

Nov. 2, 1965

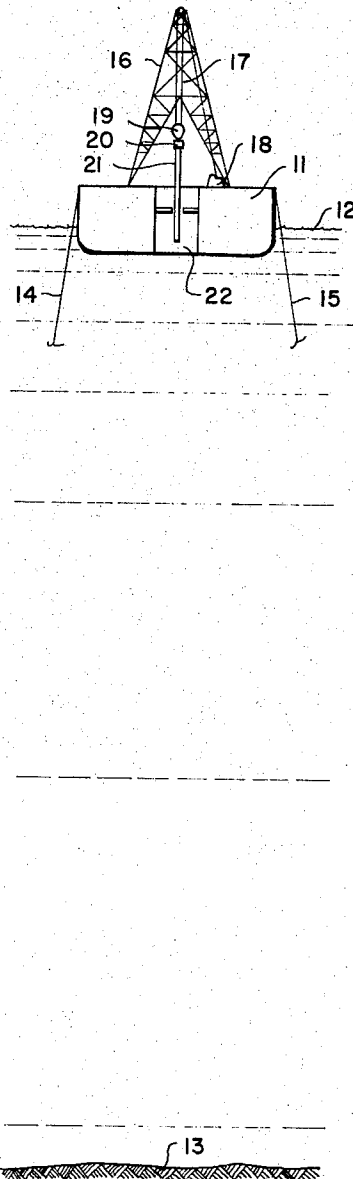
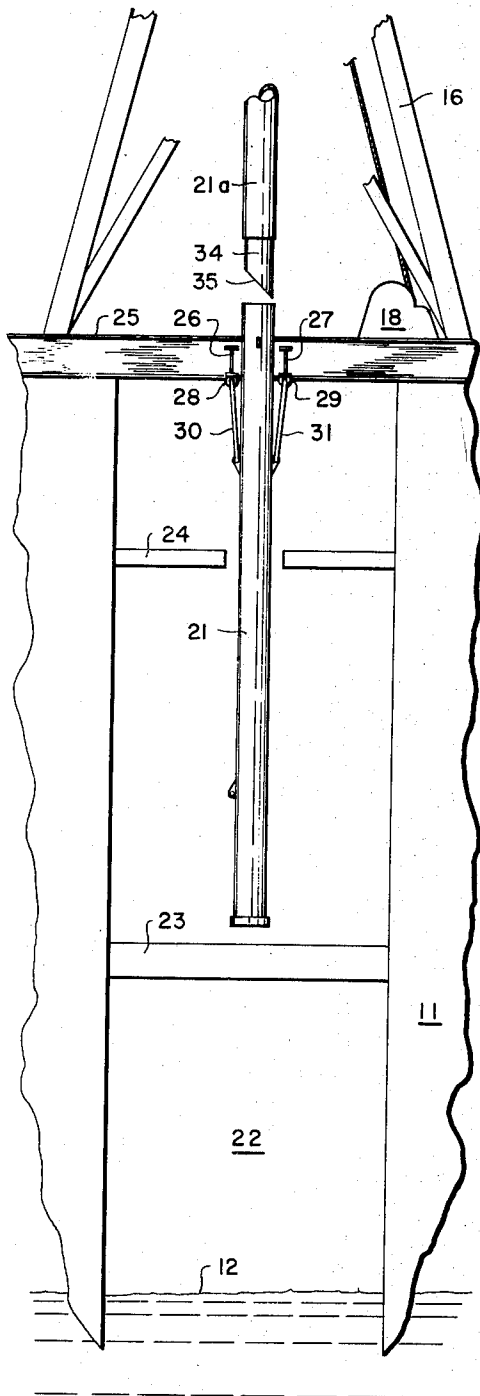
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3,215,201

WELL DRILLING METHOD AND APPARATUS

Filed Sept. 13, 1962

5 Sheets-Sheet 1



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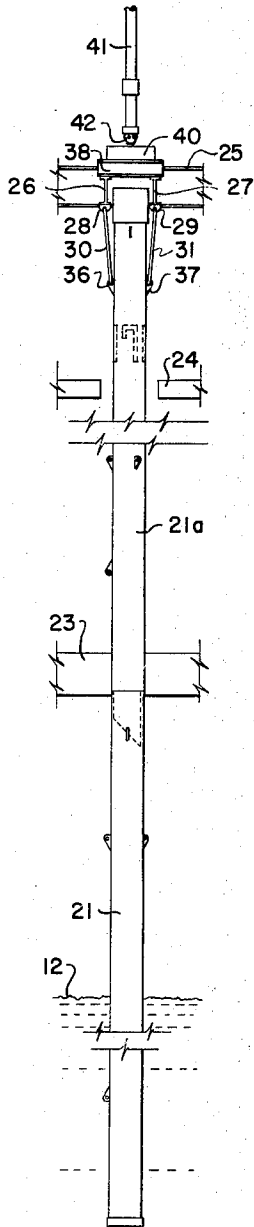


