

Oct. 15, 1940.

M. B. WILLEY

2,217,879

METHOD AND APPARATUS FOR DRILLING INTO WATER COVERED GROUND

Filed Jan. 16, 1940

2 Sheets-Sheet 1

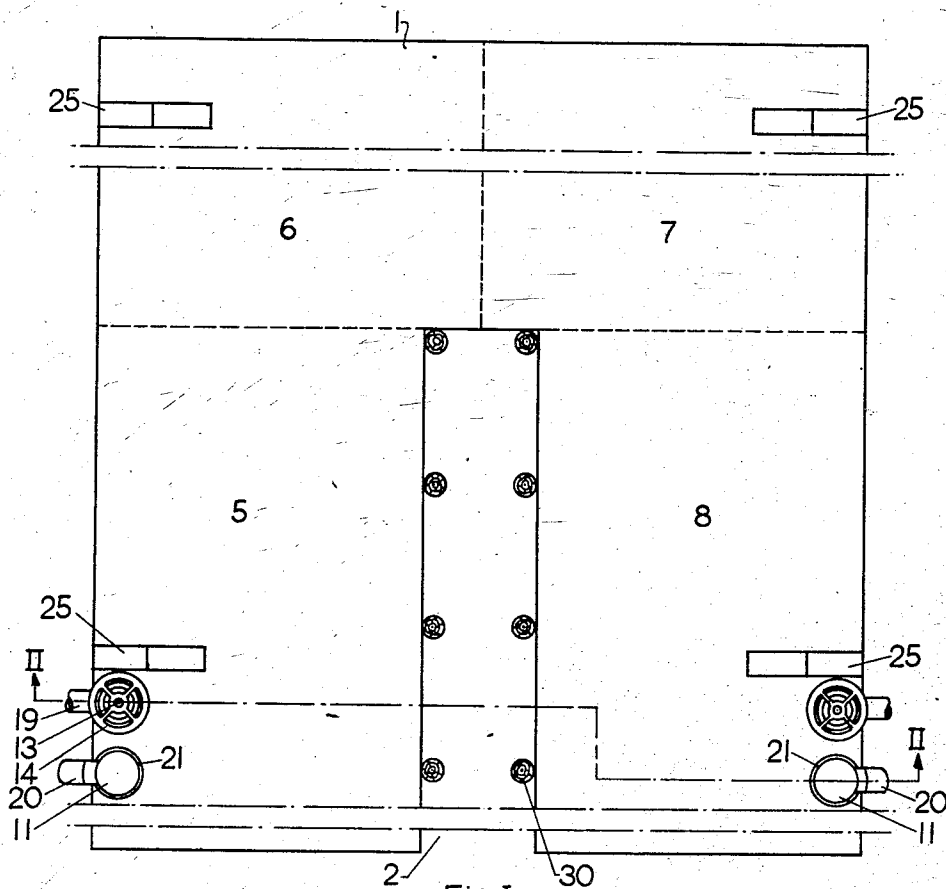


Fig. I

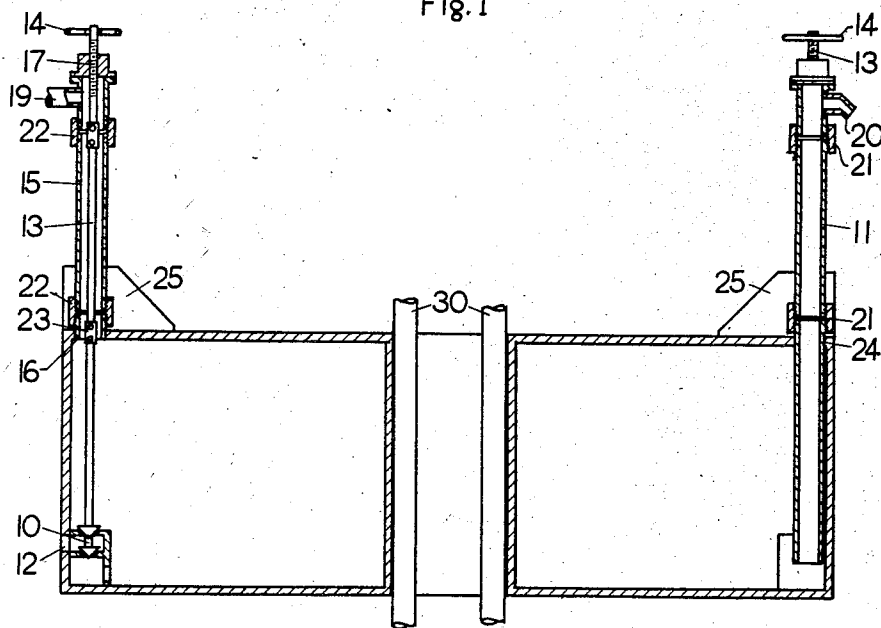


Fig. II

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2 Sheets-Sheet 2

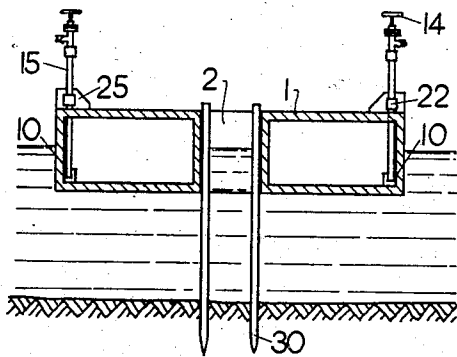


Fig. III

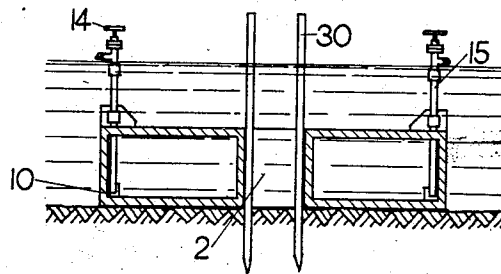


Fig. IV

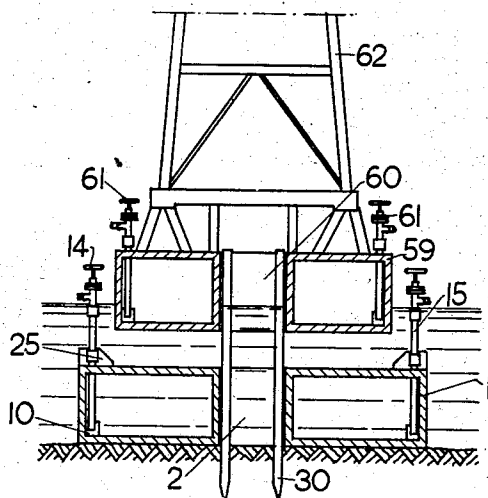


Fig. V

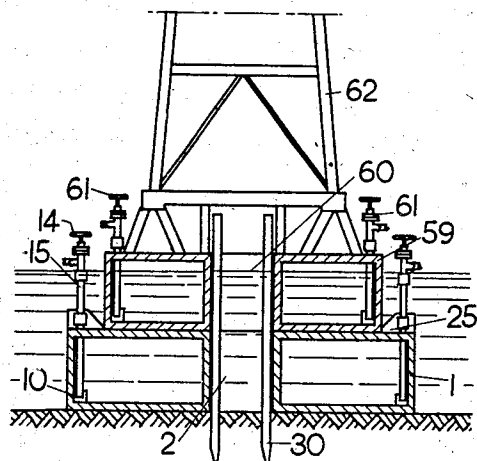


Fig. VI

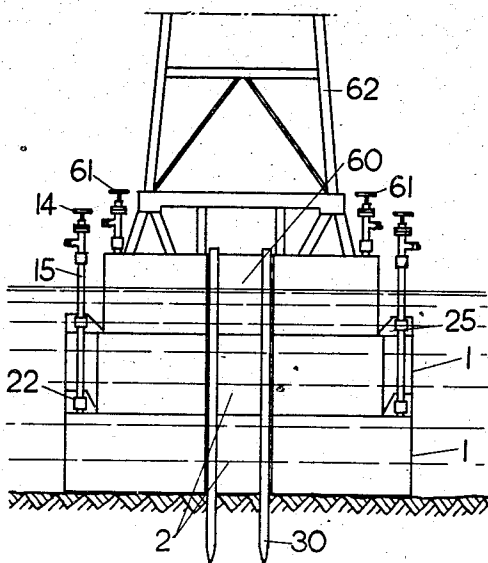


Fig. VII

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR DRILLING
INTO WATER COVERED GROUNDMarney Ben Willey, Iowa, La., assignor to Shell
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4 Claims. (Cl. 255—1)

The present invention relates to methods and apparatus for drilling wells into ground submerged under water bodies, such as into formations beneath lakes, coastal swamps, marshes, etc., and pertains more particularly to improvements in the construction and use of submersible drilling barges.

It is known to mount drilling equipment, such as drawworks, derrick, pump, etc., on barges, which may be floated to the desired location. For example, Giliasso (in U. S. Patent 1,681,533) proposes the use of such a barge which may be firmly grounded at the desired location by opening sea valves to the ballast tanks and sinking the barge hull to the bottom. The