METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

Filed Dec. 21, 1967

FIG. 1

FIG. 2

FIG. 3

William W. Word, Jr.
INVENTOR

BY Arnold, Roylance,
Kruger & Durkee
ATTORNEYS
METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

William W. Word, Jr., Houston, Tex., assignor to Armco Steel Corporation, a corporation of Ohio
Filed Dec. 21, 1967, Ser. No. 692,287

Int. Cl. E21b 7/12

ABSTRACT OF THE DISCLOSURE

Methods and apparatus operable from a floating platform for inserting a large diameter conductor in an offshore oil well without the necessity for a temporary guide base. The casing is suspended concentrically about the rotating drill string and stationary relative to the rotation of the drilling string whereby the casing is urged into the borehole behind the drill bit.

This invention relates generally to methods and apparatus for drilling offshore oil and gas wells, and more particularly relates to improved methods and apparatus for drilling such wells from a floating barge such as a barge or ship.

BACKGROUND AND PRIOR ART

It is well known that many oil wells are drilled into submerged ocean beds lying one-hundred feet or more below the surface of the water, and that an anchored ship or barge specially designed for this purpose is often used as a drilling platform to support the derrick and other drilling equipment. When a well is drilled on dry land, the drilling platform is obviously positioned in a stable manner immediately above the mouth of the borehole. However, it will be apparent that a floating platform creates many special problems—even when securely anchored—since it will tend to shift about above the mouth of the borehole due to rise and fall of the surface of the water, and also due partly to stretch of the anchoring cables. Moreover, the vertical distance or spacing between the floating platform and the mouth of the borehole, which is usually only a few feet for platforms mounted on dry land, is often 100 to 150 feet or greater in the case of offshore wells, depending upon the depth of the water at the location of the well. Finally, and perhaps most important, this distance or vertical spacing between the platform and the mouth of the borehole is not fixed but varies substantially due to wave action, tides, and atmospheric conditions.

Another abnormal feature in the drilling of offshore wells as compared with wells on dry land, is that there is a substantially greater tendency for the initial 100 to 150 feet of a submerged borehole to "cave in" or collapse. Accordingly, it is common practice to drill this initial section of the borehole with a bit capable of cutting a relatively large diameter hole, and to insert a large diameter steel casing or "conductor" in this section of the borehole. Thereafter, the large diameter bit is usually replaced with one of smaller diameter, and a further deeper section of borehole may be drilled to accommodate a string of well casing of smaller diameter which is "landed" or supported on the top end of the conductor casing by a conventional casing hanger. Other further sections or lengths of the borehole may also be drilled in this manner, if desired, each to accommodate a string of well casing each of which, in turn, is of a progressively smaller diameter than that of the preceding casing string, and each may be landed on or in the conductor by its respective casing hanger. The greater portion of an offshore well is, however, left uncased during drilling operations, just as in the case of a well being drilled on dry land, except that casing may be added after drilling operations have been completed.

Most oil wells are drilled with a bit or cutting tool mounted on the bottom end of a rotatable string of drill pipe suspended from the drilling platform. As is well known in the industry, it is necessary to periodically remove the drill string from the borehole for the purpose of inserting the aforementioned casing strings into the borehole, as well as to periodically replace a worn out or damaged drill bit with a new bit.

On dry land, it is a relatively simple matter to stab a length of casing or drill string into the mouth of the borehole, since the mouth of the borehole is clearly visible and is spaced only a few feet below the drilling platform, and since the drilling platform is stable. In the case of an offshore well, however, it will be apparent that the task of inserting the drill string or casing into the well is much more formidable. Accordingly, it is conventional practice to first land a so-called "temporary" guide base on the ocean floor at the place to be drilled, which is a platform-like structure having a drilling aperture in its center, and having a plurality of cables or guide lines extending upward therefore from the floating platform. Thereafter the drill string and bit, or the casing string, intended to be inserted into the borehole, may be guided into position by means of rigid guide arms attached to the bit or lower end of the casing, and extending outwardly thereof to connections slidably attached to the guide lines. An example of the configuration and use of a temporary guide base may be seen in U.S. Pat. No. 3,025,916.

After the initial section of the borehole has been drilled, it is usually the practice to lower a "main" guide base into position together with the aforementioned conductor to rest on top of the temporary guide base, which is thereafter abandoned. It is the function of the main guide base to support guide lines extending to the floating platform in the manner as herebefore described with respect to the temporary guide base.

