

[54] **METHOD OF INSTALLING A
COMBINATION PEDESTAL CONDUCTOR
AND CONDUCTOR STRING AT AN
OFFSHORE LOCATION**

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Aug. 24, 1971 Great Britain..... 39,636/71

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[51] Int. Cl. **E21b 7/12, E21b 33/035**
[58] Field of Search **175/5-7;**
166/.5, .6

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[57] **ABSTRACT**

A pedestal conductor, buoyancy member, and conductor string are installed at an offshore location by lowering the conductor string into the borehole during drilling, cementing the conductor string in the borehole, and subsequently lowering the pedestal conductor and the buoyancy member along a drill string to engage said conductor string prior to removing said drill string from said conductor string.

4 Claims, 11 Drawing Figures

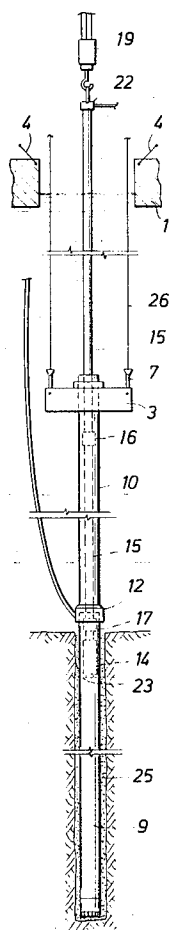


FIG. 1

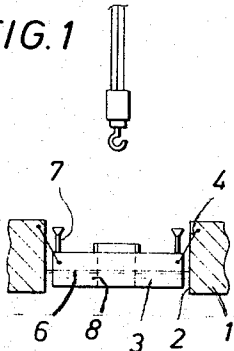


FIG. 2

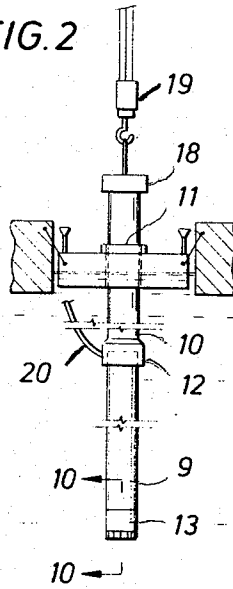


FIG. 3

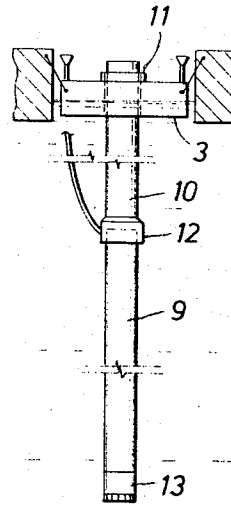


FIG. 4

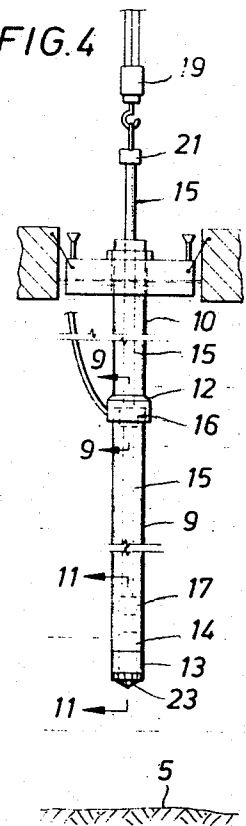


FIG. 9

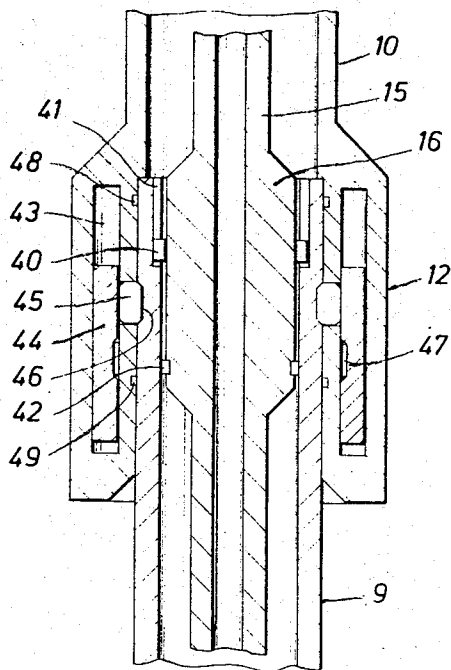


FIG. 10

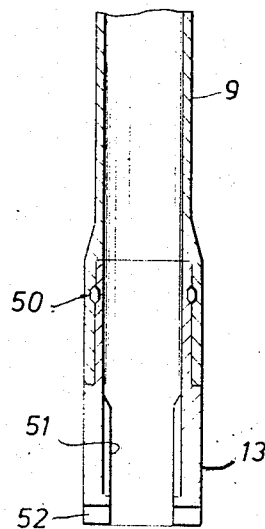
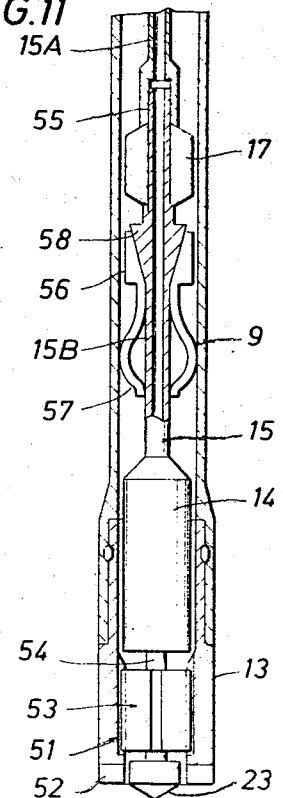