superstructure on the barge hull carries the derrick and drilling equipment. These barges are formed with a bay or open slot in one side to permit the passage of the drill or casing string therethrough so that when the ballast tanks are emptied and the hull raised, the barge may be floated away from the well head to another location.

The normal barge hulls are 8 to 12 feet in height and have a draft of $5\frac{1}{2}$ to 6 feet. In shallow marshes and swamps, canals about $6\frac{1}{2}$ feet deep are dug to allow the movement of the barges from one location to another.

However, when the water level varies to depths greater than about 12 feet, such as in some coastal swamps and lakes, the normal drilling barges must be replaced by special barges of greater draft and height.

In addition to the considerable expense in constructing these special drilling barges, the latter have the drawback of being suitable only for drilling in deep water due to their greater draft, deeper channels being required to move these special barges to new locations over shallow marshes or swamps. Costly drilling equipment thus becomes tied up and remains idle unless extensive drilling is being carried out at many points accessible to the special drilling barges.

It is, therefore, an object of the present invention to provide a method for drilling wells in ground submerged under any desired reasonable head of water by means of an apparatus comprising a separate floatable hull or auxiliary barge which may be sunk to form a foundation in deep water for a submersible drilling barge, whereby the use of special drilling barges of deep draft designed for operation at specific predetermined depths is eliminated, since it becomes possible to use any ordinary submersible drilling barge with as many separate hulls as are necessary to build up the foundation to the desired level.

Other objects and advantages of the present invention will be apparent from the following description taken in reference to the drawings, wherein:

Figure I is a schematic plan view of a submersible foundation hull, showing guiding piles in position.

Figure II is a schematic vertical sectional view of a foundation hull, taken along the line II—II of Figure I.

Figure III is a schematic vertical sectional view of a floating foundation hull, showing guiding piles in position.

Figure IV is a schematic vertical sectional view of a foundation hull which has been submerged to the bottom about the guiding piles.

Figure V is a schematic vertical sectional view of a submerged foundation hull with a drilling barge floated into position thereabove and about the guiding piles.

Figure VI is a schematic vertical sectional view of a submerged foundation hull onto which has been landed a submersible drilling barge.

Figure VII is a schematic vertical view of an operation wherein two foundation hulls are necessary.

