July 7, 1970 W. W. WORD, JR 3,519,071

METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

Filed Dec. 21, 1967 5 Sheets-Sheet 2

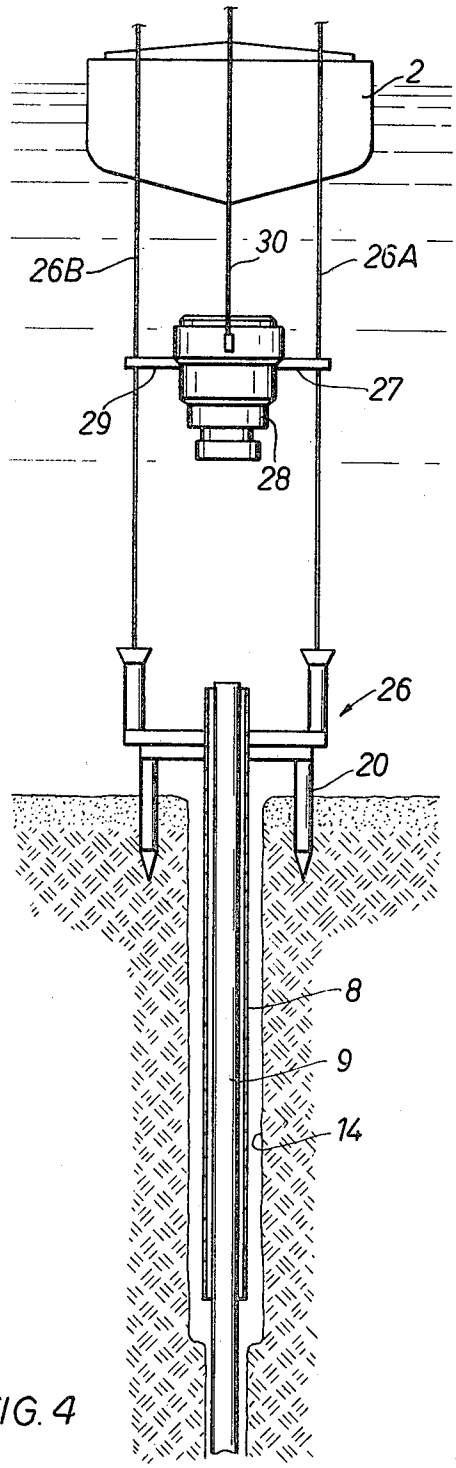


FIG. 4

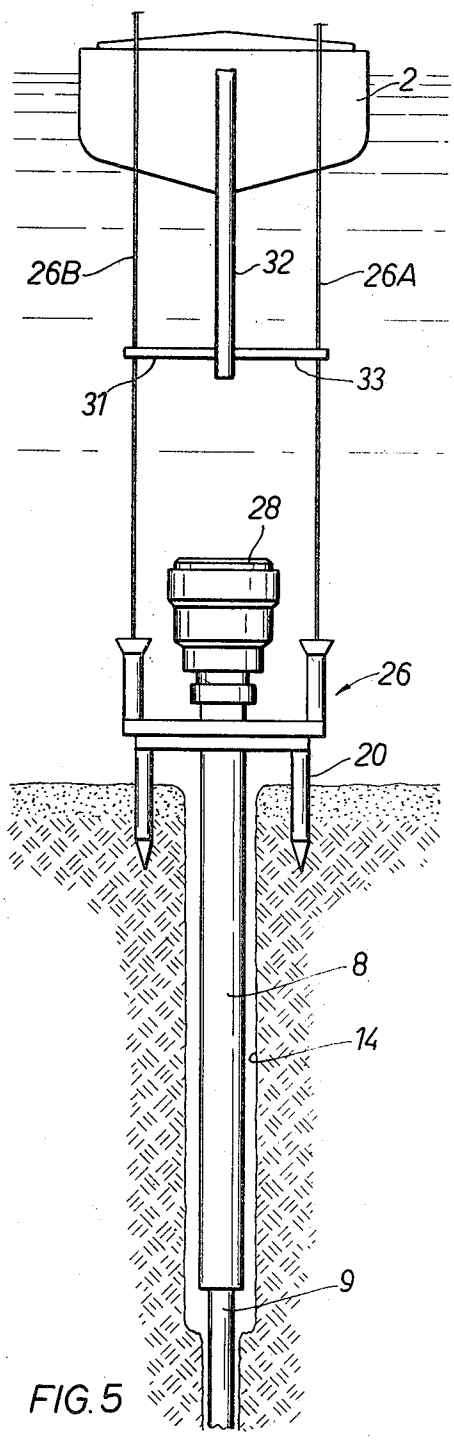


FIG. 5

William W. Word, Jr.
INVENTOR

BY Arnold, Roylance, Kruger & Durkee
ATTORNEYS

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METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