After the blowout preventer is installed or landed on at the upper end of the conductor, it is then conventional to connect a flexible "riser" between the top of the blowout preventer and the floating platform. Thereafter, the drill string and bit is inserted into the upper end of this riser for the purpose of guiding the bit into the borehole.

It is well known that it is extremely expensive to drill the shallowest of oil wells on dry land. What is not generally known outside the industry, however, is that the cost of drilling a well is directly related to the time required. Thus, it will be apparent that it is especially desirable in the case of offshore wells to eliminate as many time consuming operations as may be possible.

In particular, it has long been desired to eliminate the installation of the temporary guide base since this would shorten rig time by two or three full days or more and
3,519,071

consequently save upwards of $10,000–$25,000 or more each day towards the overall cost of the well. However, no practical technique has until now been suggested for installing the aforementioned conductor or first casing into the borehole of an offshore well without the use of both the temporary and main guide bases hereinbefore described.

Accordingly, these disadvantages of the prior art are overcome with the present invention, and novel methods and apparatus are provided for drilling an offshore oil or gas well from a floating platform, and for installing the conductor in such well, without the necessity or use of a temporary guide base of the type hereinbefore described.

SUMMARY OF INVENTION

In a particularly useful embodiment of the present invention, a drill string and expandable bit is first inserted in and through the conductor or a single length of large diameter casing having an anti-rotation device detachably or severably. The purpose of the anti-rotation device is to keep the conductor from rotating while the drill string is being revolved, and to permit the conductor to follow the drill bit down the borehole throughout a distance substantially corresponding to the length of the conductor while the borehole is being drilled. Accordingly, the conductor may be retrieved from the deep well or located at the point of investment, by means of a smooth bearing, one key longitudinally arranged along its exterior surface, and the anti-rotation device provided with a corresponding keyway for accommodating such a key.

In a preferred embodiment, the anti-rotation device includes a flat platform-like base member having two or more downwardly directed pointed members adapted to be embedded in the ocean floor to anchor the assembly and keep it from being revolved on the ocean floor by rotation of the drill string within the conductor. The base member is provided with a centrally-located aperture through which the lower end of the conductor may be slidably inserted, and is preferably secured to the conductor by shear pins or other breakaway means which are severable by some convenient means such as the weight of the conductor.

Although the drill string is preferably fitted with an expandable bit adapted to drill a borehole having a diameter slightly larger than the outside diameter of the conductor, the weight of the conductor alone may in some cases be insufficient to cause the conductor to follow the bit into the borehole. Accordingly, an annular cap-like connector may be attached to the top end of the conductor and be rotatably interconnected with the drill string by means of a special bearing section, whereby the conductor may be pulled down into the borehole by the weight of the drill string and thereafter cemented in a conventional manner.

After the section of borehole has been drilled which is to be cased as hereinbefore explained, it is only necessary to install the main guide base before drilling operations are conventional manner. Accordingly, the main guide base may be initially disposed about the upper end of the conductor, and be lowered to the ocean floor as the conductor is fed or pulled into the borehole by the drill string until it rests on top of the imbedded anti-rotation device. Thereafter, the drill string and bit may be withdrawn as hereinbefore explained, a blowout preventer or other apparatus may be lowered into place over the mouth of the borehole as hereinbefore explained, the riser installed, and the drill bit may be reinserted into the borehole in a conventional manner to complete the drilling operation.

THE DRAWINGS

The aforementioned advantages and features of the present invention, as well as others, will be apparent from the detailed description hereinafter set forth, wherein reference is made to the following drawings.

In the drawings.

FIG. 1 is a pictorial representation, partly in cross section, of one embodiment of the present invention wherein a casing having a suitable anti-rotation device at one end, and a main guide base at the other, is disposed in the water between the submerged earth and a typical floating drilling platform preparatory to drilling the borehole.

FIG. 2 is a similar representation wherein the anti-rotation device is shown to be imbedded in the submerged ocean floor and detached from the lower end of the casing, and where the casing is represented to be following the drill string into the borehole with the main guide base still attached to the upper end of the casing.

FIG. 3 is a similar representation illustrating that stage of the drilling operation wherein the initial section of the borehole has been drilled and the casing installed therein, and wherein the main guide base has been installed at the bottom of the water on top of the anti-rotation device.

