An improved method for inserting conductor pipe in an unconsolidated underwater location by detachably connecting a drill string carrying a drill bit to the inside of a relatively short length of conductor pipe and jetting the pipe into the unconsolidated underwater formations. After the conductor pipe is in place the drill string is detached from the conductor pipe and the hole drilled for receiving a further length of smaller diameter conductor pipe. The smaller length of conductor pipe is cemented to the formation and the annular space between the conductor pipe and the smaller diameter conductor pipe is filled with cement. The well head equipment is attached to the top of the smaller diameter conductor pipe.

This invention relates to a method of drilling underwater wells and, more particularly, to an improved method of inserting conductor pipe at an ocean bottom location where the ocean bottom is relatively soft or unconsolidated.

One method of inserting conductor pipe in unconsolidated ocean bottom locations consists of jetting the conductor into place using a jet string. The length of conductor pipe is suspended from a floating drilling ship and the jet string runs therein and attached to the conductor pipe. Both are lowered to the ocean floor where the jetting operation takes place. Drilling fluid or other fluid such as salt water is pumped down the jet string and out through the jetting ring to wash away the ocean bottom material at the bottom of the conductor pipe such that the conductor pipe sinks into the hole made by the jetting operation. The material displaced by the jetting operation is circulated up the conductor pipe. The jet string is attached to the conductor pipe so that the weight thereof and additional weight such as leaded collars and barite cans which are inserted in the jet string can apply sufficient force to the conductor pipe to cause it to sink into the formation. Of course, the required weight is dependent on the formation at the ocean bottom into which the conductor pipe is being jetted. It is usual for long conductor pipes of wide diameter to be made up in short sections. Thus, it is necessary on the drilling ship or barge to make up the long length of conductor pipe and then to jet it. It will be appreciated that wide diameter conductor pipe is expensive and very difficult to handle. It is necessary in real soft bottom locations to extend a large diameter conductor casing quite deep to get a good footing or grip in the more consolidated formations. Often times cementing the large diameter casing to the formation does not help. The large diameter conductor pipe must be sufficiently held to support the weight of the well head equipment, such as blow out preventers etc.

The present invention overcomes the problems mentioned above by providing an improved method of inserting the conductor pipe in unconsolidated formations which eliminates the necessity of having a long length of wide diameter conductor pipe. In most cases the length of the wide diameter conductor pipe can be cut in half, thus, reducing the expense as well as the handling problems. Furthermore, this improved method eliminates the need to provide a jet string and a pet ring along with the leaded collars and barite cans. Also, the method of the present invention reduces the number of operations necessary to insert the conductor pipe in unconsolidated formations thus cutting down on the amount of time necessary, accordingly cutting costs.

It is the main object of the present invention to provide a method of inserting conductor pipe in unconsolidated underwater location in which a shorter length of wide diameter conductor pipe is utilized.

It is another object of the present invention to provide a method of inserting conductor pipe in unconsolidated underwater locations wherein the need for a separate jetting string and a jetting ring are eliminated.

It is a further object of the present invention to provide a method of inserting conductor pipe in unconsolidated underwater locations wherein fewer operations are necessary.

It is another object of the present invention to provide a method of inserting conductor pipe in unconsolidated underwater locations in less time and at less expense than was heretofore possible.

According to the invention there is provided a method for inserting conductor pipe in unconsolidated underwater locations in which a relatively short length of a large diameter conductor pipe is arranged such that a drill string containing a drill bit may be run therein and detachably connected thereto at the lower end thereof. The conductor pipe is lowered from the floating vessel by means of the drill string to the ocean bottom. Drilling fluid is pumped down the drill string and out through the jetting head so as to act as a jetting tool for jetting a hole in the unconsolidated formation. This jetting action allows the conductor pipe to settle into the hole made thereby by thus sinking the pipe to the desired depth. The drill string is detached from the conductor pipe and the jetting operation proceeds into the formation below the wide diameter conductor pipe. Once the hole has been drilled to the desired depth the drill string and head are pulled and the smaller diameter conductor pipe is lowered from the floating vessel into the wide diameter conductor pipe and eventually into the hole made thereof. This conductor pipe is then cemented in position by pumping cement from the drilling vessel through the conductor pipe so that cement is forced up outside of the conductor pipe to form a good bond between the formation and the pipe. Also, cement is circulated down a cement pipe so that the annular space between the larger diameter conductor pipe and the smaller diameter conductor pipe is filled. The well head equipment is attached to the upper end of the smaller diameter conductor pipe.