Filed Dec. 21, 1967 5 Sheets-Sheet 1

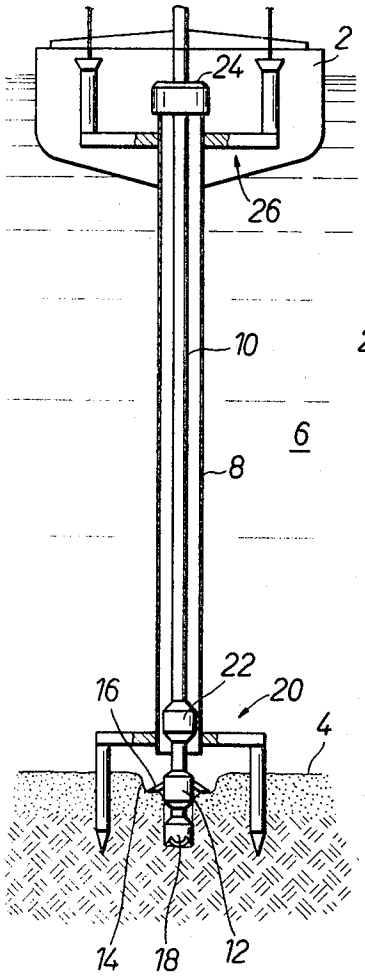


FIG. 1

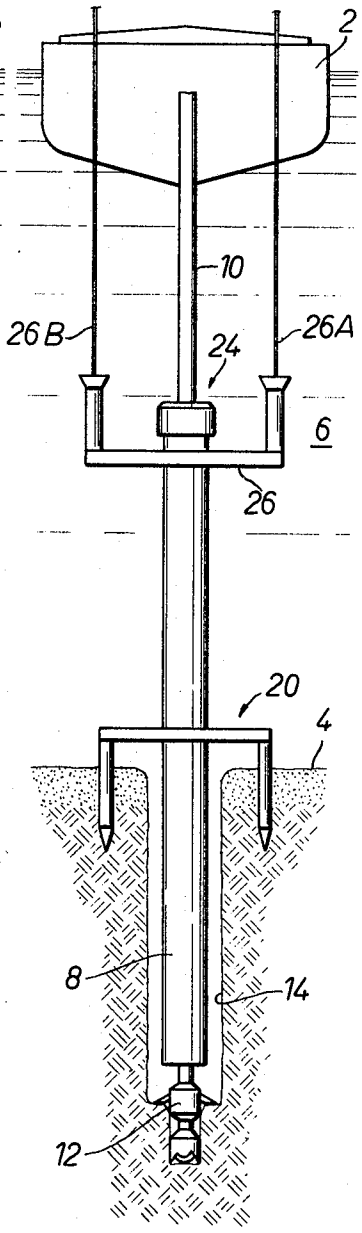


FIG. 2

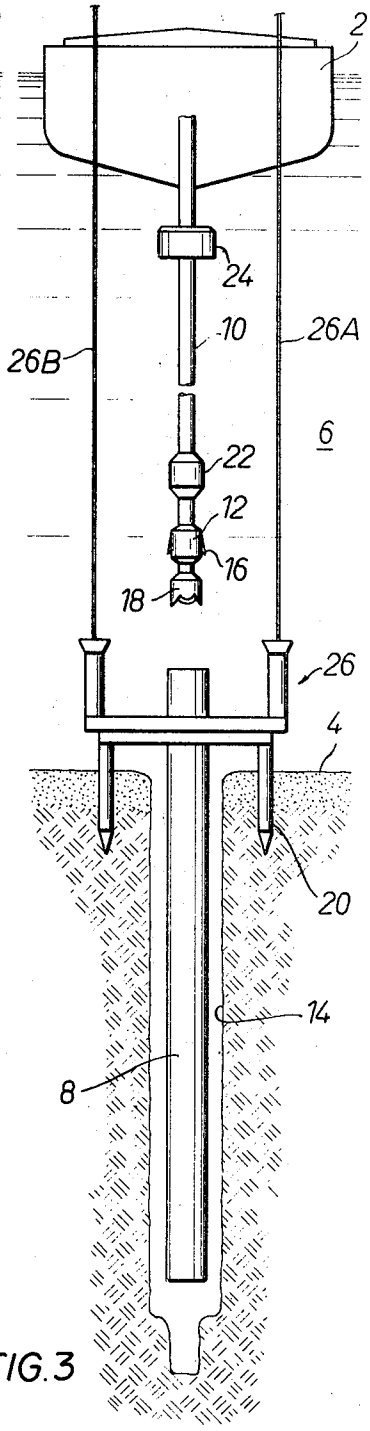


FIG. 3

William W. Word, Jr.
INVENTOR