FIG. 4 is a similar representation illustrating a further stage of the drilling operation, wherein the drill string and bit has been removed from the casing, and wherein a blowout preventer or other item of equipment is being lowered to the mouth of the casing by means of the guide lines attached to the main guide base.

FIG. 5 is a similar representation illustrating a further stage of the drilling operation, wherein the blowout preventer has been installed at the mouth of the borehole, and wherein the riser is being lowered into the water for attachment to the upper end of the blowout preventer.

FIG. 6 is a representation, partly in cross section and partly pictorial, of the details of the apparatus depicted in FIG. 1.

FIG. 7 is a cross-sectional representation of the details of an exemplary embodiment of the connector illustrated in FIGS. 1–6.

FIG. 8 is a detailed representation, partly in cross section, of one view of an exemplary embodiment of the anti-rotation device illustrated in FIGS. 1–6.

FIG. 9 is a further view of the anti-rotation device depicted in FIG. 8.

DETAILED DESCRIPTION

Referring now to FIGS. 1–5, there may be seen an illustrative example of the present invention wherein a borehole is to be drilled and partially cased without the necessity for first installing a temporary guide base as hereinbefore described. In particular, FIG. 1 depicts a typical offshore location wherein a borehole 14 is sought to be drilled from a ship or other floating platform 2 into the floor 4 of the ocean 6. A single length of steel casing 8, having a large diameter such as 30 inches and hereinbefore termed the "conductor," is shown disposed about a rotatable drill string 10 and expandable drill bit 12. Since the borehole 14 is expected to receive and accommodate the casing 8 along an initial presellected length corresponding generally to the length of the casing 8, the drill bit 12 is preferably provided with upper extendable cutting teeth 16 capable of enlarging the borehole 14 to accommodate the casing 8, as well as lower cutting teeth or cones 18 of more conventional size and design. Moreover, the upper cutting teeth 16 are preferably collapsible so that the drill bit 12 and string 10 may be withdrawn through the casing 8 after it has been inserted in the borehole 14.

As hereinbefore stated, it is desirable to prevent the casing 8 from rotating while the borehole 14 is being drilled by the rotating drill string 10 and bit 12. Accordingly, a suitable anti-rotation device 20 preferably adapted to rest substantially immovably on the ocean floor 4, may be attached to the lower end of the casing 8 in a manner such that the anti-rotation device 20 will support the casing 8 against rotation by the drill string 10, but will permit slideable movement of the casing 8 through the anti-rotation device 20 into the borehole 14.
The drill string 10 may include a suitable stabilizer 22 to prevent damage to the drill string 10 or casing 8 due to eccentric movement of the drill string 10 as it is rotated in the casing 8. A suitable cap connector 24, which is hereinafter described in detail, is preferably incorporated at the upper end of the casing 8 for urging the casing 8 into the borehole 14 as it is drifted, and for cooperating with the stabilizer 22 to restrain the drill string 10 from eccentric movement in the casing 8. In addition, a suitable main guide base 26 is disposed about the upper end of the casing 8 to be lowered into position at the ocean floor 4 as the casing 8 is urged or lowered into the borehole 14 and through the drill bit 12.

Referring now to FIG. 2, there may be seen a representation of the posture of the apparatus depicted in FIG. 1 while the initial section of the borehole 14 is being drilled. More particularly, the anti-rotation device 20 may be seen to be fixedly positioned on the ocean floor 4 at the mouth of the borehole 14, while the casing 8 is being slidably moved through the anti-rotation device 20 and into the borehole 14 by means of the cap connector 24 attached to the drill string 10. In addition, the main guide base 26 at the upper end of the casing 8 is being lowered from the drilling platform 2 to the ocean floor 4 in concert with the casing 8.

Referring now to FIG. 3, there may be seen a representation of the posture of the apparatus depicted in FIGS. 1–2, showing the relative position or arrangement of the equipment after the initial section of the borehole 14 has been drilled to an initial preselected depth generally corresponding to the length of the casing 8. In particular, the casing 8 may be seen to be substantially entirely inserted in the borehole 14, and the main guide base 26 may be seen to be resting on the ocean floor 4 and anti-rotation device 20. As depicted, the upper end of the casing 8 may conveniently be permitted to extend above the guide base 26. The cap connector 24 is shown to have been disconnected from the upper end of the casing 8, and the drill string 10 and bit 12 has been withdrawn from the borehole 14 and casing 8 inserted therein, and is being hoisted to the surface of the water 6 and the drilling platform 2.