FIG. 3

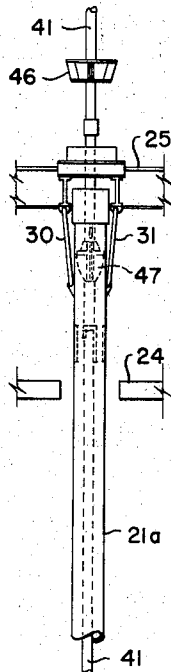


FIG. 4

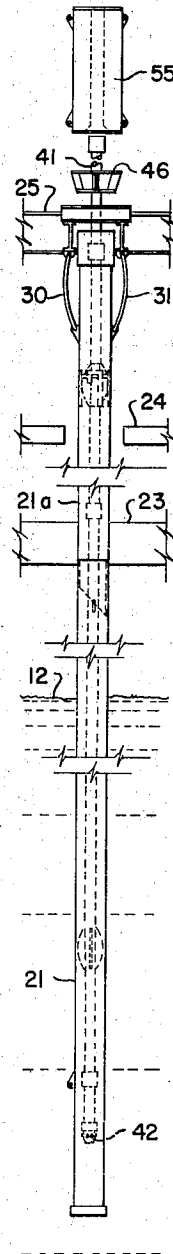


FIG. 5

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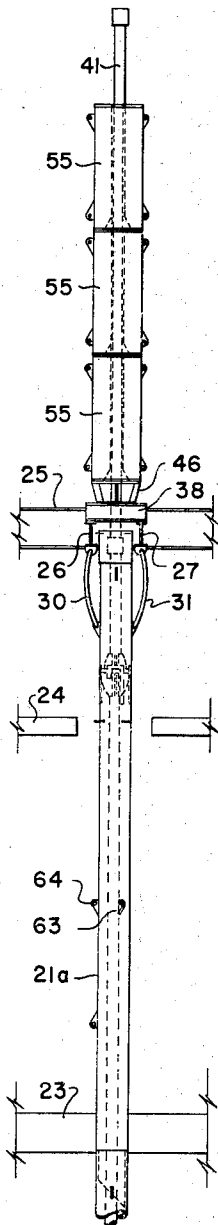


FIG. 6

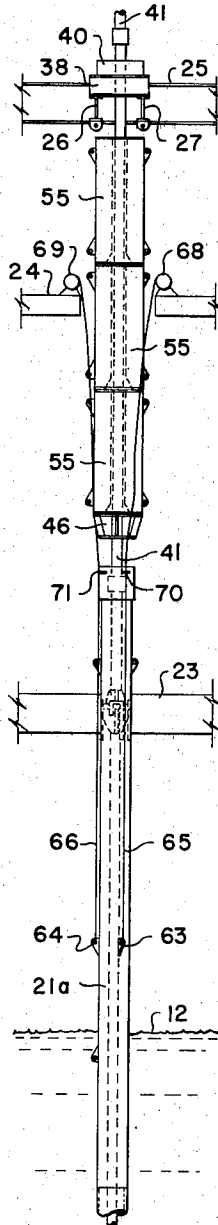


FIG. 7

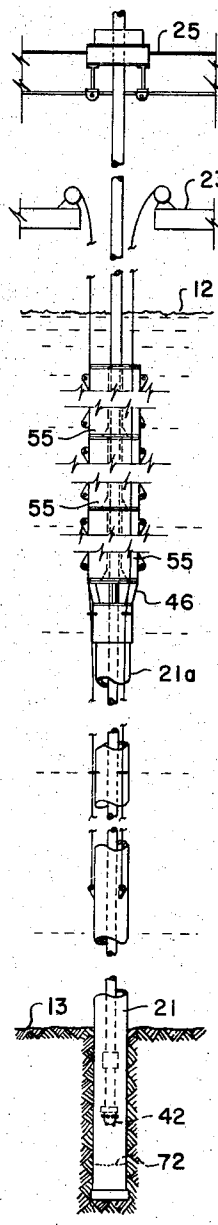


FIG. 8

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WELL DRILLING METHOD AND APPARATUS

