United States Patent

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[54] **DEEP SEA PILE SETTING AND CORING VESSEL**
11 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **175/8,** 175/58
[51] **Int. Cl.** **E21b 15/02**
[50] **Field of Search** 175/5–10; 61/69, 46

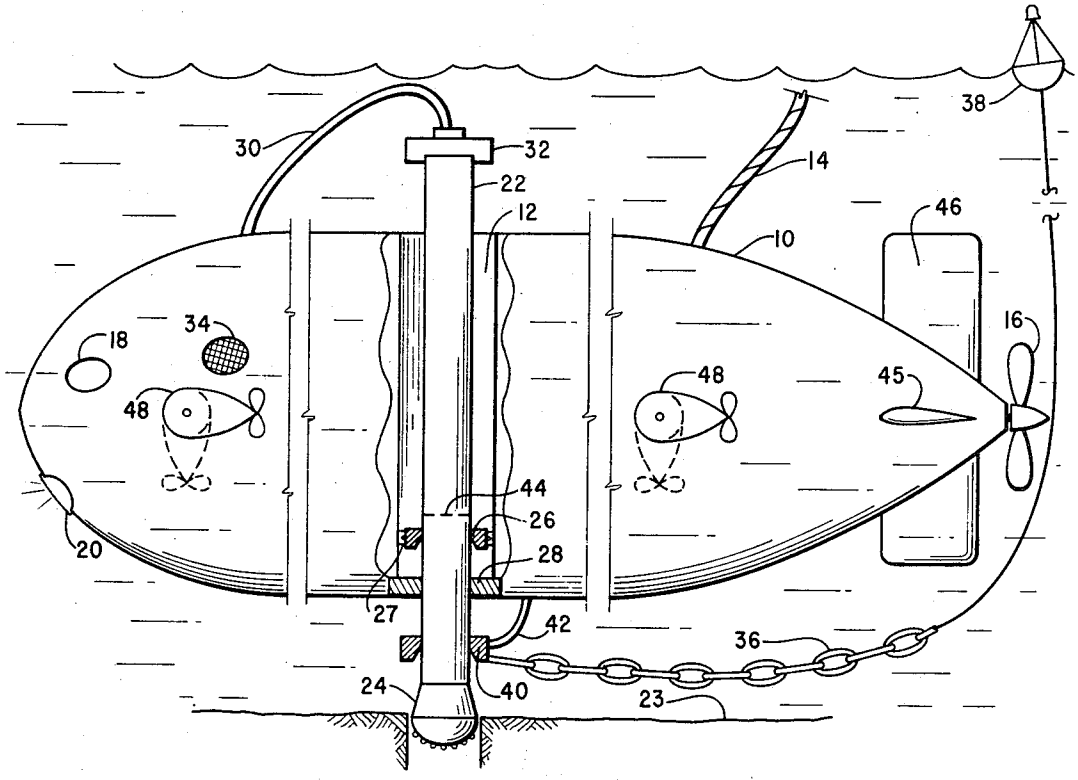
[56] **References Cited**

UNITED STATES PATENTS

2,534,480	12/1950	Shannon	175/8
2,665,885	1/1954	Gignoux	175/6
2,669,431	2/1954	Crowell	175/8 X
2,756,021	7/1956	Townsend	175/9 X
2,783,970	3/1957	Gillespie	175/8 X
3,353,364	11/1967	Blanding et al.	175/6 X
3,456,745	7/1969	Peri	175/5

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ABSTRACT: This invention relates to an underwater, manned vessel useful for drilling in piles, setting anchors and taking samples of the bottom of a body of water. A conventional submarine vessel is modified to have a vertical passage therethrough. The passage contains a rotary table for rotating an anchor pile which extends through the vertical opening. Means are provided to circulate sea water down through the pile during drilling-in operations. Means are also provided to obtain cores from the sea bottom.



