn into the outer casing 24 by the upward pull on the cable 14 when the coring apparatus 15 is hoisted to the surface and onto the barge 16. During the upward travel of the apparatus to the surface, the core sample (not shown) is held within the core barrel 40 by the core catcher 42. The core is removed from the core barrel 40 or another core barrel is secured to the prime mover means 33 before a second core is obtained.

It will be readily seen from the above description that cores of bedrock underlying a body of water may be easily and quickly obtained with the present apparatus instead of using a cumbersome rotary table carried by a barge and a string of pipe extending therefrom. It may also be seen that due to the use of a flexible cable 14 and flexible conduits 13 and 23 it is not necessary to firmly anchor the barge 16 in place at the coring location while a core is being obtained. Also, the simple and sturdy design of the present coring apparatus permits the taking of cores with a minimum amount of labor and in a relatively short time.

Unlike coring devices used in boreholes, or in rotary coring with a string of pipe, the present coring apparatus is not limited in any manner as to size or shape. The outer casing may be of any desired length, diameter or shape (round, square or polygonal), the length being of importance only in the event that loose material covers the bedrock to be cored. In such a case the length of the outer casing should be great enough to extend through the layer of loose material while the conduit connections remain above the ocean floor, as illustrated in Figure 1.

It is obvious that if an electric motor is used for the prime mover means 33 and if there is no loose material on the ocean floor to wash away before coring, both conduits 13 and 23 may be eliminated and a weight-supporting and current-conducting cable may be used. An embodiment of the present coring apparatus, shown in Figure 7, comprises a longitudinal outer casing 64 and an electric motor 65 mounted for sliding movement therein. Preferably, a motor having a watertight casing is used. A core barrel 66 is secured to the shaft 67 of the motor, said barrel 66 extending through an axial bore in the closed lower end of the outer casing 64. The walls of the axial bore may form a guide or bearing means in which the core barrel 66 turns, or other bearing means may be secured to the lower end of the casing for aligning the barrel 66. Preferably, the motor 65 is mounted for vertical sliding movement on longitudinal guide rails or tracks 68 and 69 which are affixed to the inner wall of the casing 66. A pair of guide blocks 70 and 71 are secured on either side of the motor 65, said blocks having longitudinal slots 72 and

73 (Figure 8) therein which contact the guide rails 68 and 69 to allow vertical movement therealong while limiting any rotational movement of the motor 65. It is obvious that any other suitable type of longitudinal-guide and rotation-limiting means may be employed whenever a rotating type prime mover means is used in the coring apparatus of the present invention.

Referring to Figure 7, the upward and downward movement of the motor 65 within the casing 64 may be limited by compression springs 74 and 75 or other types of shock absorbing means. If desired, a spring-operated follower plate 76 may be movably positioned between the motor 65 and the spring 74. The apparatus is lowered to the ocean floor by a load-supporting conduit means or cable 77 which is also adapted to conduct electrical power from a suitable power source on the accompanying barge. Cables of this type are well known to the art. Any suitable support means may be affixed or removably secured to the outer casing. In this embodiment the support means comprises a platform 78, preferably a plurality of interconnecting rods or bars forming a lattice or grill, a collar 79 secured to the outer casings 64 and a plurality of legs 80 affixed to the platform 78 and the collar 79 to position the outer casing 65 normal to the platform 78.

In the operation of a coring apparatus employing a rotating type prime mover means, such, for example, as the electric motor 65 shown in the embodiment of Figure 7, the weight of the motor is utilized to force the rotating coring barrel 66 into the formation being cored. If desired, additional weights may be secured to the motor.

I claim as my invention:

1. An apparatus adapted to be lowered below the surface of water to obtain cores from submerged formations, comprising in combination an outer elongated cylindrical housing member adapted to be lowered through the water and to be vertically positioned on the formation to be cored, said housing member having axially apertured closures at each end, an elongated inner member axially disposed within said housing member and in spaced relationship thereto to allow passage of fluid therebetween, said inner member comprising prime mover means adapted for limited axial movement within said housing member, a tubing member fixedly connected to said prime mover means to one side thereof, the outer end of said tubing member slidably extending through the upper apertured closure of said outer housing member, a core barrel fixedly connected to the prime mover means to the other side thereof, the outer end of said core barrel slidably extending through the lower apertured closure of said outer housing member, conduit means extending from above the surface in communication with said outer housing member for supplying a pressure fluid thereto, port means in the lower end of said housing member to permit said pressure fluid to jet therefrom, and flexible power transmission conduit means in communication between the surface and said tubing member for supplying motive power to said prime mover means.

2. An apparatus adapted to be lowered below the surface of water to obtain cores from submerged formations, comprising in combination an outer elongated cylindrical housing having axially apertured closures at the upper and lower ends thereof, an elongated inner member axially

disposed within said outer housing and in spaced relationship thereto to allow passage of fluid therebetween, said inner member comprising reciprocating-type prime mover means adapted for limited axial movement within said housing, a tubing member fixedly connected to the top of said prime mover means, the outer end of said tubing member slidably extending through the upper apertured closure of said outer housing, a core barrel fixedly connected to the lower side of said prime mover means, the outer end of said core barrel slidably extending through the lower apertured closure of said outer housing, port means in said lower apertured closure, conduit means extending from above the surface in communication with said outer housing for supplying a pressure fluid thereto, whereby said pressure fluid may be forced through said outer housing and jetted through said port means, flexible power transmission conduit means extending from above the surface in communication with said tubing member for supplying motive power to said prime mover means, and support means secured to the lower end of said outer housing for vertically positioning said apparatus on the formation to be cored.

3. An apparatus adapted to be lowered from a barge on a cable for obtaining cores from formations submerged under a body of water, said apparatus comprising, in combination, an elongated outer housing axially apertured at its lower and upper ends and adapted to be vertically positioned on the formation to be cored, an inner tubing member within the housing, prime mover means affixed to the lower end of said tubing member within the housing, guide means positioning said tubing member and attached prime mover means coaxially within said housing for slidable movement therein, closure means for the annular space between said tubing member and housing at the top thereof, a downwardly extending shaft on said prime mover means, a core barrel coupled at its upper end to said shaft, a major length of said core barrel being adapted to be forced by said prime mover means through the axial aperture in the lower end of the housing, said inner tubing member, prime mover means and the core barrel being in spaced relationship with the inner wall of said housing, fluid discharge means in the lower end of the

housing through the wall thereof, fluid inlet means near the upper end of said housing through the wall thereof, flexible conduit means attached to said fluid inlet means extending to the barge, fluid conducting conduit means attached to the tubing member in communication between said tubing member and the barge, said tubing member forming a power transmission channel within the housing to said prime mover means, said tubing member and prime mover means attached thereto being of a length at least equal to the length of the housing plus the length of the core barrel.

4. An apparatus for obtaining cores from formations submerged under water, comprising in combination an elongated outer housing adapted to be lowered through the water and to be vertically positioned on the formation to be cored, said housing having an axial aperture through its lower end, advancing-type prime mover means mounted for axial movement within said housing, a downwardly-extending core barrel within said housing having its upper end fixedly coupled to said prime mover means, and its lower end in register with said axial aperture in the housing, said prime mover means and said core barrel being in spaced relationship with the inner wall of said housing, conduit means extending from above the surface in communication with said prime mover means for supplying power thereto, whereby the major portion of the length of the core barrel is forced into the formation below the housing by the downward advance of said prime mover means, conduit means extending from above the surface in communication with said outer housing for supplying a pressure fluid thereto, and port means in the lower end of said housing to permit said pressure fluid to jet therefrom.

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