The above-mentioned and other features and objectives of this invention and the manner of obtaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment taken in conjunction with the accompanying drawings:

FIG. 1 is a schematic representation of a conductor pipe being lowered into the ocean by means of the drill string from a floating vessel.

FIG. 2 is a vertical sectional view of the conductor pipe of FIG. 1 showing the drill string detachably connected within the conductor pipe.

FIG. 3 is a cross sectional view taken along line 3—3 of FIG. 2 showing more details of the support plate and the detachable connection between the drill string and conductor pipe.

FIG. 4 is a schematic representation of the conductor pipe cemented in position in the well with the well head equipment attached to the inner conductor pipe.

Referring to the embodiment of the invention illustrated...
in FIG. 1, the numeral 10 indicates the earth formations into which it is desired to drill a well. These earth formations underlie a body of water 11 which may be several hundreds of feet in depth. Although the present invention could be used in shallow water as well as deep water, it is depicted in a deep water location wherein the drilling operation is carried out from a floating drilling structure such as a barge or vessel 12.

Once the offshore site has been selected, the vessel or barge 12 is maintained in position over the well site, for example, by anchoring to the bottom. Anchoring cables 14 shown extending from the vessel, however, the anchors are not shown.

The vessel or barge 12 has mounted on it the power source 13, derrick 16, rotary table 15, and other equipment normally used in a rotary drilling operation. In this instance, the derrick 16 is shown as being provided with a travelling block 18 to which is secured a hook 20 or other suitable means for suspending a drill string 22 during drilling operations. A flexible hose 24 is provided and is adapted to be secured to the top of the drill string 22 by means of a swivel 26 of a conventional type whereby drilling fluid may be circulated down through the drill string 22 during the drilling operation. The flexible hose 24 is in communication with the pump 28 which is adapted to circulate the drilling mud 30.

The derrick 16 is positioned over a drilling slot or well 32 which extends vertically through the vessel or barge 12 in a conventional manner. When using the equipment of the present invention, the slot 32 in the barge 12 may be either centrally located or extended from one edge. Operation with the apparatus of the present invention may be carried out over the side of the barge or thru a slot 32.

A large diameter conductor pipe 34 is shown in FIG. 1 suspended from the derrick 16 by means of a drill string 22. The large diameter conductor pipe 34 may be prepared by hanging the conductor pipe 34 from the vessel 12 by suitable means and running the drill pipe or drill collars 22 therein. The conductor pipe 34 can be previously prepared by having a support ring 36 welded therein at the lower end and may also have a further support ring 38 welded therein near the upper end (see FIG. 2). Also, a pair of pad eyes 40 may be attached to each side of the upper end of the conductor pipe 34. Once the drill string 22 is in position within the conductor pipe 34, that is, with the drill bit 42 near the lower end of the conductor pipe 34, the support plates 44 and 46 which surround the drill string 22 and which may be put on the drill string 22 before the bit 42 is attached, may be connected. The lower support plate 44 shown nearest the drill bit 42, is attached to the lower support ring 36 and to the drill string 22 by means of shear pins 48 and 48A, respectively.

The shear pins 48A are inserted prior to the running of the drill string in the conductor while the shear pins 48 are inserted when the drill string 22 within the conductor 34 is supported on the seat 52 of support ring 36. At this time the shear pins 48 are driven into openings provided in the conductor 34 so that they pass thru an opening in the support ring 36 till they enter the hole provided in the support plate 44. The drill string 22 carrying the support plate 44 attached thereto by shear pins 48A may have to be turned to align the hole in the support plate 44 with the shear pins 48 being inserted.