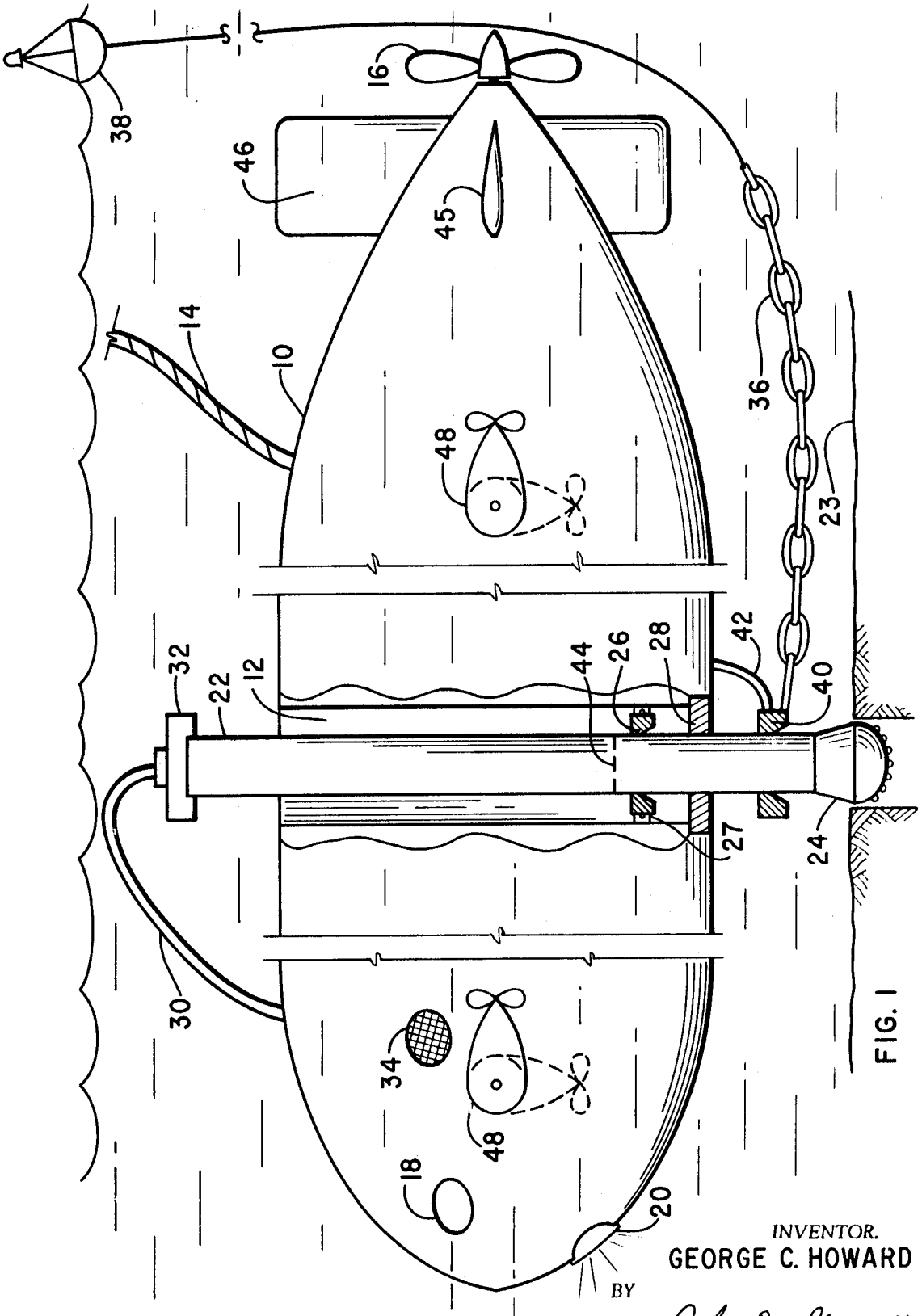


FIG. 1

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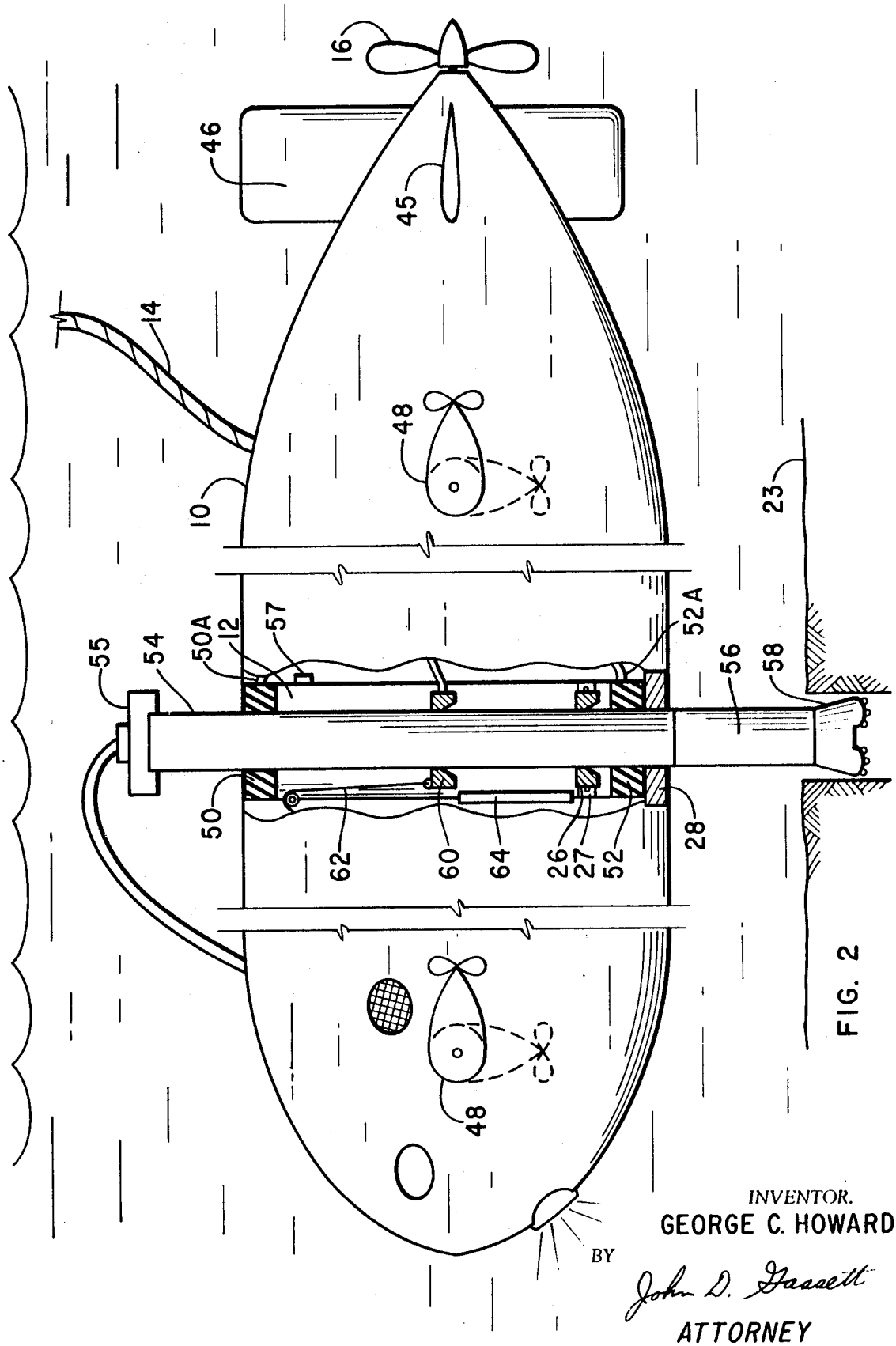


FIG. 2

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DEEP SEA PILE SETTING AND CORING VESSEL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is concerned with the drilling-in of anchor piles into the bottom of a body of water, taking of core samples therefrom and other related operations. More particularly, it is concerned with an underwater vessel which has been modified to carry out these operations.

2. Setting of the Invention

In recent years the search for and drilling for oil deposits has greatly increased in offshore water-covered ares. In such exploration and drilling operations, there are many varied operations required. Some of the necessary operations are the setting of anchor piles in the ocean floor in water that may be several hundred feet to 1,000 feet or more deep, and the obtaining of core samples from the bottom of such body of water. In the past, anchor pilings have ordinarily been set by drilling operations conducted from a vessel floating on the surface of the body of water, or by driving the piles into the sea floor by extending the pile to the surface of the water and using conventional hammer-type pile driver. Most commercial coring operations have also been conducted from vessels floating on the surface. Although these methods have been successful, as the water gets deeper there are more and more problems involved such as, for example, the placing of an anchor piling at an exact location, or maintaining the drilling vessel at a precise location in the open sea.