Referring to Figures I and II of the drawings, a preferred form of a submersible foundation hull or barge, generally designated as 1, is formed with an open drilling bay 2 through which the drilling and casing strings are lowered during the drilling operations and which allows the hull to be floated away from the standing pipe after the completion of the well. The hull 1 itself is preferably about 6 to 12 or more feet in height, 10 feet having been found most suitable, and is divided, as shown in Figure I, by dotted lines, into several water-tight compartments or ballast tanks, such as for example, compartments 5, 6, 7 and 8. Each compartment is equipped with a water inlet valve 10, a water discharge tube 11, and means, described below, for venting air therefrom and pumping air thereinto. The water inlet valve 10 is preferably of the balanced type, as shown in Figure II, and arranged to control an opening 12 in the lower portion of the compartment. Serving to operate the valve 10, an elongated valve stem 13, having a hand-wheel 14 at its upper end, is attached thereto and extends upwards through a vertical tube 15 attached about and above an opening 16 in the upper wall of the compartment. The upper portion of the valve stem 13 is threaded and passes through a threaded opening 17 in the upper end of the tube 15. In the upper portion of the tube 15 is a side

opening 19 fitted with suitable nipple or coupling connections. The tube 15 thus serves as an air venting means or means for pumping air into the compartment for displacement of water therefrom as well as a protective casing and support for the valve stem 13. The water discharge tube 11 extends from within the lower portion of the compartment up through an opening 24 in the upper wall thereof to a point above the deck of the hull. The upper portion of the discharge tube 11 may be provided with a downwardly-directed spout 20 for discharging the water from the compartment away from the hull. The vertical tubes 11 and 15 and the valve stem 13 are extended upward to a distance such that when the hull is submerged the outlets 20 and 19 and the hand wheel 14 are above the high water level; for example, the outlets and hand wheel may be 8 to 12 feet or more above the deck of the hull 1. For greater manipulative flexibility, the tubes 11 and 15 and the valve stem 13 may be constructed with couplings 21, 22 and 23, respectively, whereby the length of the tubes and of the stems may be varied by connecting thereto additional sections, depending on the depth of the water at the well location.

The tubes 11 and 15 for each compartment are preferably arranged adjacent each other and all the vertical tubes are preferably situated so as to extend upwards from along the sides of the deck of the hull.

In order to permit the bay of the drilling barge to align itself with the bay of the foundation hull as it is submerged and landed on the foundation hull, suitable guiding means may be provided on the deck of the foundation hull to direct the drilling barge bottom into proper relationship with the deck of the foundation hull. In a preferred structure several triangular guides 25 are attached to the deck of the foundation hull and are preferably arranged along each side of the deck of the hull and spaced adjacent the tubes 11 and 15 on their side adjacent the bay 2 of the hull 1. However, other arrangements of the triangular guides 25 on the hull deck, such as spacing them along the edge of the bay 2 or along the edges at each end of the hull or combinations thereof, as well as other types of guides, such as tapered sockets and pins on the bottom of the drilling barge and the deck of the hull, may be suitably used.

In another desirable arrangement each compartment is fitted with a steam ejector having discharge and steam pipes extending above the deck. This arrangement for discharging water from the hulls is often preferred, since steam is readily available from steam boilers which usually furnish power to the drilling equipment on the drilling barge.

In another embodiment each spout 20 may be fitted with means to attach thereto a flexible suction hose, whereby water may be withdrawn from the compartments by attaching the other end of the hose to a suction pump on the drilling barge.

The method of drilling wells by means of the present foundation or auxiliary barge in combination with a regular submersible barge provided with drilling equipment, is as follows: the foundation hull of the present invention with its water inlet valve 10 closed and compartments 5, 6, 7, and 8 substantially free of water is floated into position over the desired well location. Guide pilings 30 are placed in an upright position closely adjacent the walls of the hull within the bay

2 thereof and are driven into the ground below the bay 2 of the hull, as shown in Figures I and III. With these pilings serving as guides during sinking, the hull is submerged to the position illustrated in Figure IV by opening the valves 5 10 by means of valve stem 13 and hand wheel 14 attached thereto, which allows the water to pass through the opening 12, through the open valve 10, into each of the compartments 5, 6, 7 and 8, permitting the air to escape therefrom 10 through the tube 15 and opening 18.