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5 Sheets-Sheet 4

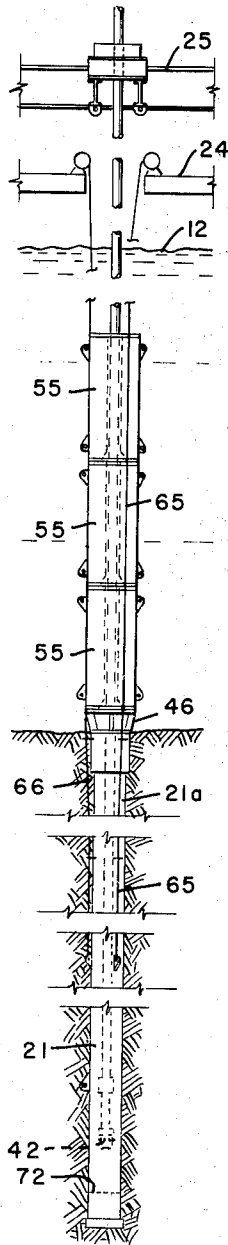


FIG. 9

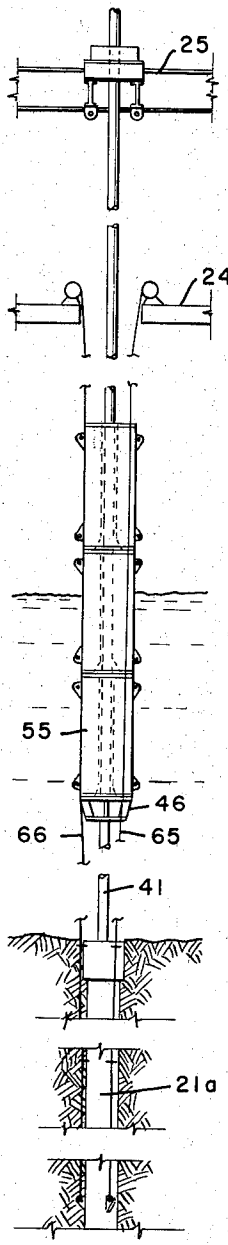


FIG. 10

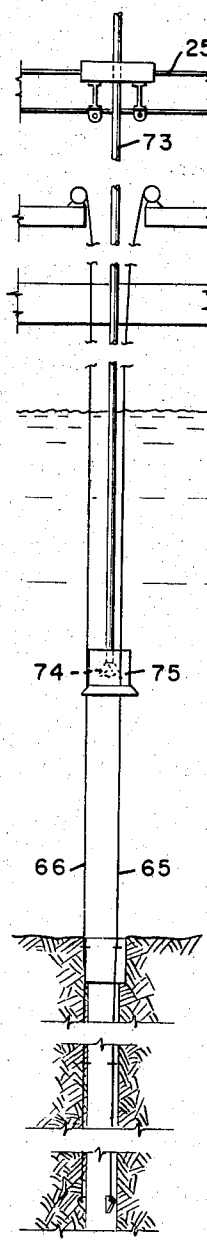


FIG. 11

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WELL DRILLING METHOD AND APPARATUS

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5 Sheets-Sheet 5

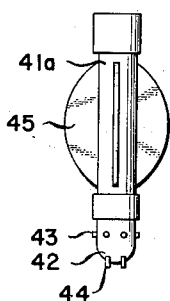


FIG. 12

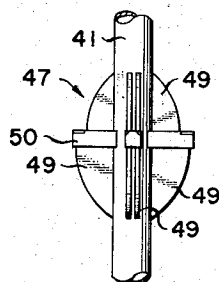


FIG. 13

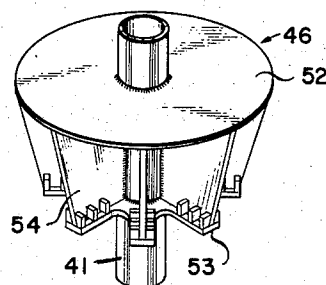


FIG. 14

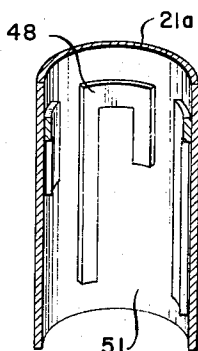


FIG. 15

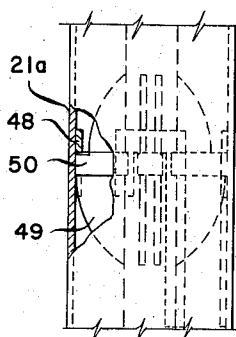


FIG. 16

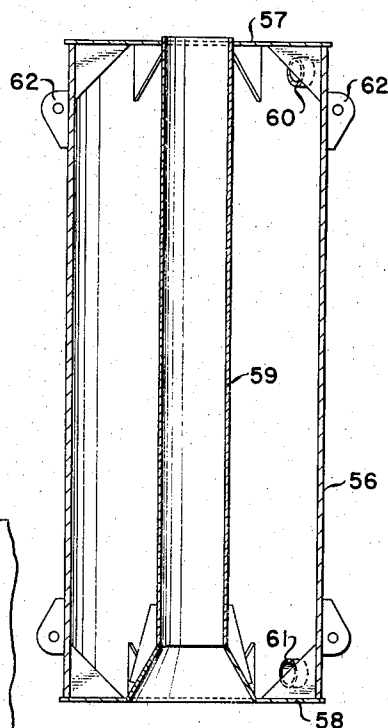


FIG. 17

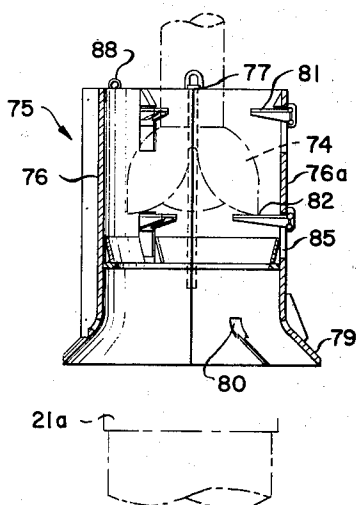


FIG. 18

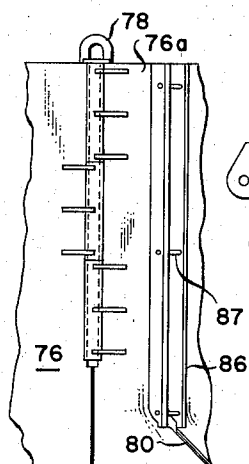


FIG. 19

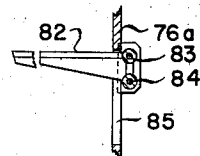


FIG. 20

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WELL DRILLING METHOD AND APPARATUS
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Filed Sept. 13, 1962, Ser. No. 223,368
7 Claims. (Cl. 166—46)

This invention relates to the underwater drilling of oil and gas wells and pertains more particularly to methods and apparatus for installing a conductor or foundation pipe, or a large-diameter well casing, in an underwater well.

During the recent years, the continued search for oil has resulted in developing methods and apparatus for drilling underwater wells at locations where the water may range from 100 to 1500 feet or more in depth. In these locations it is customary to position the wellhead assembly at a considerable distance below the surface of the water, preferably on the ocean floor, so that it is not a hazard to the navigation of ships in the area. One method of drilling and completing wells underwater in this manner is described in copending patent application, Serial No. 830,538, filed July 30, 1959, and entitled "Underwater Well Completion Method."