FIG. 11



SHEET 2 OF 2

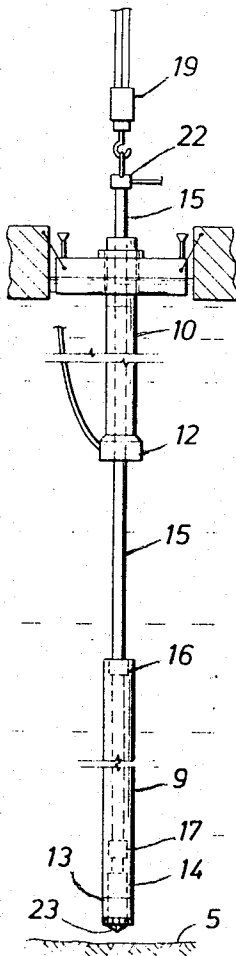


FIG. 5

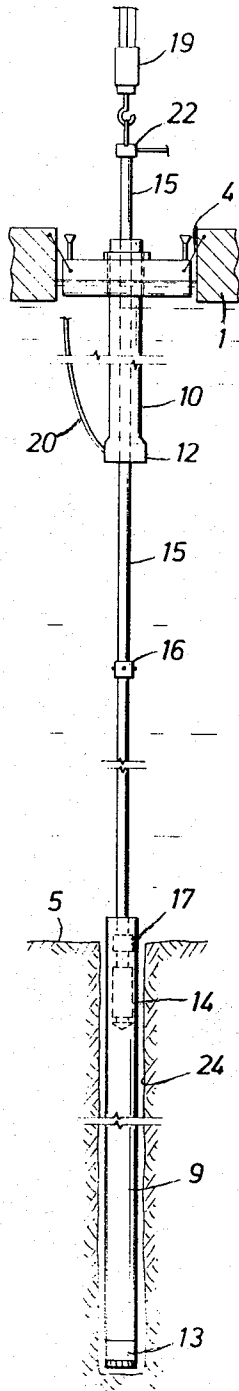


FIG. 6

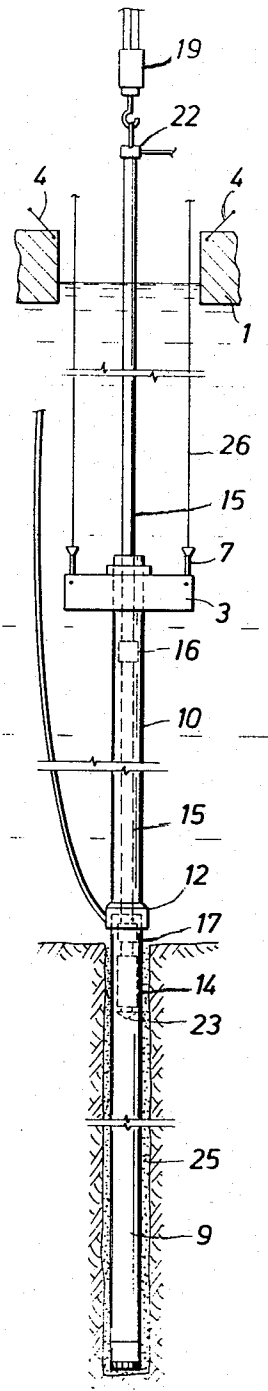


FIG. 7

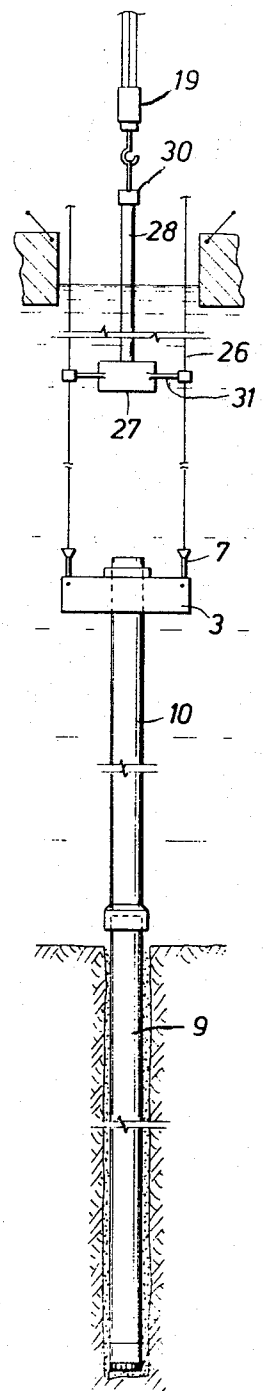


FIG. 8

METHOD OF INSTALLING A COMBINATION PEDESTAL CONDUCTOR AND CONDUCTOR STRING AT AN OFFSHORE LOCATION

BACKGROUND OF THE INVENTION

The present invention relates to a method of placing a pedestal conductor and a conductor string used in drilling a well into a formation located below a body of water.

DESCRIPTION OF PRIOR ART

Numerous methods of drilling underwater wells are well known in the art. One such method utilizes a marine structure supported on the bottom of a body of water and which extends upwardly with a platform disposed above the water level with the drilling installation positioned on the platform structure. A well is then drilled via a conductor string extending from the drilling installation into the formation and wellhead equipment adapted for land operation is installed above the level of the water.

In another method, wells are drilled below a body of water by special equipment using wellheads suitable for use on the bottom of the body of water. The necessary operations to be carried out at the wellhead are performed by divers or by remotely controlled manipulators. This technique is suitable for application in water which is either too deep for placement of permanent marine structures or where structures disposed above the body of water are not permitted for navigation or other reasons.

However, in still deeper water, the placement of wellhead equipment at or near the sea bottom creates problems if repairs to or substitution of equipment can only be effected by divers. In solving these problems, it has already been proposed to place the well head on a pedestal conductor that extends from a level at or below the sea bottom to a level at which divers can easily operate. Such a pedestal conductor is maintained in an upright position by guy-lines and/or by a buoyancy member connected to the top of the conductor and/or by buoyancy members distributed along the length of the conductor.

A major problem affecting the installation of a pedestal conductor in its operative position is the influence of the weather. Deterioration of weather conditions during lowering of a pedestal conductor from a vessel from which the operations take place will endanger the operation and therefore the lowering and coupling operation should take place in a time interval which is as short as possible.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method of installing a pedestal conductor and a conductor string at a subsea location in a quick and reliable manner.