A drilling barge 59 of suitable type having a bay 60, watertight compartments, water inlet valves, valve controls 61, derrick 62, drilling equipment, etc., is then floated into position 15 above the submerged foundation hull and with its bay 60 about the guide piling 30, as shown in Figure V. The drilling barge hull 59 is landed, as shown in Figure VI, on top of the foundation hull 1 by submerging means similar to those in 20 the foundation hull. The drilling barge is guided and centered onto the foundation hull by means such as the triangular guides 25 and the guiding piles 30, so that the drilling barge is properly supported with its weight distributed over the 25 frame structural members of the foundation hull and so that the bay of the barge is properly aligned with the bay 2 in the foundation hull. The drilling barge and foundation hull may be then linked or fastened together to prevent relative shifting due to tides, waves, machinery vibration, etc. The upright tubes 11 and 15 are protected from damage by the drilling barge hull by the triangular guides 25 or by auxiliary protective means. 35

When the well is completed and it is desired to move the apparatus to a new location, the drilling barge is raised, as usual, by pumping air into its watertight compartments or by ejecting the water with steam ejectors, or by means of 40 a pump, and made ready to float to a new location. The foundation hull is then raised by attaching air pressure lines, such as from an air pump on the drilling barge by means of flexible hoses, to the coupling connection 19 on the upper end of the tube 15 or by connecting flexible 45 steam hoses to the ejectors, or by attaching flexible suction hoses from the pumps on the drilling barge to the spouts 20. With the water inlet valve 10 closed, and by any of the above 50 means, water is removed from the hull through the water discharge tube 11 and spout 20, until the hull comes to the surface. After being thus brought to the surface, the foundation hull may be towed to a new location. 55

When the depth of the water in the desired well location is greater than the combined height of one foundation hull and the drilling barge, two or more foundation hulls may be submerged one above the other, as shown in Figure VII. 60

I claim as my invention:

1. The process of drilling wells in ground submerged under water bodies, comprising the steps of sinking a foundation hull to the bottom of said water body, sinking a barge provided with 65 drilling equipment onto the top of said foundation hull, that portion of the barge carrying the drilling equipment remaining above water level, operating the drilling equipment to drill the well, separately floating the barge and the foundation 70 hull to the surface, and removing said barge and hull to a new location.

2. The process of drilling wells in ground submerged under water bodies, comprising the steps of sinking a foundation hull to the bottom of 75

said water body, sinking at least one other foundation hull on top of said first foundation hull, sinking a barge provided with drilling equipment onto the top of the uppermost of said foundation hulls, that portion of the barge carrying the drilling equipment remaining above the water level, operating the drilling equipment to drill the well, separately floating the barge and the foundation hulls to the surface, and removing said barge and said hulls to a new location.

3. In a system for submarine drilling, the combination comprising a submergible hull having a substantially flat bottom adapted to rest on a submerged solid surface, said hull having a substantially flat deck adapted to serve as a foundation for a second submergible hull, a second submergible hull having a bottom adapted to rest on the deck of the first hull, said second hull having a deck and drilling means supported on said deck above the water level when said hull is submerged, valve means for submerging said hulls by admitting water therein, a bay in each of said hulls permitting a drill string to pass therethrough, centering means to guide said second hull in such manner with regard to the first hull that said bays are substantially in register when said second hull is submerged on top of said first hull, and valve and conduit means for

floating said hulls by forcing compressed air therein.

4. In a system for submarine drilling, the combination comprising a submergible hull having a substantially flat bottom adapted to rest on a submerged solid surface, said hull having a substantially flat deck adapted to serve as a foundation for a second submergible hull, a second submergible hull having a bottom adapted to rest on the deck of the first hull, said second hull having a deck and drilling means supported on said deck above the water level when said hull is submerged, valve means for submerging said hulls by admitting water therein, a bay in each of said hulls permitting a drill string to pass therethrough, centering means to guide said second hull in such manner with regard to the first hull that said bays are substantially in register when said second hull is submerged on top of said first hull, valve means for floating said hulls by forcing compressed air therein, and adjustable length valve control members and conduit means cooperating with said valves and extending from said first hull to the surface for operating said valves when said hull is in submerged position.

MARNEY BEN WILLEY.