PORTABLE MARINE FOUNDATION FOR DRILLING RIGS AND METHOD OF OPERATION

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This invention relates to improvements in the form and operation of drilling barges, particularly drilling barges which are adapted to be submerged completely in a water body through which wells, such as oil or gas wells, are to be drilled.

In my co-pending applications, Ser. No. 44,626, filed August 17, 1948, now Patent No. 2,549,878 dated February 6, 1951, and Ser. No. 65,475, filed December 15, 1948, now Patent No. 2,575,578 dated May 28, 1951, and Ser. No. 90,694, filed jointly with Paul A. Wolff, several types of such barges and improvements in the construction and operation thereof have been disclosed. This invention is a continuation-in-part of these prior applications.

Such drilling barges are designed particularly for use in open ocean areas such as those occupying the continental shelves along the coasts of the United States and particularly along the Gulf Coast. Such barges, as described in the aforementioned applications, generally comprise a substantially flat-bottomed hull which supports an open-work superstructure designed to extend above the surface of the water when the barge is fully submerged and resting on the underlying land bottom. A working platform is mounted on the superstructure and a conventional drilling derrick and drilling machinery may be mounted on the working platform so that when the barge hull is on bottom, the working platform and drilling rig will be well above the maximum water level and wave heights which may be anticipated in the area. Such drilling barges are, therefore, fully portable for towing to and from the site of the well to be drilled, and with suitable compartmentation and ballast handling facilities to effect submergence and re-floating of the structure.

When fully equipped with derrick, drilling machinery, drilling equipment, and other quarters and machinery as is required to render the structure fully self-contained and portable as a unit, which is highly desirable for purposes of economy and efficiency, such a barge structure will have great weight and height. For example, a barge hull 160 feet long by 54 feet wide, having a molded depth of about 13 feet (a generally conventionally sized drilling barge), when fully equipped, as described, will weigh from about 1600 to about 2000 tons. Its height from the hull bottom to the top of the drilling derrick will range from about 170 to about 200 feet, of which only the barge hull and a portion of the superstructure supporting the platform and derrick will be below water when the barge is fully submerged and resting on bottom.

It is a matter of extreme importance to assure complete immovability, both laterally and vertically, of such massive structures when on bottom. As is well known to those skilled in this art, once a drilling of a well has been begun and surface or conductor casing has been set, no movement of the barge structure relative to the ocean floor in any direction may be permitted without serious danger of breaking of the well pipe and destruction of the well. It will be understood that drilling is conducted in the usual manner from the derrick floor, which will be well above the water level, through a narrow slot which is conventionally closed in the barge hull extending centrally of the hull from one end thereof to about its midportion. The surface casing or conductor pipe must, therefore, extend from the ocean floor upwardly to just below the derrick floor, a height of 30 or 40 feet or more, depending upon the water depth and the relative elevation of the derrick floor. Such a slender member may not, of course, be subjected to any lateral forces and since all drilling operations must be conducted therethrough, no relative movement or any kind between it and the drilling barge may be permitted. Moreover, the upper end of such a conductor casing is normally equipped with conventional wellhead fittings which ordinarily include very heavy and massive master valves, preventers and other fittings required for safe control of the well during drilling. Such wellhead fittings, therefore, form a heavy and bulky mass mounted on a relative slender and flexible stem, which would tend to fall over and bend or break, if not suitably held against any movement relative to its vertical axis. Accordingly, it is most desirable to be able to lash or otherwise fasten the wellhead, as by a plurality of radiating connections, to appropriate portions of the barge structure, again making it extremely important that there be no appreciable movement of the barge structure.

The difficulty of preventing any lateral movement of the structure over the ocean floor is greatly intensified by the fact that a very tall superstructure must necessarily be continuously exposed to the lateral forces imposed thereon by the waves and winds which are prevalent in the open ocean and these forces may, under storm conditions which frequently prevail, attain great magnitudes, despite the fact that the superstructure may be of work structural form, so as to present a minimum of solid surfaces subject to these forces.