BY Arnold, Roylance, Kruger & Durkee
ATTORNEYS

July 7, 1970 W. W. WORD, JR 3,519,071

METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

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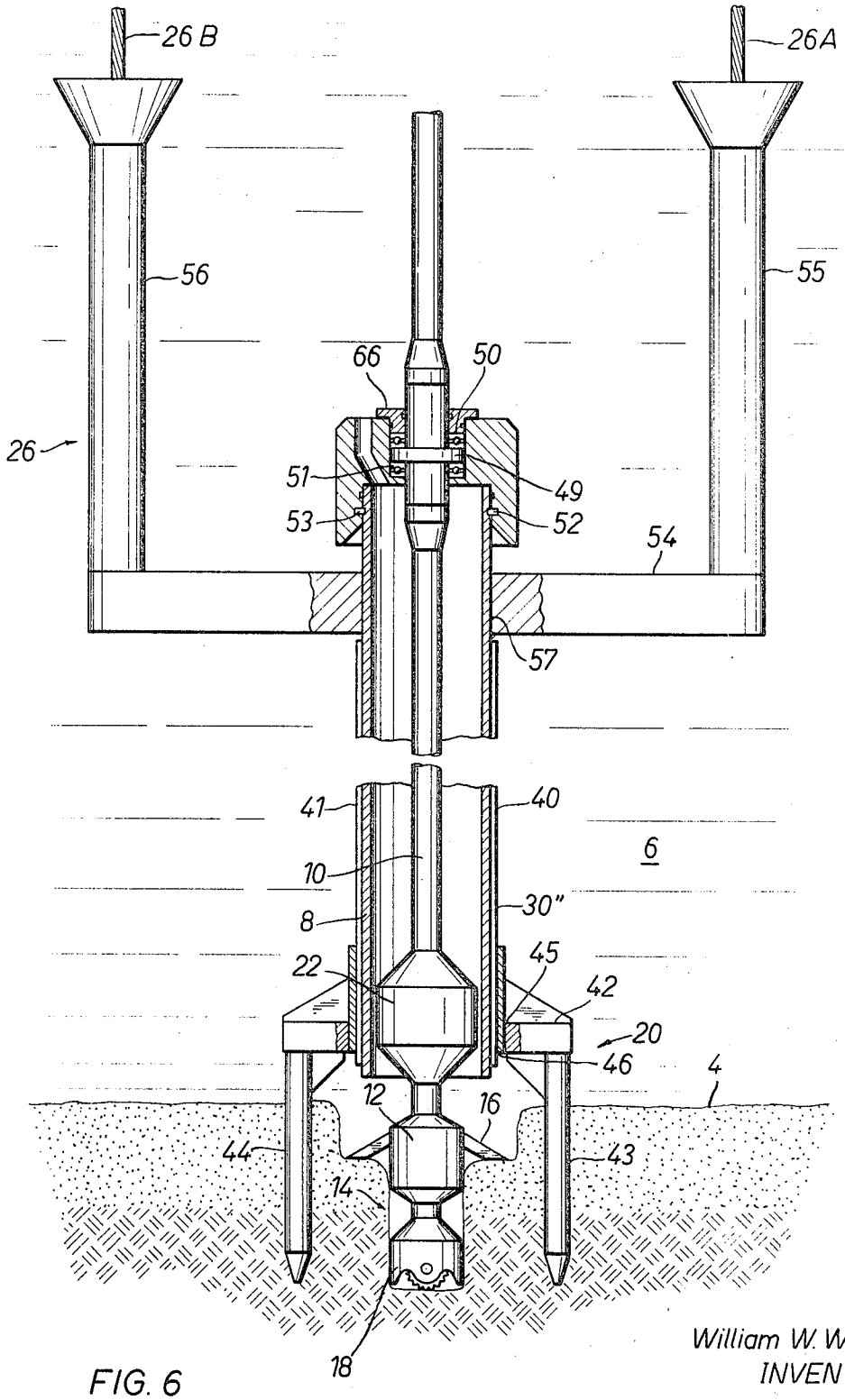