Another object of the present invention is to provide a method of drilling a hole into the sea bottom for placing a conductor string therein followed by the installation of a pedestal conductor on the conductor string without requiring the use of any guide lines for guiding the drilling equipment, conductor string and pedestal conductor to the location where a well is to be drilled.

An even further object of the present invention is to provide a method of placing a pedestal conductor on a well to be drilled into the sea bottom, wherein all the

equipment is suspended from a vessel before making any contact with the sea bottom thereby reducing the time interval in which deterioration of weather conditions could adversely influence the landing operations of the pedestal conductor on the conductor string.

DESCRIPTION OF THE DRAWINGS

The invention will be more fully appreciated by way of reference to the drawings wherein:

FIG. 1-8 show schematically the various steps that are taken to install a pedestal conductor and a conductor string at a desired location on the sea bottom;

FIG. 9 shows a cross-section of the couplings taken along line 9-9 in FIG. 4;

FIG. 10 shows a cross-section of the lower end of the conductor string along line 10-10 of FIG. 2; and

FIG. 11 is a cross-section taken along line 11-11 of FIG. 4 and shows the lower end of the conductor string when the drilling unit is mounted therein.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1-8, there is shown a floating vessel 1 having a passage 2 therethrough of sufficient width to house and allow passage of a buoyancy member 3. The buoyancy member 3 is provided with connecting means 4 to facilitate connecting it to the floating vessel 1. The buoyancy member 3 is partly supported by the body of water which extends between the sea bottom 5 and the water level 6.

Guide posts 7 are mounted on the buoyancy member 3 which can in a later stage of the operations, be used for guiding drilling and completion equipment to the well. A central opening 8 is provided in the buoyancy member 3 to allow the conductor string 9 (FIG. 2) and the pedestal conductor 10 (FIG. 2) to pass therethrough. Coupling means 11 is also provided for coupling the pedestal conductor 10 to the buoyancy member 3 (FIG. 3).

The conductor string 9 is coupled to the pedestal conductor 10 by a coupling 12 which can also be passed through the opening 8 of the buoyancy member 3 when being lowered with the conductor string 9 and the pedestal conductor 10. The coupling 12 (FIG. 9) consists of a thickened portion of the lower end of the wall of the pedestal conductor 10 wherein an annular cylinder 43 housing an annular piston 44 is arranged. Locking dogs 45 are provided for engaging an annular groove 46 in the outer wall of the conductor string 9. By upward displacing of the piston 44, the locking dogs 45 are pressed into the annular groove 47 in the inner wall of the piston 44. Displacement of the locking dogs 45 is accomplished by an axial displacement of the conductor string 9 with respect to the pedestal conductor 10. The slanted edges of the groove 46 in contact with the slanted edges of the locking dogs 45 will then displace the dogs radially outwards and partly into the groove 47 disengaging a coupling 16.

The coupling action of coupling 12 is accomplished by a downward movement of the piston 44. The piston 44 is movable by pressure changes in the upper and lower parts of the cylinder 43. These pressure changes are created by variation of the pressure in the channels of a hose 20 (FIG. 2). The hose 20 and the communication between the channels thereof and the spaces of cylinder 43 are not shown in FIG. 9. Sealing elements 48 and 49 are provided to prevent leakage of fluid through the coupling 12.

In order to fully appreciate the operation of the present invention the sequence of steps which are carried out to install the pedestal conductor 10 on the conductor string 9 after the latter has cemented in a hole in the sea bottom 5 will now be described with reference to FIGS. 1-8.

After the buoyancy member 3 has been installed in the passage 2 of the vessel 1 and connected thereto by means 4 (FIG. 1), the conductor string 9 is lowered (FIG. 2) through the opening 8 by an elevator 18 carried by the travelling block 19 of the derrick (not shown) supported by the vessel 1. Since this type of operation is well-known in the art, no further details of its operation will be described.

When a sufficient length of conductor string has been lowered, the coupling 12 is assembled and the lower end of the pedestal conductor 10 connected thereto, and subsequently lowered through the opening 8 of the buoyancy member 3. The hydraulic control conduit 20 is connected to the coupling 12 and lowered simultaneously therewith to hydraulically operate the coupling 12 as hereinbefore described. After the desired length of the pedestal conductor 10 has been lowered into the water, the conductor 10 is coupled to the buoyancy member 3 by means of a coupling 11 and suspended from the buoyancy member 3 (FIG. 3).