One of the most important operations in the drilling of an underwater well is that of starting the well and installing the conductor or foundation pipe in the ocean floor. This operation may be carried out in any one of several ways, two of which are described in U.S. patents 2,929,610 which issued March 20, 1960, to H. Stratton, and U.S. 2,891,770 which issued June 23, 1959, to R. F. Bauer et al. In one method a drill bit drills a hole in the ocean floor slightly larger in diameter than the diameter of the well conductor or foundation pipe which is subsequently slipped down along the drill pipe and into the hole during which time drilling fluid is pumped down the drill pipe and up the outside of the foundation pipe. In another method, a hole is flushed in the ocean floor for the well conductor or foundation pipe by pumping fluid down the conductor, allowing it to jet out the lower end thereof to wash a hole in the ocean floor into which the conductor pipe is progressively lowered. The conductor pipe is then held in place in the hole until the surrounding earth has had time to settle in around the outside of the pipe and anchor it firmly in the hole.

In certain locations, the above-described methods of starting to drill a well in the ocean floor and positioning a well conductor or foundation pipe therein are unsatisfactory because of the peculiar soil conditions of the ocean floor. In certain locations the ocean floor is too soft to drill a hole of shallow depth without the earth caving in and filling the hole as fast as it is drilled. Alternatively, if a hole is first washed in the ocean floor while lowering a conductor pipe progressively into the hole, there is insufficient bearing surface or frictional contact between the surrounding earth formation that settles into the hole and the outside of the pipe to permit the pipe to support any substantial weight.

It is therefore an object of the present invention to provide a method and apparatus for starting the drilling of an underwater well whereby a well conductor pipe or foundation pipe may be installed in a relatively soft ocean bottom in a manner so that substantial weights can be supported on the pipe as the well drilling operations progress.

A further object of the present invention is to provide a method of installing a well conductor or foundation pipe in a soft ocean bottom while removing any earth from the interior of the pipe.

Another object of the present invention is to provide

apparatus for guiding well drilling equipment from a vessel on the surface of a body of water to a well foundation or conductor pipe sunk in the ocean floor so that well drilling operations may be continued after the foundation pipe has been installed.

Still another object of the present invention is to provide a method whereby any substantial excess length of conductor pipe or foundation pipe extending above the floor of an ocean may be removed prior to continuing drilling operations of the well.

These and other objects of this invention will be understood from the following description taken with reference to the drawing, wherein:

FIGURE 1 is a diagrammatic view taken in longitudinal projection illustrating the operation of lowering a well pipe from a vessel at the surface of the water to the ocean floor;

FIGURE 2 is a fragmental longitudinal view of a portion of the vessel of FIGURE 1 wherein a well pipe is shown as being assembled at the vessel;

FIGURES 3 through 11 are diagrammatic longitudinal views illustrating the sequential steps of suspending a well pipe from the drilling vessel or platform of FIGURE 1, installing a wash pipe in the well pipe, connecting the wash pipe to the well pipe, adding weights to the well pipe-wash pipe combination, lowering the assembled apparatus through the water to the ocean floor, forcing the well pipe into the ocean floor while washing the loose core from the inside of the well pipe, removing the weight means from the well pipe and returning them to the barge, and subsequently lowering a drill bit down to the well pipe at the ocean floor;

FIGURE 12 is a longitudinal view illustrating the wash head at the end of the wash pipe;

FIGURE 13 is a longitudinal view of one form of a support means carried by the wash pipe for supporting a well pipe;

FIGURE 14 is an isometric view of one form of a weight platform adapted to be carried by the wash pipe and derrick against the well pipe;

FIGURE 15 is a fragmental longitudinal isometric view taken in cross section of a J-slot connector device on the inner wall of the well pipe which is adapted to engage the well support device of FIGURE 13 carried on the outside of the wash pipe;

FIGURE 16 is a longitudinal view, taken partially in cross section, illustrating the support means of FIGURE 13 positioned in the J-slot section of the well pipe of FIGURE 15;

FIGURE 17 is a longitudinal cross sectional view of one form of a weight adapted to be positioned on the weight platform of FIGURE 14;

FIGURE 18 is a longitudinal view, taken in cross section of one form of a bit guide for use in lowering a drill bit from the vessel to the ocean floor; and,

FIGURE 19 is a longitudinal fragmental view of the hinge detail of the bit guide of FIGURE 18.

FIGURE 20 is an enlarged detail, taken in cross section, of one form of a retractable support finger carried by the bit guide of FIGURE 18.

Referring to FIGURE 1 of the drawing, a drilling vessel, barge or platform 11, of any suitable floating or floatable type is illustrated as floating on the surface of a body of water 12 while being substantially fixedly positioned over a preselected well location by suitable vessel positioning means well known to the art, or by being anchored to the ocean floor 13 by anchor lines 14 and 15 running to anchors (not shown). Equipment of this type may be used when carrying on well drilling operations or well work over operations in water varying from about 100 feet to 1500 feet or more in depth. The

drilling vessel 11 is equipped with a suitable derrick 16 containing a fall line system 17 which includes a suitable hoist 18, traveling block 19, and suitable hook or other connector means 20 adapted to connect to the top of a large-diameter pipe, such as a well foundation pipe section 21. The vessel 11 is also provided with other auxiliary equipment needed during well-drilling operations, such for example, as a rotary table positioned on the operating deck, a hinge slip and spider assembly, etc. The derrick 16 is positioned over a drilling slot or well 22 which extends vertically through the barge in a conventional manner. When using the equipment of the present invention, a slot 22 in the vessel 11 may be either centrally located or extend in from one edge. Alternatively, drilling operations may be carried out over the side of the vessel without the use of a slot. For example, the drilling vessel may be provided with a deck portion which overhangs the hull of the vessel.