Moreover, not only is it essential that all lateral movement of the barge structure relative to the well be prevented, but it is equally important that there be no substantial vertical movement of the structure relative to the well, since the mouth of the conductor pipe and its related fittings, which is a fixed point above the land on which the well is drilled, through which all drilling operations must be conducted. Obviously, therefore, once the barge structure is on bottom and drilling has begun, any appreciable vertical movement, either up or down, of the barge structure relative to the wellhead would constitute a very serious hazard to the drilling operations and to the well itself. This presents an additional problem of very serious nature with barge structures of the kind described intended for drilling in deep and open waters. This is due to the fact that the ocean floor, particularly along the Gulf Coast, is ordinarily covered by a layer of varying thickness of a soft, silty and sandy material which will not support a body of substantial weight but will allow such a body to sink unevenly into the soft soil, particularly if subjected to the heavy vibrations normally attendant upon conventional drilling operations. Thus, if the full weight of a tall and heavy structure such as one of the described drilling barges is imposed thereon, the barges are very likely to tilt or sink into the soft material with the resulting serious hazard to the drilling operations.

Accordingly, it is a primary object of this invention to provide improved forms of portable marine foundations and methods of operation thereof which will overcome the several difficulties above enumerated while still retaining to a maximum degree full freedom in submerging and raising the barge at water locations and ready portability thereof to and from the well locations.

Generally stated and in accordance with illustrative embodiments of this invention, there is provided a drilling structure which includes a hollow generally flat-bottomed hull which is suitably compartmented and provided with ballast handling facilities whereby the buoyancy of the hull may be regulated to render it floatable on a body of water or to fully submerge it and which may be employed to vary the buoyancy to the desired extent while the hull remains fully submerged in order to regulate the weight imposed by the structure on the land bottom. The hull is equipped with means for preventing lateral and vertical movement thereof relative to the land when submerged to rest thereon and adapted to prevent any appreciable lateral movement of the structure while floating. The various objects and advantages of this invention will become apparent from the following detailed description when read in conjunction with the accompanying...
ing drawings which illustrate several useful embodiments in accordance with this invention.

In the drawings:

Fig. 1 is a side elevation of a barge structure in accordance with one embodiment of this invention showing the structure in the normal afloat position on a water body;

Fig. 2 is a view similar to Fig. 1 showing the structure with the foundation hull entirely submerged in a water body and resting on the underlying land bottom;

Fig. 3 is an end elevation of the structure looking toward the bottom end thereof;

Fig. 4 is a view similar to Fig. 2 looking toward the opposite end of the structure;

Fig. 5 is a plan view of the hull looking upwardly toward the bottom thereof;

Fig. 6 is a longitudinal sectional view of the barge hull taken generally along line 6–6 of Fig. 7;

Fig. 7 is a horizontal sectional view taken generally along line 7–7 of Fig. 6;

Fig. 8 is an enlarged fragmentary sectional view taken generally along line 8–8 of Fig. 4, illustrating one embodiment of a means for controlling attachment of the barge hull to the land bottom;

Fig. 9 is an enlarged fragmentary view taken in longitudinal section along line 9–9 of Fig. 4; and

Fig. 10 is a generally schematic view of a portion of the barge structure illustrating another embodiment of apparatus for controlling the attachment of the barge hull to the land bottom.