SUMMARY OF THE INVENTION

This invention concerns a modified submarine vessel for use in drilling in anchor piles, taking cores and related operations conducted on the bottom a body of water. In a preferred embodiment, a submarine is modified to have a vertical passage extending therethrough. The anchor piles to be set are supported in this vertical passage by remotely actuated slips. A bit is attached to the lower end of the pile. Located near the bottom of the passage is a rotary table which is powered to rotate the pile. A flexible hose connects to the upper end of the pile so that sea water can be circulated therethrough. An anchor chain is secured to a slip which attaches it to the pile.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a preferred embodiment of the invention and illustrates, in a partly cutaway view, an anchor piling positioned in the vertical passage of the submarine;

FIG. 2 illustrates a modification of the device of FIG. 1 to facilitate coring operations.

Attention is first directed to FIG. 1 which illustrates a submarine vessel 10. According to this invention the vessel is constructed to contain a vertical passage 12 extending therethrough. Vessel 10 can be similar to any of a number of commercially available subsea vessels. It can be either self-sufficient, i.e., have its own power and air supply, or a multiple conduit line 14 can be connected to a support vessel floating on the surface so that power and air can be brought to the submarine in a known manner. The vessel has a propeller or driving means 16 and guide means including elevations 45 and rudders 46, or propeller or jet-driven, directionally controlled thruster 48, there being typically four, two on each side of this vessel, for example. Suitable observation ports 18 and suitable lights 20 are provided.

A hollow pile 22 having a bit 24 at the lower end thereof is mounted in passage 12. It is held in place by slips 26 remotely operated by means not shown. Slips 26 are rotatably mounted in well 12 as by bearing members 27, for example. It is preferred that pile 22 be square as it simplifies its rotation similarly as with the kelly joint in land operations. A rotary table 28 is provided at the lower end of passage 12 and is driven by a power source not shown but carried within vessel 10.

Means will now be discussed for providing circulating fluid through the pile. This includes a flexible hose 30 connected through a swivel cap 32 on top of pile 22. A pump means, not shown but carried inside vessel 10, obtains suction through port 34 and pumps sea water through hose 30 to the pile down through the bottom of the bit where it returns up the annulus between the pile and the borehole wall and discharges onto the sea bottom 23.

When drilling operations have commenced, reaction from the rotating of the anchor pile must be counteracted. This is done by (1) by mass of the submarine and its resistance to rotation and (2) the suction of the circulating pump through port 34 tends to rotate the vessel in a direction opposite the reaction force. If this is not sufficient, additional thruster means 48 in the form of jets or propellers to counteract the reaction of the drilling operation can be provided.

In addition to rotating the bit 24, drilling progress is greatly improved by the addition of weight thereto. The addition of weight in this case is obtained by deballasting vessel 10. Then the effective weight of the vessel 10 is transferred through slips 26 to pile 22 and to bit 24. The slips, while rotatable in their closed position, prevent the supported pile moving up or down except as the submarine vessel moves up or down. When the vessel rests on bottom, the submarine is lightened and the slips 26 are released, allowing vessel 10 to move upward at this point and the process is repeated.

The anchor chain 36 is connected to a buoy 38 at the surface on one end and at the other end is connected to a slip 40 which is mounted about pile 22. This slip is loosely placed around pile 22 so that as the pile is drilled in, slip 40 will slide upwardly with respect thereto. When drilling operations are finished, slip 40 is actuated so that it securely clamps the pile. This can conveniently be accomplished by having slip 40 be a hydraulically held-open device e which receives hydraulic pressure through line 42 from the interior of the vessel. This hydraulic pressure is released when it is desired that slips engage the pile 22. This is done when the anchor piles have been set and the vessel 10 is to be removed. Then the slips 26 are released and rotary table 28 retracted. At this time hose 30 is severed in any desired way from the top of the pile. Water is pumped out of certain tanks within vessel 10 and the vessel rises above the top of pile 22 which at this time may be as indicated at line 44 near slips 26. The vessel then goes to the surface where it is loaded with another pile 22 so that the drilling and pile setting operations can be repeated.

Frequently it is desired to obtain cores from the bottom of a body of water. This can be accomplished using a modification of the tool, as shown in FIG. 2. There, passage 12 of vessel 10 is modified to have upper seals 50 and lower seals 52. They can be hydraulically actuated seals with hydraulic fluid supplied through hoses 50A and 52A. Placed in passage 12 is a tubular drill member 54 which has a core barrel section 56 which is adjacent coring bit 58. Elevator means are provided for raising and lowering the pipe 54. This includes remotely actuatable elevator slips 60 which are raised and lowered by a cable 62 to a drum means within the vessel 10. As will be seen, a doorway 64 is provided so that access may be had to passage 12 so that cores from section 52 can be repeatedly removed without being returned to the surface. A rotary table 28 is provided below seal 52. Slips 26 are provided the same as in FIG. 1.