Referring now to FIG. 4, there may be seen a representation of the apparatus depicted in FIGS. 1–3 at a further stage of the drilling operation, wherein the borehole 14 is depicted as having been drilled to a further depth, and wherein the conductor casing 8 has been fully inserted in the borehole 14 as hereinbefore described. In addition, the outer one of the two casing 8, of a smaller diameter has been disposed inside of the casing 8 so as to extend into and case off a further deeper section of the borehole 14 as has been previously explained.

As may also be seen, the drill string 10 and bit 12 depicted in FIGS. 1–3 have been removed from the borehole 14, and the blowout preventer 28 is illustrated being lowered to the main guide base 26 by means of suitable handling means 30 or by the drill string, and by rigid guide arms 27 and 29 which are slidably attached to the guide lines 26A and 26B extending from the main guide base 26 to the drilling platform 2. Accordingly, it will be apparent that the guide arms 27 and 29, together with the guide lines 26A and 26B, function to permit the blowout preventer 28 to be lowered from the shifting platform 2 directly to the mouth of the borehole 14 in a convenient manner.

Referring now to FIG. 5, there may be seen a representation of the posture of the apparatus depicted in FIGS. 1–4, wherein the blowout preventer 28 has been landed at the mouth of the borehole 14 to receive the lower end of the riser 32 hereinbefore mentioned. It may further be seen that rigid guide arms 31 and 33 slidably attached to the guide lines 26A and 26B may conveniently be used to guide the lower end of the riser 32 into connection with the top of the blowout preventer 28. Thereafter, the drill string 10 and bit 12 may be reinserted into the borehole 14 by way of the riser 32 and blowout preventer 28, and drilling may be resumed in a conventional manner.

FIG. 6 includes a more detailed representation of the combination of the casing 8, anti-rotation device 20, cap connector 24, main guide base 26, and the drill string 10 and bit 12 contained therein. In particular, the casing 8 may be a single length or "joint" of large diameter steel pipe or tubing of conventional design, but being preferably provided with a first key 40 longitudinally located on its exterior surface, and a second key 41 arranged longitudinally on its exterior surface and positioned 180° from the first key. The anti-rotation device 20 which is attached to the lower end of the casing 8, and which will hereinafter be described in greater detail, is essentially composed of a horizontal base member 42 having a plurality of downwardly directed vertical members 43 and 44. As may also be seen, it is the function of the vertical members 43 and 44 to penetrate the ocean floor 4 to hold the base member 42 in a non-rotatable posture. Accordingly, the vertical members 43 and 44 are each preferably provided with pointed lower ends to facilitate deep penetration of the submersed earth. It is intended that the anti-rotation device 20 be driven firmly and relatively fixedly into the ocean floor 4 by only the weight of the anti-rotation device 20 for reasons which will hereinafter be apparent. However, explosive setting devices (not depicted) having upwardly directed jets may be included in those instances wherein the ocean floor 4 may be composed of coral or other highly consolidated material.

As may be seen, the lower end of the casing 8 and keys 40 and 41 are inserted through a suitably shaped aperture 45 shaped to slidably grip the exterior surface of the casing 8 and provided with keyways 46 and 47 suitably shaped to accommodate the keys 40 and 41 for the purpose of preventing the casing 8 from rotating. It is further expected that the anti-rotation device 20 be supported by the casing 8 during the period of lowering it from the drilling platform to the ocean floor 4, and thus shear pins (see FIGS. 8, 9) or other detachable retaining means may be included therewith.

The drill string 10 may be assembled from a suitable number of lengths or joints of conventional hose pipe, except that a special bearing section 48 having a flange 49 arranged and located thereon is preferably included for interconnection with the cap connector 24. As functionally suggested, upper and lower annular thrust bearings 50 and 51 are preferably provided in the connector 24 to facilitate rotation of the bearing section 48 and flange 49 with respect to the connector 24 which is preferably fixedly attached to the upper end of the casing 8 by hydraulically detachable pins 52 and 53 or other suitable retaining means. As depicted, a suitable locking insert 66 may be provided for securing the connector 24 to the drill string 8.

The main guide base 26 is essentially of conventional design and composed basically of a horizontally arranged platform or base member 54 supporting at least two spaced apart vertical column members 55 and 56 securing the guide lines 26A and 26B. The base member 54 is further provided with a centrally located aperture 57 through which the upper end of the casing 8 may be inserted and by which the main guide base 26 may be fixedly attached if desired.