FIG. 6

William W. Word, Jr.
INVENTOR

BY Arnold, Roylance, Kruger & Durkee
ATTORNEYS

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METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

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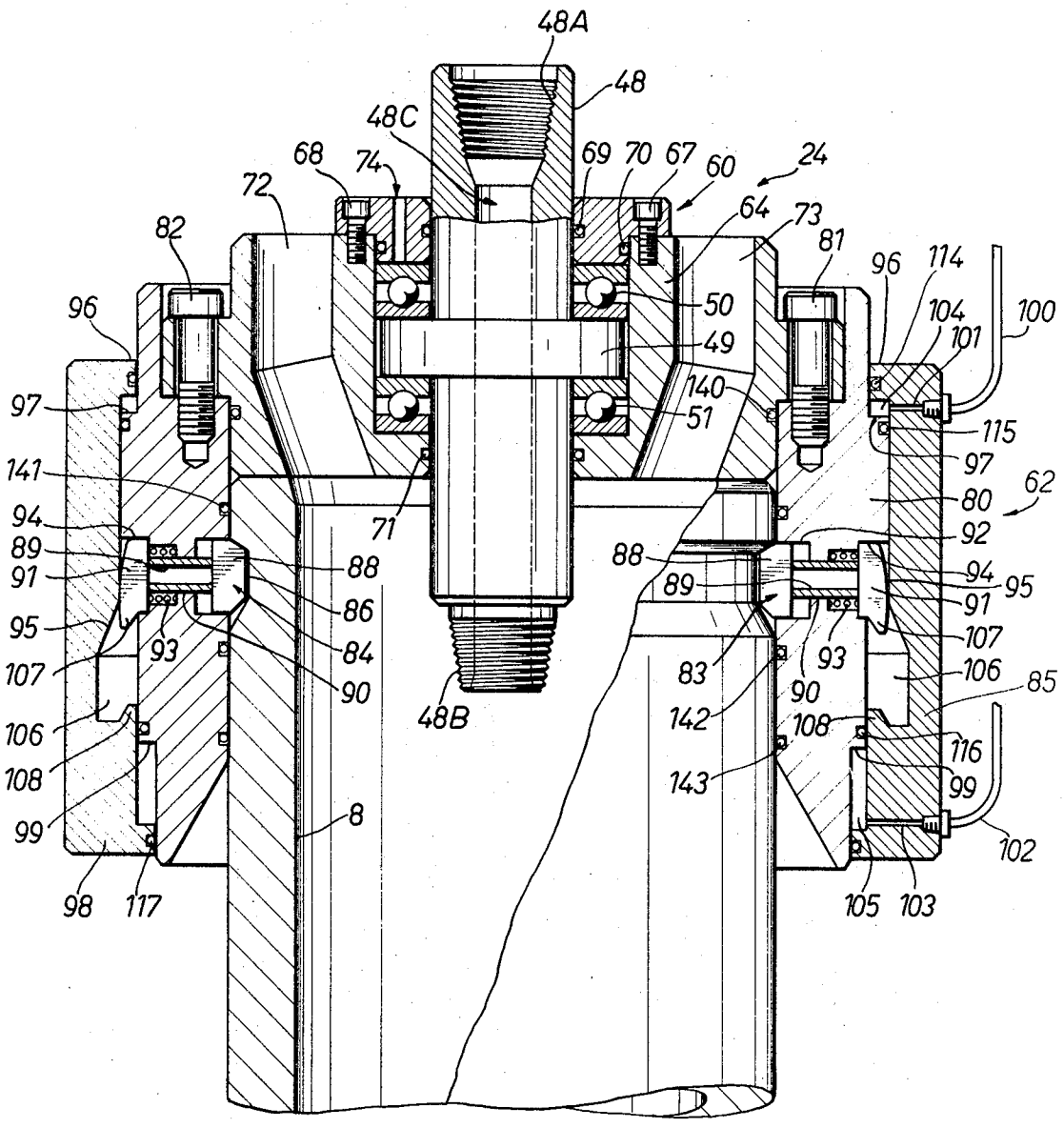