In the event it is not convenient to insert the shear pins 48 as just outlined, the pins may be preinserted in support plate 44 and spring loaded for automatic insertion. The springs urging the pins outwardly of the support plate 44. The support ring 36 would be curved in such a manner that the shear pins 48A are forced in against the spring when the support plate 44 is approaching seat 52. At this time the drill string can be turned until the shear pins 48 are aligned with a hole provided in the support ring 36. When alignment of the pins and holes are made, the pins will be pushed into this corresponding hole by the spring force. The upper support or stabilizing plate 46 is connected to the upper support ring 38 also by means of shear pins 50. The upper support plate 46 is not connected to the drill string 22 and thus merely serves as a stabilizing or guide plate. It should be noted that the support rings 36, 38 have seats 52 thereon upon which the support plates 44, 46 when in position are seated. It should be noted that the lower support plate 44 is of a smaller diameter than the upper support or stabilizing plate 46 so that the lower support plate 44 when removed by pulling the drill string 22 will easily pass the upper support ring 38.

Once the large diameter conductor pipe 34 is made up with the drill string 22 detachably connected therein, guide lines 34 are attached to the previously installed pad eyes 40 and the conductor pipe 34 lowered by means of the drill string 22 to the ocean bottom 33 where it is desired to drill the well. Since this particular method is to be utilized in connection with ocean bottoms where the formations are unconsolidated, that is, where they are soft, the conductor pipe 34 due to its own weight will sink somewhat into the bottom. Drilling mud 30 or other fluid is now pumped down the drill string 22 and the drill bit 42 to bottom the hole for setting a hole in the unconsolidated formations 10 into which the attached conductor pipe 34 settles. In the usual jetting operation for conductor pipe, a heavy jetting string and jetting ring are utilized which, once the conductor pipe is in position, are withdrawn and the jetting string and ring are replaced with the drill string and bit which are lowered into the conductor pipe to proceed with the drilling of the hole. In the present invention the full weight of the drill string 22 and bit 42 is now applied to the shear pins 48A of support plate 44 which are designed to shear at this particular weight. The shear pins 48A may also be designed to shear because of torque which can be applied thereto by applying the turning force to the drill string 22 by means of the draw works 56 etc. located on the drilling barge 12 above. In any event, once the drill bit 42 and string 22 are detached from the support plate 44, the drilling of a hole suitable for inserting the further conductor pipe 58 can commence.

The hole beneath the large diameter conductor pipe 34 is drilled to a depth such that the further conductor pipe 58 when inserted therein will sit on the bottom of the hole and extend to the mud line 60 up through the large diameter conductor pipe 34. Once this hole is drilled, the drill string 22 and drill bit 42 are pulled thru the hole by means of the derrick 16 out of the floating barge 12. As previously mentioned, the support plate 44 and the stabilizing plate 46 are removed from the conductor pipe 34 along with the drill string 22 and drill bit 42. The further conductor pipe 58 is now made up at the drilling vessel 12 and lowered by means of the derrick 16 from the surface toward the ocean bottom.

The further conductor pipe 58 as it is lowered from the vessel 12 is guided along the guide lines 54 by guide means, not shown, such that the further conductor pipe 58 will enter the large diameter conductor pipe 34 and proceed therethrough. After the further conductor pipe 58 is set on the bottom of the hole, this conductor pipe 58 is cemented to the formation in the known manner. Also, cement 62 is introduced into the annular space between the further conductor 58 and the large diameter conductor pipe 34. This is easily accomplished by providing one or more cement lines 64 which extend into the space between the two conductor pipes 34, 58 thus allowing cement 62 in a fluid state to flow from the barge 12 into the annular space.