In FIGURE 2 the vessel 11 is shown as being provided with an auxiliary deck 23 and an intermediate deck 24 within the slot 22. The cut-away portion of the floor of the derrick 16 reveals one of the I-beams 25, it being understood that the floor of the derrick 16 employs a series of parallel I-beams as a framework. Extending between two of the countermost beams 25, and illustrated in FIGURE 2 as extending outwardly from beam 25, are a pair of rotary-support beams 26 and 27 which are normally employed to support a rotary table which rests on top of them and is secured thereto. The lower side of the rotary-support beams 26 and 27 are provided with sling eyes 28 and 29, or any other suitable type of connectors to which a pair of slings 30 and 31, tie rods, or other support means may be connected. The lower ends of the slings 30 and 31 are secured to supports or sling eyes 32 and 33 that are welded to the outer surface of the foundation pipe section 21. As shown in FIGURE 2 a second section 21a of the well foundation pipe 21 is about to be lowered, as by means of the hoist system of the derrick, so that a stabbing guide 34 carried at the end of the pipe section 21a is stabbed into the top of the pipe section 21. The stabbing guide 34 may be in the form of a short section of pipe slightly smaller in diameter than the pipe sections 21 and 21a so that it can fit inside the pipe sections. The lower end of the stabbing guide 34 is preferably bevelled or cut at an angle as at 35 to facilitate the stabbing operation. After the two pipe sections 21 and 21a have been stabbed together they are fixedly secured to each other, as by welding.

The number of sections of the well foundation pipe 21-21a which are welded together depends upon the length of the sections used and the overall length of the well foundation pipe to be sunk in the ocean floor. In one installation two 50-foot sections of large-diameter pipe were employed with the pipe diameter being in the order of 30 inches. After connecting the pipe sections together, the hoist sections of the derrick 16 is employed to lower the welded pipe and suspend it in a manner similar to suspending the single pipe section 21 in FIGURE 2. Thus, in FIGURE 3 the slings 30 and 31 secured to the sling eyes 28 and 29 are temporarily connected at their lower end to a pair of sling eyes 36 and 37 near the upper end of the uppermost pipe section 21a, as shown in FIGURE 3.

With the well foundation pipe 21-21a suspended from the rotary support beams 26 and 27 in a manner illustrated in FIGURE 3, a pair of cross-support beams are arranged in spaced relationship and secured to the rotary support beams 26 and 27. In FIGURE 3, only one of the cross-support beams 38 is illustrated. Secured to the top of the cross-support beam 38 and its parallel member (not shown) is a casing spider 40 of any suitable type well known to the art which employs slips to fixedly position a pipe therein with the pipe hanging downwardly from the casing spider 40. In FIGURE 3 a wash pipe 41, preferably having a jet head 42 at the lower

end thereof, is shown as being lowered, as by the hoist system of the derrick 16, down through the central opening in the casing spider 40, and thence downwardly into the open upper end of the well foundation pipe 21a. The wash pipe 41 is of smaller diameter than the foundation pipe so that it may readily pass through it while providing annular space between the outer wall of the wash pipe 41 and the inner wall of the foundation pipe 21-21a which serves as a return fluid passage in the apparatus of the present invention. A wash pipe in the order of 9 inches in diameter may be used in a 30-inch foundation pipe 21-21a. The jet head 42 of the wash pipe 41 is shown in greater detail in FIGURE 12 as being provided with a series of horizontally-directed jet ports 43 and vertically-directed jet ports 44. Additionally, if desired, a series of spacer plates or centralizer plates 45 may be arranged vertically on the outer surface of the lower portion 41a of the wash pipe 41. The horizontal dimension of the pipe section 41a and diametrically opposing centralizer plates 45 would be slightly less than the internal diameter of the well foundation pipe 21-21a so that the jet head and centralizer plates 45 could pass readily therethrough while at the same time maintaining the jet head 42 in substantially the center of the foundation pipe 21-21a.

In addition to providing a conduit through which wash water can be pumped, the wash pipe 41 provides means for supporting the well foundation pipe 21-21a as it is being lowered from the vessel through the water into the ocean floor. In addition, the wash pipe 41 provides means for lowering and/or supporting weights in contact with the top of the well foundation pipe 21-21a and subsequently removing the weights from the pipe 21-21a after the pipe has been sunk to the desired depth in the ocean floor.

In FIGURE 4 the wash pipe 41 is shown as being lowered into position within the upper section 21a of the well foundation pipe. The wash pipe 41 has a suitable weight-transfer or weight-support member 46 and a pipe-support member 47 fixedly secured thereto at definite spaced intervals on the outside of the pipe. The particular arrangement of pipe support member 47 which is illustrated is designed to engage a J-slot cooperating support element 48 on the inner surface of the well foundation pipe 21a. The pipe support member 47 is shown in greater detail in FIGURE 13 as comprising a series of vertically-arranged and outwardly-extending support arms 50. The overall spread of the diametrically-opposed support arms 50 is slightly less than the internal diameter of the well foundation pipe 21a. A section of the well foundation pipe 21a is illustrated in FIGURE 15 as being provided with a series of J-slot elements 48 arranged around the inner wall of the pipe. The space 51 between any two J-slot elements is sufficiently wide to allow the support arms 50 to pass between them. Thus, after a support arm 50 passes down the space 51 between the J-slot elements 48, a slight rotation of the wash pipe 41 will rotate the support arm 50 across the end of the J and allow it to move upwardly into the closed portion of the J upon vertical movement of the wash pipe 41, in a manner shown in FIGURE 16. Alternatively, if the weight members are fixedly secured to the wash pipe 41, then the weight-transfer or weight-support member 46 and the pipe support member 47 may be one and the same element, for example a J-slot device.