Referring now to FIG. 7, there may be seen a more detailed representation of a suitable embodiment of the cap connector 24, the bearing section 48, the drill string 10, and the upper end of the casing 8, hereinbefore depicted and described. In particular, there is depicted the tubular bearing section 48 having an annular bearing flange 49, and having internal threads 48A at one end and external threads 48B at the other end for interconnection with adjacent lengths of drill pipe (not depicted).
in the drill string 10. In addition, a central longitudinal aperture or channel 48C is preferably provided by which drilling mud or water may be conducted down through the drill string 10 to the cutting cones 18 on the drill bit 12 in a conventional manner.

The cap connector 24 depicted in FIG. 7 may be seen to be essentially composed of a bearing coupling member 60 disposed about the bearing section 48 and positioned on top of the casing 8, and a main body connector 62 which functions to couple the bearing coupling member 60 to the top end of the casing 8. In particular, the bearing coupling member 60 may be seen to comprise two lower and upper annular or ring-shaped thrust bearings 50 and 51 disposed above and below the bearing flange 49, and between the bearing section 48 and the inside surface of an annular retaining member 64. A locking insert 66 is preferably fastened to the retaining member 64 by means of recessed bolts 57 and 68, and suitable O-ring gaskets 69-71 may be included as dust seals if desired. In addition, flow ports 72 and 73 may be provided as an exit means for the water or drilling mud flowing upward through the annular space in the casing 8. A conventional grease port 74 may also be provided for the purpose of applying suitable lubricants to the thrust bearings 50 and 51.

The main body connector 62 may be seen to be composed of a coupling ring 80 slidably disposed about the exterior surface of the upper end of the casing 8 and connected to the annular retaining member 64 by bolts 81 and 82, retractable latch pins 83 and 84, and a latching ring 85 which is slidable disposed about the coupling ring 80. As may be seen, an annular recess 86 is preferably provided in the exterior surface of the casing 8, or in the exterior surface of a special extension member (not depicted) which may be welded onto the upper end of the casing 8, to permit gripping engagement by the latch pins 83 and 84.

Although the coupling ring 80 is preferably slidably disposed about the top end of the casing 8 as hereinbefore explained, it is also preferable that the coupling ring 80 constitute a fluid-tight coupling with respect to the exterior surface of the casing 8, so that water or drilling mud being injected into the borehole 14 through the center of the drill string 10 will flow out of the casing 8 only through flow ports 72 and 73. Thus, O-rings 140-143 are preferably disposed in suitable recesses in the inside surface of the coupling ring 80, and in the outer surface of the bearing coupling member 60, as illustrated in FIG. 7.

Each of the aforementioned latch pins 83 and 84 is composed of an inwardly directed engaging head 88 mounted on one end of a pin shaft 89 which is slidably disposed in an aperture 90 extending through the coupling ring 80, and an actuating head 91 mounted on the outwardly directed end of each pin shaft 89. Each aperture 90 is further provided with an inside recess 92 for receiving the engaging head 88 of each latch pin 83 and 84 for disengagement from the casing 8, and an outside recess 94 for partially receiving the actuating head 91 when the connector 24 is locked to the casing 8. Further, a spring 93 is disposed about the pin shaft 89 to urge each latch pin 83 and 84 outward of the casing 8.

As may be seen, the connector 24 is locked to the casing 8 when each engaging head 88 of the latch pins 83 and 84 is opposite the recess 96. Thus, it will be apparent that the connector 24 will be fixedly attached to the coupling ring 85 when the latching ring 85 is moved slidably downward relative to the coupling ring 80 whereby the angular inside shoulder 95 moves in a cam-like manner to urge the actuating head 91 of each latch pin 83 and 84 against its adjacent spring 93 to force each engaging head 88 into the annular recess 86 or groove in the casing 8. It will be noted that the latching ring 85 is provided with an inwardly directed upper rim 96, and that the coupling ring 80 is provided with an upwardly directed shoulder 97 which engages the upper rim 96 to limit downward travel of the latching ring 85 relative to the coupling ring 80. In addition, it will be noted that the latching ring 85 is also provided with a similar inwardly directed lower rim 98 which catches the lower shoulder 99 on the coupling ring 80 and thereby limits upward travel of the latching ring 85.