Referring to the drawings and to Figs. 1 to 6, inclusive, the barge structure comprises a hull, indicated generally by the numeral 10, which is of rectangular form having a generally flat bottom 11, a deck 12, side walls 13, and end walls 14. The latter may be connected to the bottom by conventional rake portions 15. The hull is provided with a mediolal slot 16 extending longitudinally therethrough of the section of the hull where it terminates in an end wall 17. It will be understood that slot 16 extends vertically entirely through the hull to provide access to the underlying land through the division of parts of projections or ribs 18 rigidly connected to the bottom of the hull and downwardly therefrom and are adapted to become embedded in the land surface when the barge hull has been submerged to rest thereon. Ribs 18 may be of any suitable form or shape and may be arranged about the perimeter of the hull, as illustrated, or at any other suitable points along the hull bottom, one such rib 18c being shown extending along the center line of the barge from end wall 17 to the opposite end of the hull. The hull is provided with a plurality of longitudinal and transverse partitions 19 adapted to divide the interior thereof into a plurality of compartments 20 which may be of any desired number, shape, and size. One of the compartments 20, ordinarily one which is located at or near the mid-ship portion of the hull, may be employed as a pump room in which pumps 22 may be located and employed for handling ballast which is to be introduced into or removed from the several compartments. The pumps are connected through suitable valved manifolds 23 to pipes 24 extending into the several compartments, and through which the ballast is transferred, in being understood that the ballast will be sea-water, although it may be any other suitable ballasting material. Suction and discharge pipes 25 extend through the barge walls to provide communication between the pump room and the water body outside the hull. Extending upwardly from the deck of the barge is a superstructure composed of a plurality of hollow columns 26, preferably round in shape, the upper ends of which are adapted to support a working platform 27 on which is mounted a conventional drilling derrick 28, and having portions thereof enclosed by walls to form rooms 29 for housing the drilling machinery and other equipment quarters for the operating crew. The height of the columns 26 will be made such as to extend well above the surface of a water body W when the barge is fully submerged therein and land on the underlying land bottom L. Some or all of these hollow columns may serve as trunks or conduits connecting the working platform with the interior of the barge hull and particularly with the pump room, to permit passage between the working platform and the hull, of personnel, power and water lines, and the like.
entire structure which must be suitably supported, and constitutes a weight which is variable between rather wide limits during the ordinary drilling operation. In addition to this, the buoyancy of the submerged hull will be regulated by the adjustment of the ballast, as described, to provide a sufficient degree of buoyancy which will buoyantly support a substantial portion of the total weight of the entire structure, including the dispensible operating materials, the remainder of the total weight being upon and directly supported from the land bottom. In order to maintain the portion of the total weight which will be imposed on the land at a substantially constant value, the weight will be varied in accordance with the changes in weight of the operating materials in order to maintain the established buoyancy and thereby maintain the portion of the total weight imposed on the land bottom at the desired substantially constant value.

Thus, in the above example, in which the total weight of the structure including full loads of operating materials is about 1600 tons and it is desired to limit the weight to be imposed directly on the land bottom to, for example, approximately 500 tons, sufficient ballast will be removed from appropriate compartments, such as the submerged hull to provide the hull with a buoyancy value equal to about 1100 tons, or sufficient to provide buoyant support for the portion of the total weight, while still keeping the hull in contact with the land bottom, as the weights of the operating materials vary, ballast will be added to or removed from appropriate compartments in accordance with the variation in weight, in order to maintain the buoyancy value constant. This variation will be substantially constant the predetermined portion of the weight to be kept imposed directly on the land bottom. It will be understood that generally it will not be necessary to maintain the weight imposed on bottom at an exactly constant figure, but that some variation within reasonable limits will ordinarily be permissible. Thus, in the example, the operators may be instructed to keep the weight on bottom at 500 tons, plus or minus 50 to 100 tons.

With the method in accordance with this invention, it does not become necessary to store the operating materials on the structure in any uniformly distributed manner. If the load over one portion of the structure should be increased, or decreased materially with respect to another portion, as to create a tendency of the structure to tilt in one direction or another, particularly when on a soft bottom, it is only necessary to correspondingly vary the amount of ballast in the appropriate compartments to compensate for this situation and thereby maintain the structure in level position while still maintaining the previously established overall buoyancy value and the load on bottom.

It should be noted that in order to effectively use buoyancy, in the manner described, to take some of the load off the bottom, it is essential to employ a hull whose design provides for the operation of the ribs in such a manner that the ribs will be partially submerged, any changes in water level, whether due to tidal changes or to the passage of relatively large waves, will proportionally lift and lower the hull relative to the bottom. The position of the hull under these conditions, which, as noted above, would be entirely intolerable for barge drilling, particularly when conducted in open ocean areas.