The weight-support member 46 (FIGURE 4) and the weights to be supported thereon may take any form which can be readily handled on board a drilling vessel. One form of a weight-support member 46 is shown in FIGURE 14 as comprising upper and lower radially-extending plates 52 and 53 arranged in spaced relationship and re-inforced by means of vertically directed gussets 54 to which they are welded. Both of the plates 52 and 53 and the gussets 54 are fixedly secured, preferably as by welding, to the outer surface of the wash pipe 41 at

a selected distance above the pipe support member 47 (FIGURE 4). The lower plate 53 is perforated or of a form to permit circulation of fluid thereby. The spacing between the weight-support member 46 and the pipe-support member 47 must be such that the pipe support member 47 can be engaged in the J-slot element 48 on the inner surface of the foundation pipe 21a while the weight-support member 46 is above the top of the foundation pipe 21a.

One form of a weight element 55 is shown in greater detail in FIGURE 17 as comprising an elongated cylindrical container 56 having closure means at the top 57 and bottom 58 thereof and a vertical open-ended pipe 59 along the axis of the container 56. The open-ended pipe 59 has an internal diameter slightly greater than the outside diameter of the wash pipe 41 so that the wash pipe can pass through it. Either the top 57 or the bottom 58 of the container 56 may be removable so that the container may be filled with a weighting material, such for example as barite, or the container 56 may be provided with upper and lower closable openings 60 and 61 which may be used for emptying and/or filling the container 56. The openings 60 and 61 may be closed in any suitable manner, at by threaded plugs. The container 56 is preferably provided with lifting eyes 62 whereby slings from the hoist system on the derrick can be connected for lowering the weight container into place on the wash pipe 41. A weight container 10 feet high and four feet in diameter filled with barite may weigh on the order 25,000 pounds. It is to be understood that the weight elements may take any other suitable form as large diameter drill collars, hollow drill collars filled with a heavy material, cement pipe section, etc. which are positioned outside the wash pipe or form an integral part thereof.

In FIGURE 6 the assembled apparatus is shown with three weight containers 55 positioned concentrically on a wash pipe 41, it being understood that the wash pipe continues upwardly and is adapted to engage and be supported by the hoist system of the derrick in a manner well known in the art. At the same time, the upper end of the wash pipe 41 is connected to a source of fluid pressure, such for example as a pump which is positioned on the drilling vessel 11. As the wash pipe is picked up (FIGURE 6) the slings 30 and 31 become slack and may be disconnected. Subsequently, by removing the cross support beams 38, the wash pipe 41 and the weight containers 55 and be lowered downwardly through the deck 25. Obviously, the spacing between the rotary-support means 26 and 27 must be greater than the diameter of the weight containers 55. Otherwise, the rotary-support beams 26 and 27 must be removed temporarily until the weight containers have passed therethrough and then they would be re-installed in the deck of the derrick, when the equipment is in the position shown in FIGURE 7.

The outer surface of the upper section 21a of the well foundation pipe is provided with two or more eyes 63 and 64 to which guide cables 65 and 66 may be secured. This operation is usually done at the time the eyes 63 and 64 pass the auxiliary deck 23 of the barge. It is obvious that this operation can also be done at any time the equipment is above the surface of the water. Preferably, a three-guide line system is employed although for ease of illustration only two of the guide lines will be shown. The guide lines 65 and 66 extend upwardly to a pair of winches 68 and 69 which are mounted on the vessel at any suitable location, such for example, as on the intermediate deck 24. Preferably, the winches 68 and 69 are constant tension hoists. If desired, the guide lines 65 and 66 may pass through a pair of guide rings 70 and 71 having vertically-directed openings, the rings being fixedly secured to the upper end of the foundation pipe section 21a, and serving to hold the guide cables against the pipe section 21a. If desired, the winches 68 and 69 could be of a size and type adapted to be employed in lowering the entire well founda-

tion pipe 21 and 21a and the weight containers 55 into place in the ocean floor either together with or independent of the wash pipe 41 which could be independently suspended by the hoist system of the derrick. However, it is preferred that during the lowering and installation of the well foundation pipe 21-21a into the ocean floor, all of the weight be suspended by the wash pipe 41 when necessary and that the guide lines 65 and 66 be only used for purposes as will be described hereinbelow.

In FIGURE 8, the lower end of the lowermost section 21 of the well foundation pipe is illustrated as having entered the ocean floor. Since the top of the ocean floor is softer and more readily penetrated than the deeper formations, the great weight carried in the weight containers 55 is sufficient to drive the well foundation pipes 21-21a to a substantial depth instantaneously. However, it is desired that the earth core that enters the bottom of the well foundation pipe section 21 as it is forced into the ocean floor be washed out of the interior of the foundation pipe 21-21a so as to permit greater penetration by the pipe 21-21a. It is for this purpose that the wash pipe 41 and its jet head 42 is provided with fluid, such as salt water, which is pumped continuously down through the wash pipe to wash the earth particles from the interior of the well foundation pipe 21-21a. The water is pumped down through the wash pipe 41, out the jet head 42, and circulates up the annular space between the outside of the wash pipe 41 and the inside of the well foundation pipe 21-21a and out the spaces in the lower plate 52 between the gussets 54 of the weight support member 46 (FIGURE 14).