It is desirable that suitable means operable from the floating platform 2 be provided for disengaging the connector 24 from the casing 8. In the apparatus depicted in FIG. 7, flexible hydraulic hoses 100 and 102 may be connected through ports 101 and 103, respectively, to function alternately as supply and return lines for annular hydraulic chambers 104 and 105, which are defined by upper and lower rims 96 and 98 cooperating with shoulders 97 and 99, respectively. Thus, hydraulic fluid may be applied through hose 102 to expand the lower chamber 105, and thereby drive the latching ring 85 downward, until the upper rim 96 engages the upper shoulder 97, in order to engage the head 88 of each of the latch pins 83 and 84 into the recess 86 in the top end of the casing 8. In this configuration, it will be noted that hose 100 will act as a return line for fluid compressed in chamber 104. Note also that O-rings 114, 115 may be included between the slidably engaged surfaces of the coupling ring 80 and the latching ring 85 to prevent loss of hydraulic fluid during operation of the connector 24.

Alternatively, if power is supplied through hose 100 to chamber 104, the upper rim 96 will be driven upward from the upper shoulder 97 until upward travel of the latching ring 85 is limited by the lower rim 98 engaging the lower shoulder 99 of the coupling ring 80. In this configuration, the fluid compressed in the lower chamber 105 will enter the lower hose 102. It may also be seen that the annular pin recess 106 inside the latching ring 85 will now be positioned to accommodate the actuating head 91 which is being urged outwardly due to the spring 93 about each of the latch pins 83 and 84.

It occasionally happens that one or both of the latch pins 83 and 84 may be jammed in latching condition. Accordingly, each actuating head 91 may be seen to be provided with a downwardly directed lip 107 for engagement with the upwardly directed lip 108 on the latching ring 85. Thus, the upward movement of the latching ring 85 tends to drive the upwardly directed lip 108 under the downward lip 107 on the actuating head 91, to disengage or free the latch pins 83 and 84 from binding in the aperture 90.

Referring now to FIGS. 8 and 9, there may be seen two different views of a suitable anti-rotation device 20 such as that depicted generally in FIGS. 1-6. More particularly, FIG. 8 depicts the horizontal base member 42 represented in FIG. 6 as having at least two vertical members 43 and 44 secured thereto by two triangular leg brackets 110 and 111, and supporting a centrally located and vertically arranged collar 112 represented in cross section. The lower end of the casing 8 may be seen to be slidably inserted in the collar 112 and secured thereto by shear pins 114 and 116 inserted in the two longitudinal keys 40 and 41 along the length of the casing 8. Stop screws 118 and 120 may be inserted in the lower ends of the keys 40 and 41 to prevent the weight of the anti-rotation device 20 from shearing the shear pins 114 and 116, and thus to prevent the anti-rotation device 20 from sliding off of the casing 8 as it is being lowered to the ocean floor 4. Upper triangular brackets 122 and 124 may be provided to support the alignment of the collar 112 in the horizontal base member 42.

Referring now to FIG. 9, there may be seen a top view of the exemplary anti-rotation device 20 depicted in FIG. 8, wherein the horizontal base member 42 is illustrated as being composed of struts 126 and 128 mounted on the exterior of the collar 112 at locations 180°
apart and being supported thereon by the aforementioned upper triangular brackets 122 and 124. Side straps 130 welded tangentially to the collar 112 and to the struts 126 and 128 at points adjacent the vertical members 43 and 44 may also be provided for strength against rotation caused by the drill string 10 revolving inside the casing 8. The keyways 46 and 47 inside the collar 112 are provided to accommodate the keys 40 and 41 hereinbefore mentioned.

Although the casing 8 proper, which is depicted in the accompanying drawings, has been illustrated as having an annular groove or recess 86 circling the end of the casing 8, an alternate form of apparatus may (as hereinbefore stated) be provided wherein a conventional conductor casing may be used which is conventional in all respects except for the provision of keys 40 and 41, and an extension member having such a recess may be welded or attached by threads to the upper end of the casing 8. Such an extension member may have a thicker wall, and thus may be provided with a deeper annular groove for better engagement by the latch pins 83 and 84. In addition, the keys 40 and 41 need be of only limited length, and need not necessarily extend up to the exterior of the casing 8 for more than a limited portion of its overall length, especially if the walls of the borehole 14 tend to grip the casing 8 to prevent it from being rotated by the rotating drill string 10.