In operation, the device in FIG. 2 is maneuvered by an operator to a selected location on the floor of a body of water. There, the device is set down such that bit 58 rests on the floor 23 so that coring operations can be commenced by rotating pipe 54. When a sufficient amount of core is collected into the core barrel section 56, rotation of the pipe is stopped, elevator slips 60 actuated and slips 26 released. The coring assembly is then raised by elevator 60 and cable 62 so that bit 58 is above seal 52. At this time upper seal 50 is actuated to engage drill pipe 54 and lower sealing means 52 is actuated to close off the lower end of vertical passage 12. Water is blown out of passage 12 through conduit 67 by injected high pressure air

through port **57** from a source within vessel **10**. Alternatively, the water can be pumped out by a mechanical pump, not shown. This alternate method has the advantage of having the interior of passage **12** at a low pressure. This is important if the interior of the vessel **10** is maintained at atmospheric pressure. Now door **64** can be opened and the core from within core barrel **56** removed, labeled and placed inside vessel **10**. Door **64** is closed, seals **50** and **52** released and the vessel is moved to the next location at which a core is to be recovered.

The upper end of drill pipe **54** can be closed off with a swivel cap **55** as shown in FIG. **2**, and a circulating hose and pump are provided but not shown, in vessel **10** in a manner described above for FIG. **1**.

While the above embodiments have been shown with a great deal of detail, various modifications thereof can be made without departing from the spirit or scope of the invention.

I claim:

1. A mobile subsea self-propelled vessel for performing undersea operations in a body of water, which comprises:

means supported by said subsea self-propelled vessel for propelling and maneuvering said vessel through said body of water, said propelling being operative independent of externally applied force;

a vertical passage extending through said vessel;

means within said vertical passage for supporting a drill pipe therein; and

means for rotating said pipe.

2. An apparatus as defined in claim **1** including means for circulating fluid through said drill pipe.

3. An apparatus as defined in claim **2** wherein said means for circulating fluid includes a water pump having a suction port opening exterior said vessel, said suction port positioned so that the flow of water thereinto resists reaction in the vessel caused by rotating the drill pipe.

4. An apparatus as defined in claim **1** including an anchor chain and slip means connecting said anchor chain to said pipe.

5. An apparatus as defined in claim **1** including a core barrel connected within said drill pipe, means to raise said drill pipe within said vertical passage and means to isolate the interior of said passage from the surrounding water exterior said vessel.

6. An apparatus as defined in claim **1** including means to remove water from the interior of said vertical passage when its interior is isolated from the exterior thereof.

7. An apparatus as defined claim **1** including a drill bit on the lower end of said drill pipe.

8. A subsea vessel for performing undersea or underwater operations, which comprises:

a vertical passage extending through said vessel;

means within said vertical passage for supporting a drill pipe means therein;

means for rotating said pipe;

means for circulating fluid through said drill pipe including a water pump having a suction port opening exterior said vessel, said suction port positioned so that the flow of water thereinto resists reaction in the vessel caused by rotating the drill pipe.

9. A subsea vessel for performing undersea or underwater operations, which comprises:

a vertical passage extending through said vessel;

means within said vertical passage for supporting a drill pipe means therein;

means for rotating said pipe; and

an anchor chain and slip means connecting said anchor chain to said pipe.

10. A subsea vessel for performing undersea operations, which comprises:

a vertical passage extending through said vessel;

means within said vertical passage for supporting a drill pipe therein;

means for rotating said drill pipe;

a core barrel connected within said drill pipe;

means to raise said drill pipe within said vertical passage;

means to isolate the interior of said passage from the surrounding water exterior said vessel.

11. A method of setting an anchor in the floor of a body of water using a subsea vessel having a vertical passage extending therethrough which comprises:

carrying said anchor in said vertical passage to the vicinity of the location at which the anchor is to be set;

forming a hole at said location and placing said anchor in said hole;

connecting an anchor chain to said anchor.