FIG. 7

William W. Word, Jr.
INVENTOR

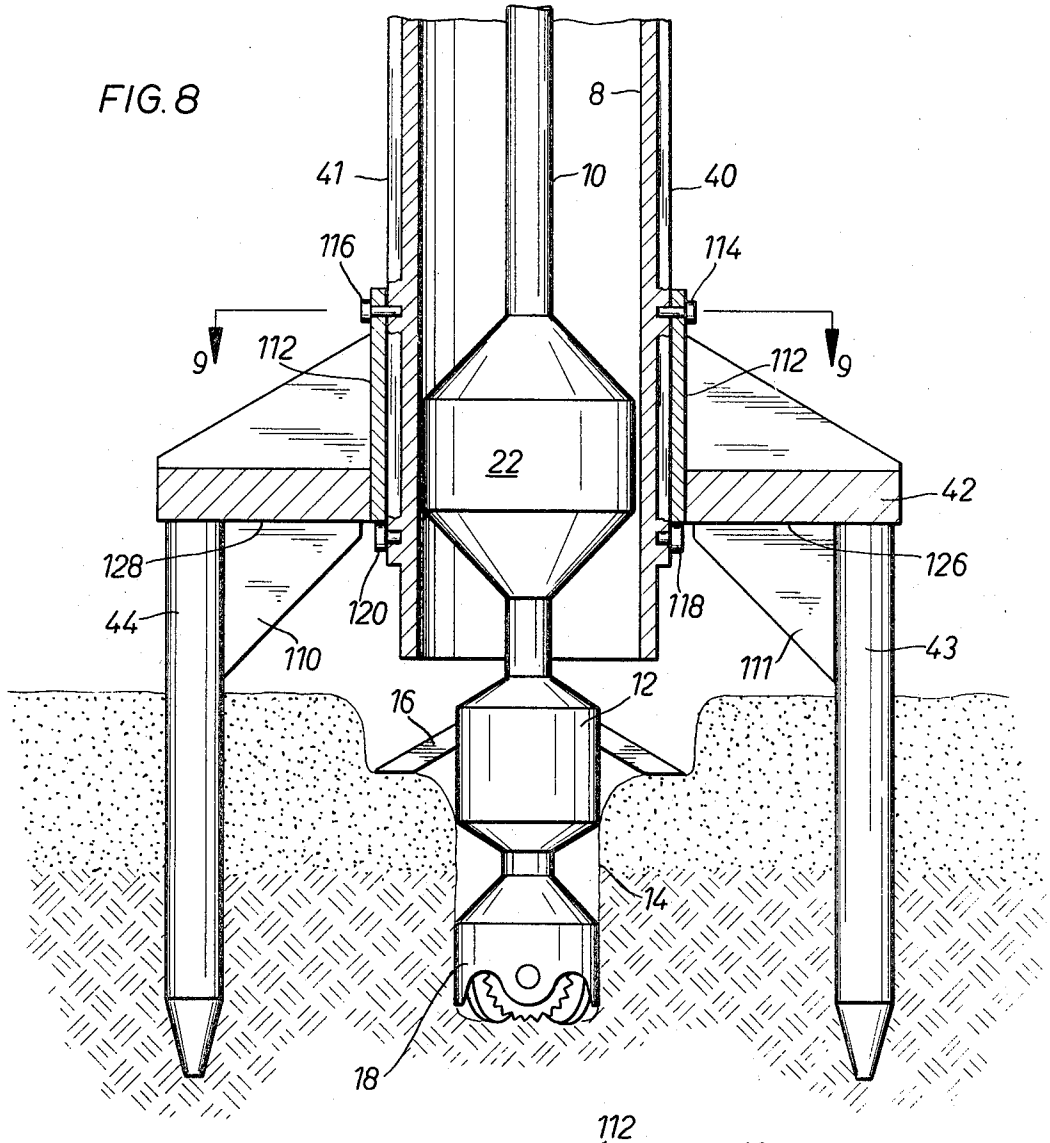
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July 7, 1970 W. W. WORD, JR 3,519,071