Many other modifications and variations will be apparent from the foregoing description. Accordingly, the forms of the present invention which are described herein and depicted in the accompanying drawings are only intended to be illustrative and are not intended as limitations on what is sought to be disclosed and claimed hereby.

What is claimed is:

1. The method of inserting a conductor casing in a borehole in submerged earth lying below a floating drilling platform, said method comprising disposing said conductor casing concentrically about a rotatable drill string carrying a drill bit, suspending said conductor casing and drill string from said platform, securing the lower end of said casing to said submerged earth for immobilizing said casing against rotation relative to the earth, and thereafter rotating said drill string and bit independently of said casing for drilling said borehole while urging said immobilized casing longitudinally and slidably into said borehole behind said drill bit.

2. The method described in claim 1, including the step of disengaging said casing and said drill string after said casing guide base is positioned on the earth, and withdrawing said drill string and bit from said borehole and conductor casing.

3. The method described in claim 2, including the step of disposing a main guide base about the upper end of said conductor casing, and lowering said conductor casing and main guide base to said submerged earth together as a unit.

4. The method described in claim 3, including the step of lowering said main guide base to said submerged earth while urging said conductor casing into said borehole behind said drill bit.

5. The method described in claim 4, including the steps of urging said conductor casing into said borehole until said main guide base rests on said submerged earth, and withdrawing said drill string and bit from said borehole and conductor casing.

6. Apparatus for drilling an offshore borehole from a floating platform, said apparatus comprising a drill string suspended at its upper end at said floating platform and carrying an expandable drill bit at its free traveling end for drilling said borehole, a length of steel casing disposed concentrically about said drill string between said platform and said drill bit, a connector detachably connected to said casing at its upper end and rotatably coupled to said drill string, and anti-rotation means longitudinally slidably mounted on said casing adjacent said drill bit for fixedly engaging the submerged earth below said floating platform and for securing said casing against rotation relative to said submerged earth.

7. The apparatus as described in claim 6, wherein said connector means further includes gripping means remotely actuable for releasably gripping the upper exterior surface of said casing means.

8. The apparatus as described in claim 7, wherein said casing means includes key means longitudinally disposed along the exterior of at least a portion of the length of said casing means and including its lower end for rotatably engaging said anti-rotation means and for opposing rotation of said casing means relative to said anti-rotation means.

9. The apparatus as described in claim 8 wherein said anti-rotation means includes coupling means detachably connecting said anti-rotation means to the lower end of said casing means.

10. The apparatus as described in claim 9, wherein said anti-rotation means further includes base means having a centrally-located circular aperture and keyway for longitudinally slidable disposition about the lower end of said casing means, a plurality of vertical support members mounted on the under side of said base means and adapted to be thrust into said submerged earth to fixedly support said base member relative to rotation of said drill string, and shear means interconnecting said key means and said base means and frangible under the weight of said casing means.

11. The apparatus as described in claim 10, wherein said casing means is provided with an annular recess in its exterior surface adjacent its upper end for accommodating said gripping means.

12. As a subcombination, a conductor casing adapted to be concentrically disposed about a rotatable drill string and bit suspended from a floating drilling platform to drill a borehole in the submerged earth below said platform, tubular bearing means adapted to be interconnected integrally in said drill string for supporting the upper end of said conductor casing independently of the rotation of said drill string, and anti-rotation means rotatably fixed to and longitudinally slidably disposed about the lower end of said conductor casing for engaging the surface of said submerged earth and immobilizing said conductor casing relative to said rotation of said drill string.

13. The subcombination described in claim 12, wherein said anti-rotation means is releasably secured to said lower end of said conductor casing.

14. The subcombination described in claim 13, wherein said conductor casing includes a key longitudinally disposed along the exterior surface of the lower end of said casing, and wherein said anti-rotation means includes a shear pin interconnected with said key.

15. The subcombination described in claim 14, wherein said anti-rotation means further includes stop means for limiting downward slidable movement of
said anti-rotation means relative to said conductor casing.

References Cited
UNITED STATES PATENTS

3,115,755 12/1963 Siebenhausen 175—171
3,145,775 8/1964 McCarty 166—5
3,174,563 3/1965 Edbloa et al. 175—171

3,252,528 5/1966 Nicolson 166—5
3,259,198 7/1966 Montgomery et al. 175—7
3,301,324 1/1967 Smith 175—79
3,426,844 2/1969 McDaniel 166—5

JAMES A. LEPPINK, Primary Examiner

U.S. Cl. X.R.