It is essential during this washing-out phase of the method of the present invention that the jet head 42 of the wash pipe not be immersed in soft formations to a depth such that it could not circulate the material up and out of the foundation pipe 21-21a. Thus, during the initial washing-out stage, that is, as the foundation pipe first starts to penetrate the ocean floor, it is generally necessary to support a portion of the weight of the apparatus on the wash pipe and to slowly feed the wash pipe 41 and the surrounding foundation pipe 21-21a into the ocean floor. While it has not been mentioned hereinabove, one of the most important aspects of the method of the present invention is that there be a core of earth, generally represented by numeral 72 (FIGURES 8 and 9) in the bottom of the lower section 21 of the foundation pipe so that at no time does any of the wash water jetting out of the jet head 42 circulate down under the lower edge of the foundation pipe 21 and escape up the outside thereof to the surface.

While the escape of fluid in this manner would facilitate the entry of the foundation pipe into the ocean floor, the resulting pipe installation would be of little use as a base pipe for an underwater well as the frictional resistance and/or holding power supplied by the formation bearing against the outer surface of the foundation pipe 21-21a would be destroyed, thus reducing greatly the vertical loads that the foundation pipe could subsequently support. In order to maintain a core 72 in the bottom of the pipe 21 throughout the installation thereof, it is essential that the jet head 42 of the wash pipe 41 be positioned at a determined distance above the lower end of the pipe 21 so that water can escape up the outside of the pipe. In one given installation the jet head 42 was positioned six feet above the bottom of the foundation pipe 21; in another installation it was eight feet above the bottom of the pipe 21. Accurate positioning of the jet head 42 of the wash pipe 41 relative to the lower end of the foundation pipe 21 can be accomplished by interconnecting the wash pipe 41 and the pipe 21-21a in any suitable manner, as by means of the J-slot 48 and support arms 50 as described hereinabove. Thus as the foundation pipe 21-21a penetrates the ocean floor, the jet head 42 is at a known distance from the bottom of the foundation pipe 21.

While it is necessary to maintain a core 72 in the bottom of the foundation pipe 21 throughout the installing procedures, it is especially desirable that the core of earth 72 be kept as small as possible to decrease the frictional resistance that it exerts on the inner wall of the foundation pipe 21 as increased resistance at this point decreases the depth to which the foundation pipe 21-21a can be sunk and hence lowers the amount of weight it could later support when the earth core 72 is drilled out during later drilling operations. It has also been found that the greatest penetration by a foundation pipe can be achieved by sinking the foundation pipe in a continuous operation to the depth desired. Thus, in the event that a hundred foot foundation pipe 21-21a is to be employed in the underwater well structure, two fifty foot sections 21 and 21a, respectively would be connected together, as by welding, and loaded with weights so that they are forced into the ocean floor, with washing, in one continuous stroke. In some formations, if the moving foundation pipe is stopped during the pipe sinking operation, it is impossible to start the pipe moving downwardly again even by the addition of extra weights. Thus, it is preferred that the entire length of foundation pipe be made up originally before starting the pipe sinking operation so that the sinking operations do not have to be stopped to add additional sections of pipe to the upper end thereof.

In FIGURE 9 the top of the foundation pipe 21-21a has been sunk level with the ocean floor and the wash pipe, weight support member 46 and weights 55 are then withdrawn upwardly (FIGURE 10) after rotating and manipulating the support arms 50 (FIGURE 13) out of the J-slot elements 48 (FIGURE 15) to disengage it therefrom. If it is planned to use a foundation pipe 21-21a with the upper end thereof flush with the ocean floor and it is found later to be impossible to force the last portion, say 20 feet of a hundred foot pipe section, into the ocean floor, an inside pipe cutter could be lowered on the running pipe string, similar to the wash pipe 41 except with a cutting head replacing the jet head 42, and the inside pipe cutter could be manipulated to cut off the exposed upper end of the pipe and a fishing tool could be sent down on the lower end of a pipe string to pull the upper pipe section up along the guide lines 65 and 66 (FIGURE 10) where it would be retrieved at the vessel.

With the foundation pipe 21-21a in place in the ocean floor and the guide lines 65 and 66 extending from the foundation pipe to the vessel, drilling can be commenced by lowering a drill pipe 73 from the barge with a bit 74 at the lower end thereof contained in a bit guide 75. One form of a bit guide is shown in FIGURE 18 as comprising a cylindrical housing 76 comprising two halves hinged on one side by a hinge pin 77 and provided on the other side with a connector pin 78 (FIGURE 19) for connecting together the two halves 76 and 76a of the housing. The housing 76 is provided with an outwardly flaring skirt 79 at its lower end to aid in positioning the bit guide on the upper end of a foundation pile 21a. Suitable means, such as slots 80 in the skirt 79 are provided for slidably mounting the bit guide 75 on the guide lines 65 and 66 (FIGURE 11). In addition to the slots 80 (FIGURE 19) channel-iron guides 86 are provided on the outside of the bit guide above the slots 80 to hold the guide lines with the use of removable keeper pins 87.