The two conductors 34, 58 cemented into position are shown in FIG. 4. It will be appreciated, that even though the formation 10 through which the large diameter conductor pipe 34 has been inserted is very soft and unconsolidated, the large diameter conductor pipe 34 is not only held in position by the surrounding formation 10 but is supported by the deeper extending further conduc-
tor pipe 58 which is cemented into the formation and also cemented to the large diameter conductor pipe 34. The well head equipment 66, such as the blow out preventers etc., is attached to the top of the further conductor 58 that extends through the large diameter conductor 34 to the mud line or ocean bottom. The weight of the well head 66 is not, therefore, applied directly to the large diameter conductor pipe 34 but is distributed through the cement 62 to the large diameter conductor pipe 34 and to the further conductor pipe 58 which is seated deeper in the more dense formations and which is cemented therein. Thus, a shorter length of large diameter conductor pipe 34 can be used in this arrangement than has been the case heretofore in unconsolidated formations.

Obviously, many modifications and variations of the invention as hereinabove set forth, may be made without departing from the spirit and scope thereof, and therefore, only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. The method of inserting conductor pipe in unconsolidated ocean bottom formations comprising the steps of:

(a) locating a floating drilling structure over the proposed well site,
(b) positioning a wide diameter length of conductor pipe for lowering to the ocean bottom,
(c) running a drill string having a drill bit attached thereto through the wide diameter conductor pipe,
(d) detachably connecting said drill string to the conductor pipe near the bottom thereof,
(e) attaching guide lines to the top of the conductor pipe,
(f) lowering the conductor pipe bottom first from the floating drilling structure to the ocean bottom by means of said drilling string,
(g) pumping fluid down the drill string and out of the drill bit to provide jetting action to wash out a hole in the ocean bottom underneath said conductor pipe so that the conductor pipe is inserted in the ocean bottom to the desired depth,
(h) detach ing said drill string from said conductor pipe,
(i) drilling a hole with said drill string and drill bit to a desired depth for a second conductor pipe having a narrower diameter than said wide diameter conductor pipe,
(j) pulling said drill string from the well,
(k) lowering said second conductor pipe from said vessel into said well, said second conductor pipe extending through said first conductor pipe and being concentric therewith when in position,
(l) cementing said second conductor into the formation,
(m) filling the annular space between said first and second conductor with cement,
(n) and attaching the well head equipment to the top of said second conductor.

2. The method according to claim 1, wherein said drill string is detachably connected to said conductor pipe by locating a support ring in said conductor pipe and locating a circular support plate about said drill string, and connecting said support plate to said drill string and said support ring by shear pins.

3. The method according to claim 1, wherein said drill string is maintained in the middle of said conductor pipe by a guide plate detachably connected to said conductor pipe.

4. The method according to claim 1, wherein said guide plate is detached from said conductor pipe by said drill bit when the drill string is being removed from said conductor pipe after drilling the hole the second conductor pipe and both said support plate and guide plate are removed with said drill string.

5. A method of inserting conductor pipe in an unconsolidated underwater formation comprising the steps of:

(a) locating a floating drilling structure over the well site,
(b) positioning a wide diameter length of conductor pipe for lowering to the ocean bottom,
(c) running a drill string having a drill bit attached thereto through the wide diameter conductor pipe,
(d) detachably connecting said drill string to the conductor pipe near the bottom thereof,
(e) attaching guide lines to the top of the conductor pipe,
(f) lowering said conductor pipe bottom first from the floating structure to the underwater well location by means of said drill string,
(g) pumping fluid down the drill string and out of the drill bit to provide jetting action to wash out a hole in the ocean bottom at the bottom of said conductor pipe so that the conductor pipe descends therein to the desired position,
(h) detach ing said drill string from said conductor pipe,
(i) drilling a hole with said drill string and drill bit to a desired depth for the second conductor pipe,
(j) pulling said drill string from the well,
(k) lowering said second conductor pipe from said vessel and guiding it by means of said guide lines into said well, said second conductor pipe extending through said first conductor pipe and being concentric therewith when in position,
(l) cementing said second conductor pipe into the formation,
(m) filling the annular space between said first and second conductors with cement,
(n) and attaching the well head equipment to the top of said second conductor.

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CHARLES E. O'CONNELL, Primary Examiner.
R. E. FAVREAU, Assistant Examiner.

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