Subsequently a hydraulic turbine 14 carrying a drill bit 23 is lowered through the pedestal conductor 10 and the conductor string 9. The hydraulic turbine 14 is suspended from a drill string 15 which is lowered in sections into the pedestal conductor 10 by the elevator 21 carried by the travelling block 19 of the derrick (not shown) mounted on the vessel 1. Lowering proceeds until the turbine 14 is in a position (FIG. 4) to mate with the cutting shoe 13. When the hydraulic turbine 14 is in engagement with the cutting shoe, the drill pipe 15 is coupled to the conductor string 9 by means of a coupling 16. The coupling 16 consists of a thickened wall portion of the drill string 15, which carries a number of pins 40 to engage an equal number of J-slots 41 arranged in the inner wall of the conductor string 9. The way in which such coupling is actuated is well-known and needs no further explanation. A sealing number 42 is provided to prevent leakage of drilling liquid along the coupling parts.

After the drill pipe 15 is coupled to the conductor string 9 by means of coupling 16, the coupling 12 between the pedestal conductor 10 and the conductor string 9 is uncoupled and the conductor string 9 and the drill string 15 are lowered by adding sections of drill pipe to the top of the drill string 15 until the drill bit 23 rests on the sea bottom 5 (FIG. 5).

Drilling operations are then started by introducing a liquid (such as sea water) to actuate the hydraulic turbine 14 through the drill string 15 via the swivel 22 carried by the travelling block 19. The drilling bit 23, which is connected to the hydraulic turbine 14, and the cutting shoe 13 are in turn actuated by the hydraulic turbine 14 and a hole 24 (FIG. 6) is drilled and the conductor string 9 is lowered as the depth of the hole 24 increases.

When a sufficient depth of the hole has been drilled, coupling 16 is uncoupled and the drill string 15 is partially retracted from the conductor string 9 to a position (FIG. 6) where a packer 17 is still within the conductor string 9. To close off the annular space between the drill string 15 and the conductor string 9 when in

the position as shown in FIG. 6, the packer 17 is set. To accomplish this the drill string 15 is made in two parts 15A and 15B, which are connected by a screw coupling 55 (FIG. 11), which on actuation in one direction moves the parts of the drill string to compress the packer element 17. To this end part 15B is coupled to the inner wall of the conductor string 9 by the slips 56 which are pressed outwardly by a downward movement of the drill string 15. The action of spring elements 57 pressing against the inner wall of the conductor string 9 will then displace the slips 56 relative to the slanted surfaces 58 and clamp the part 15B to the conductor string 9. To prevent undesired setting of the slips during running-in of the drill string 15 into the pedestal conductor and the conductor string, locking dogs co-operating with J-slots (not shown) maintain the springs immovable with respect to the part 15B. When the part 15B has been set in the conductor string 9, rotation of part 15A compresses the packer element 17 closing off the passage through the annular space between the drill string 15 and the conductor string 9. The packer 17 is released by carrying out the operations in reversed order. It will be appreciated that the hole 24 is not deeper than the length of the conductor string 9. Thus the upper end of the conductor string is located above the floor 5 of the body of water and is capable of being coupled to the lower end of the pedestal conductor 10 in a later stage of the operation.

Subsequently, cement is passed through the swivel 22, the drill string 15, the hydraulic turbine 14, the conductor string 9, and the cutting shoe 13 and into the space around the conductor string 9 where it hardens to a cement layer 25 (FIG. 7). The cement is followed by a slug of cleaning liquid, such as water, to clean the interior of the hydraulic turbine 14.