To position the bit guide 75 (FIGURE 18) on a drill bit 74, the bit guide is provided with two sets of latch fingers 81 and 82 which extend into the bore of the bit guide 75 a distance sufficient so that the clearance between each set of latch fingers will not allow a bit to pass therethrough when the latch fingers are in their horizontally-extended and operative position, as shown in FIGURE 18. As shown in FIGURE 20 each latch finger is movable in a vertical plane about a horizontal pivot pin 83, but is normally held in the horizontally extended position by means of a shear pin 84. Upon application of a predetermined weight to the latch fingers 82, the shear pins 84 break al-

lowing the bit 74 (FIGURE 18) to pass downwardly through the bit guide and into the foundation pipe 21a so that drilling operations can proceed. When the latch fingers 82 move downwardly they move into vertical openings 85 cut in the wall of the housing 76a. Upon withdrawing the drill bit 74 from the well, the latch fingers 81 contact the bit as it is withdrawn pull the bit guide 75 back to the vessel in the event that the guide was not previously retrieved by a retrieving line. A string of well casing, with or without the casinghead attached to the top of it, can then be run down into the place along the guide lines 65 and 66 by positioning the lower end of the well casing on the lower fingers 82 of the bit guide 75 (FIGURE 18) and lowering it along the guide lines. The lower end of the well casing would have a portion thereof similar to that shown in FIGURE 2 with regard to the lower end of foundation pipe 21, which was larger in diameter than the rest of the pipe so that the enlarged portion would be between the upper and lower latch fingers 81 and 82 so that the bit guide would not fall off the lower end of the casing. After the lower end of the casinghead entered the foundation pipe 21a, in a manner described hereinabove with regard to a drill bit, a cable attached to the connector pins 78 could pull the pin out and a bit guide could be retrieved by means of a separate cable secured to another ring 86.

We claim as our invention:

1. A method of setting a well foundation pipe in an unconsolidated formation underlying a body of water, said method comprising the steps of
 - (a) vertically suspending a foundation pipe from a floating vessel with the lower end of said pipe extending into the body of water,
 - (b) positioning independent fluid conduit means within said foundation pipe with said fluid conduit means extending downwardly from said vessel and centrally positioned in open spaced relationship within said foundation pipe, and connecting the fluid conduit means to said foundation pipe so that the lower end of said conduit means is adjacent but above the lower end of said foundation pipe,
 - (c) lowering said fluid conduit means and said foundation pipe until the pipe contacts the formation below said body of water,
 - (d) sinking said foundation pipe together with said fluid conduit means positioned therein into said unconsolidated formation,
 - (e) simultaneously pumping fluid down said central conduit means into the bottom of said foundation pipe to disintegrate and wash out the formation core entering the bottom of the foundation pipe as said pipe is forced into said formation, and
 - (f) circulating all of said pumped fluid and formation washings up the foundation pipe and through the annular flow passage outside said conduit means while maintaining the end of said conduit means a distance above the lower end of said pipe so that a core of said formation remains in the bottom of said pipe at all times preventing the escape of fluid therefrom.
2. The method of claim 1 including the steps of suspending said foundation pipe in open concentric spaced relationship from said fluid conduit means and outside thereof while suspending said conduit means from said vessel.
3. The method of claim 1 including the step of removably connecting the foundation pipe to said conduit means in a rigid manner so that the lower end of said conduit means is at a fixed distance above the lower end of said pipe as the two are lowered together into the underwater formation.
4. The method of claim 1 including the step of forcing said foundation pipe together with said fluid conduit means positioned therein into said formation by applying a weight positioned adjacent said conduit means to said pipe.

5. The method of claim 1 including the steps of continuing sinking said foundation pipe into said formation and washing the core therefrom until the top of said foundation pipe is at the desired level relative to said formation, and subsequently removing said conduit means from said foundation pipe. 5

6. The method of claim 1 including the steps of sinking said foundation pipe into said formation to refusal while washing the core therefrom, removing the conduit means from said foundation pipe, and subsequently cutting off the upper portion of said foundation pipe at the desired level relative to said formation. 10

7. A method of setting a well foundation pipe in an unconsolidated formation underlying a body of water, said method comprising the steps of 15

(a) locating a floating vessel over the underwater formation,

(b) substantially fixedly positioning said vessel at said location,

(c) making up a foundation pipe on said vessel, 20

(d) vertically suspending said foundation pipe from said vessel with the lower end of said pipe extending into the body of water,

(e) installing fluid conduit means extending downwardly from said vessel and centrally positioned in open concentric spaced relationship within said foundation pipe with the lower end of said conduit means adjacent but above the lower end of said foundation pipe, 25

(f) transferring the suspension of said foundation pipe from said vessel to the outside of said fluid conduit means in open spaced relationship therewith while suspending said conduit means from said vessel, 30

(g) lowering said fluid conduit means and said foundation pipe until the pipe contacts the unconsolidated formation below said body of water, 35

(h) forcing said foundation pipe together with said fluid conduit means positioned therein into said formation by applying a weight to said pipe,

(i) simultaneously pumping fluid down said central conduit means into the bottom of said foundation pipe to wash out the formation core entering the bottom of the foundation pipe as said pipe is forced into said formation,

(j) circulating all of said pumped fluid and formation washings up the foundation pipe and through the annular flow passage outside said conduit means while maintaining the end of said conduit means a distance above the lower end of said pipe so that a core of said formation remains in the bottom of said pipe at all times preventing the escape of fluid therefrom, and

(k) continuing forcing said foundation pipe into said formation and washing the core therefrom until the top of said foundation pipe is at the desired level relative to said formation.

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