METHOD AND APPARATUS FOR CASING OFFSHORE WELLS

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FIG. 8



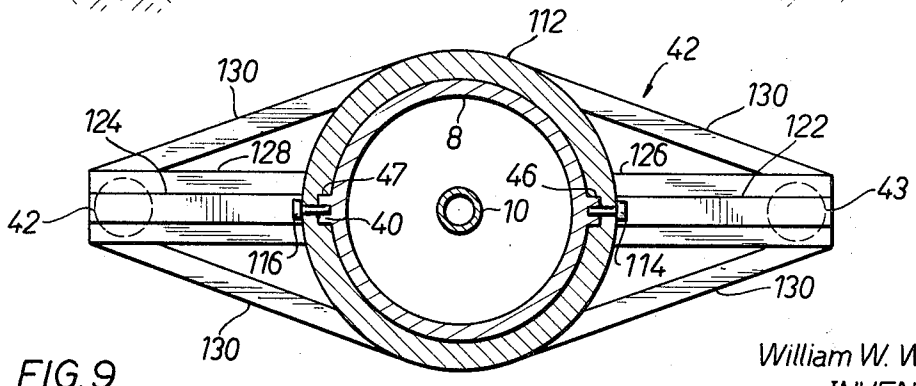


FIG. 9

William W. Word, Jr.
INVENTOR

BY Arnold, Roylance, Kruger & Durkee
ATTORNEYS

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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. 692,587
Int. Cl. E21b 7/12
U.S. Cl. 166—.5 15 Claims

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 basing 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 therefrom to 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 hereinbefore described with respect to the temporary guide base.

After the blowout preventer is installed or landed on or 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

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 fastened about its lower end. 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 provided with at least 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 acuse 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 may be resumed in a conventional manner. Accordingly, the main guide base may be initially disposed about the upper end of the conductor, and may be lowered to the ocean floor as the conductor is fed or pulled into the borehold 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 preventor or other item of equipment is being lowered to the mouth of the cased borehole 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 drill 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 preselected 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 drilled, 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** behind 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 main 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, another length of casing **9** 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 **26**A and **26**B 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 **26**A and **26**B, 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 **26**A and **26**B 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 **40**. 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 submerged 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 and 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 hollow drill pipe, except that a special bearing section **48** having a flange **49** intermediately arranged 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 **26**A and B. 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** of 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 **48**A at one end and external threads **48**B at the other end for intercon nection 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 be composed of upper and lower 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 **67** 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 latching ring **85** which is slidably 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 **86**. Thus, it will be apparent that the connector **24** will be fixedly attached to the casing **8** 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 force the engaging 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 **114–117** 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 latching 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 necessary extend up 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 main 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 describzed 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 fixed 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 longitudially 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 downard slidable movement of

said anti-rotation means relative to said conductor casing.

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JAMES A. LEPPINK, Primary Examiner

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