After hardening of the cement, the pedestal conductor 10, together with the buoyancy member 3, is guided downwards along the drill string 15. Before lowering takes place, cables 26 (FIG. 7) are connected to the guide posts 7 of the buoyancy member 3 and the buoyancy member is disconnected from the vessel 1 (by uncoupling the elements 4). Subsequently the buoyancy of the member 3 is decreased by pumping water into this member, and the combination of the member 3 and the pedestal conductor 10 is suspended from the cables 26 which are paid out to lower the lower end of the pedestal conductor 10 gently onto the upper end of the conductor string 9. In this position as shown in FIG. 7, the coupling 12 is again coupled by sending the required signals through the conduit 20. After coupling, the buoyancy of the member 3 is increased again, such as by displacing ballast water from the interior thereof, and the pedestal conductor 10 is put under tension.

The packer 17 is subsequently released and the drill string 15 together with coupling 16, packer 17, hydraulic turbine 14 and drill bit 23 are retracted from the pedestal conductor 10 and stored aboard the vessel 1. Thereafter, a blow-out preventer stack 27 (FIG. 8) is lowered onto the top of the pedestal conductor 10 by means of a string 28 suspended from the travelling block 19 by elevator 30. The stack 27 is guided to the top of the pedestal conductor 10 by means of the cables 26 which act as guide cables for the arms 31 connected to the stack 27. After placement of the stack, all drilling operations for deepening the well take place in a manner known per se, using the guide cables 26 for guiding the required drilling and completion equipment

into and onto the entrance of the pedestal conductor 10.

The lower end of the conductor string 9 carries a rotatable cutting shoe 13, and is shown in detail in FIG. 10. The shoe 13 is rotatably connected to the lower end of string 9 by locking means 50 preventing axial displacement between the shoe 13 and the string 9. The shoe 13 is further provided with a splined section 51 which mates with a splined section of the turbine 14. The lower end of the cutting shoe 13 also carries an annular row of cutting elements such as teeth 52.

As shown in FIG. 11, the central opening of the cutting shoe 13 is surrounded by cutting elements 52 and houses a drill bit 23 which is connected via a splined section 53 to the output shaft 54 of the hydraulic turbine 14. Splined section 53 co-operates with the splined section 51 of the rotatable cutting shoe 13 such that on actuation of the hydraulic turbine the drill bit 23 and the cutting elements 52 of the cutting shoe 13 are rotated in unison thereby drilling a hole into the floor 5 of the body of water, lowering the conductor string 9 as the drilling proceeds.

In the method described with reference to FIGS. 1-8 the conductor string 9 is cemented in the hole 24 before the pedestal conductor 10 is lowered thereon. However, the present invention is not limited to this mode of operation. If desired, the pedestal conductor 10 may be lowered onto the conductor string 9 and coupled thereto before the conductor string 9 is cemented in the hole 24. In this case the drill string 15 preferably remains in the position in which it is coupled to the conductor string 9 by coupling 16. Subsequently, coupling 12 is made, and drill string 15 is uncoupled from the conductor string 9 and retracted, together with packer 17, hydraulic turbine 14 and drill bit 23 to the position as shown in FIG. 7 and the packer 17 is set and cement is injected via the drill string 15, hydraulic turbine 14 and conductor string 9, followed by a slug of cleaning liquid to clean the turbine 14. The packer 17 is released after hardening of the cement around the conductor string 9 to prevent backflow of the cement into the conductor string. Subsequently, drill string 15, packer 17 and turbine 14 together with drill bit 23 are retracted from the pedestal conductor 10 and conventional drilling operations are commenced.

In still another embodiment of the invention, the pedestal conductor 10 is not suspended from the cables 26 as described with reference to FIG. 7 of the drawing, but is coupled by a coupling (not shown) to the drill string 15 and suspended from this drill string in a position in which the drill string is for the greater part retracted from the conductor string. Subsequently, the drill string is lowered until the coupling between the lower end of the pedestal conductor and the upper end of the conductor string can be made. This operation may take place either before or after cementing of the conductor string in the hole drilled into the sea bottom.

It will be appreciated that the method of placing a pedestal conductor and conductor string as described above is a safe way of handling an extremely long pipe strings from a vessel. Since the pedestal conductor is suspended from the vessel while the drilling operation is carried out to lower the conductor string into the sea bottom, the pedestal conductor cannot be lost if drilling operations have to be terminated, even if this were to entail abandoning of the conductor string. Moreover, lowering of the pedestal conductor onto the con-

ductor string once it is positioned in the hole drilled in the sea bottom can take place in a very short time interval as the pedestal conductor is already suspended from the vessel and ready for use.

Since the conductor string does not need to pass through the pedestal conductor, the diameter of the latter may be equal to or only slightly greater than the diameter of the conductor string allowing a more economical pedestal conductor than in prior art operations which require that the conductor string be guided through the pedestal conductor. Moreover, the lighter construction of the pedestal conductor allows the use of a smaller buoyancy member.

It will further be understood that the same results will be obtained by the method according to the invention if the drill string is introduced into the pedestal conductor-conductor string combination in two parts instead of one. To this end the first part of the drill string (carrying a coupling, a packer, a turbine and a drill bit) is introduced into the conductor string and suspended therein by the coupling, just after the conductor string has been made up to its full length. The second part of the drill string is introduced and coupled to the first part thereof, just after the pedestal conductor has been made up to its full length and connected to the buoyancy member by a coupling suitable for the purpose. Subsequently, the coupling between the pedestal conductor and the conductor string is released and the operation proceeds as described already hereinabove with reference to FIGS. 5-8. I claim as my invention:

1. A method of installing a conductor string and a pedestal conductor at an offshore location from a floating structure, said method comprising the steps of:

- suspending a buoyancy member from a floating structure;
- passing a conductor string, first coupling means, and a pedestal conductor consecutively through a central passage of said buoyancy member, said first coupling means connecting said conductor string to said pedestal conductor;
- coupling said pedestal conductor to said buoyancy member and suspending said pedestal conductor and conductor string from said buoyancy member;
- passing a drill string carrying a fluid actuated drilling unit through said pedestal conductor and said conductor string and connecting by means of a second coupling means said drilling unit to the cutting shoe mounted on the lower end of said conductor string;
- uncoupling said first coupling means;
- lowering said conductor string and said drill string by adding sections of drill pipe to the upper end of said drill string;
- flowing drilling fluid through said drill string thereby actuating said drilling unit;
- drilling a hole in the floor of said body of water;
- interrupting said drilling;
- lowering said buoyancy member having said pedestal conductor suspended therefrom until the lower end of the pedestal conductor contacts the upper end of said conductor string;
- coupling said first coupling means; and
- retracting said drill string and said drilling unit to said floating structure.

2. The method of claim 1 further including the steps of:

- uncoupling the second coupling means;

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retracting the drill string partly from the conductor
string;
setting a packer around the drill string;
cementing the conductor string in the hole by inject- 5
ing cement through the drill string and the conduc-
tor string followed by a slug of cleaning fluid;
releasing said packer;
said steps being carried out immediately after the
step of interrupting said drilling action and prior to
the step of lowering said buoyancy member. 10
3. The method according to claim 1 further including
the steps of:
uncoupling the second coupling means;
retracting the drill string partly from the conductor
string; 15
setting a packer around the drill string;
cementing the conductor string in the hole by inject-
ing cement through the drill string and the conduc-
tor string followed by a slug of cleaning fluid; and
releasing the packer; 20
said steps being carried out between the step of cou-
pling said first coupling means and prior to the step
of retracting said drill string.
4. Apparatus for installing a pedestal conductor and
conductor string at an offshore location wherein the 25

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conductor string is lowered into a hole in the sea bot-
tom during the drilling operation, said apparatus com-
prising:
a drill string;
a conductor string adapted to be cemented over sub-
stantially the entire length thereof in a hole drilled
in the sea bottom;
a buoyancy member having a central passage there-
through;
a pedestal conductor adapted to extend between the
upper end of said conductor string and said buoy-
ancy member;
first coupling means adapted to couple said pedestal
conductor to said conductor string; 15
second coupling means adapted to couple said drill
string to the inner wall of said conductor string;
third coupling means adapted to couple said pedestal
conductor to said buoyancy member;
a drilling unit having a drilling bit, said unit being car-
ried by the lower end of said drill string; and
a rotatable cutting shoe carried by the lower end of
said conductor string and adapted to be driven by
said drilling unit.
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