A portion of the total weight of the barge structure is imposed on the land bottom, as above described, the stability of the structure may be reduced with a consequent increase in the possibility of lateral movement of the land bottom under forces exerted by wind and wave striking the exposed portions of the superstructure. This possibility, while very greatly reduced by employing an openwork superstructure, as illustrated, may be sufficiently serious that suitable means should be provided on the hull bottom to substantially supplement its normal frictional engagement with the land. This may be done in various ways by increasing the weight on bottom between the hull bottom and the land bottom on which it is resting.

Ribs 18 constitute one suitable means for effecting positive engagement of the hull with the land bottom to resist lateral movement under forces of the kind described above. These ribs may be of any suitable shape and dimensions which are adapted to be embedded in the land surface under the weight of the barge structure and, as previously noted, may be distributed and arranged beneath the hull bottom in any suitable arrangement which will thereby offer effective resistance to lateral movement of the hull over the land bottom. As illustrated in Figs. 1 to 6, ribs 18 may be disposed along several portions of the hull bottom, and more ribs 18a may be disposed along the center line thereof between the inner end of slot 16 and the opposite end of the hull to provide a balanced arrangement for uniform distribution of the barge load. The ribs will ordinarily be made in two sections in length but may be made longer or shorter depending upon the nature of the land bottom in which they are embedded. Figs. 8 and 9 illustrate one generally suitable form for such ribs. The ribs are suitable for the hull bottom 11 by these ribs will, as noted, become embedded in the land bottom when the barge hull settles thereon and their engagement in the land will act as effective anchors to prevent lateral movement of the hull over the land bottom.

It has been found that a barge structure constructed and operated in the manner above described will remain perfectly immobile under even severe wind and wave conditions, and drilling may be safely conducted under such conditions. To reloat the barge after drilling has been completed, sufficient ballast is pumped from the several compartments and in a suitable order to increase its buoyancy sufficiently to allow the hull to again become sufficiently buoyant as to arise from the surface and float thereof. The aforementioned applications describe effective methods for refloating a structure of the kind described herein, that is, either by raising one end first or by employing pontoons to stabilize the main hull while its buoyancy is increased and it is rising to the surface.

Ribs 18 and 18a may also be employed to additionally supplement the gripping engagement between the hull and the land. Referring again to Figs. 8 and 9, rib 18a is there illustrated as constructed of a pair of side plates 29—29 which are rigidly connected to the hull bottom and converge downwardly thereby engaging the land and are rigidly connected together by a bottom plate 30 forming an enclosed box-like structure. A plurality of longitudinally spaced stiffening plates 31 are installed transversely across the interior of the rib, being rigidly connected to side plates 29—29, bottom plate 30 and hull bottom 11 to provide strong structural reinforcement of the rib structure. Openings 32 are provided through these stiffening plates to provide open communication between the interior of the rib and the adjacent spaces beneath hull bottom 11. A pipe 33 connects the interior of the rib with the exterior of the hull through a conventional fitting, such as a sea chest 36, which may be mounted at any location along the wall of the hull, as adjacent the juncture of end wall 14 and rake portion 15, and communicates with the exterior of the barge hull through openings 37 in end wall 14. A valve 38 is interposed in pipe 36 to control the passage of water therethrough. A second pipe 39 connects the interior of rib 18e at the opposite end with the exterior of the barge hull through another conventional fitting, such as a sea chest 40, which may be conveniently arranged, as illustrated, at a suitable elevation along end wall 17 and communicates with the exterior of the barge hull through opening 41 in wall 17. A reversible pump 42, of any suitable and conventional design, is interposed in pipe 53 for the purpose of moving water between the interior of rib 18e and the exterior of the barge hull.

The above-described apparatus may be employed to augment the gripping engagement between the hull bottom and the underlying land in the following manner: When the hull is resting on the seabed as above described, pump 42 will be driven in a direction to draw a stream of water from water body I through sea chest 36 and pipe 35 into the interior of rib 18e at one end and to discharge the water from the opposite end of the rib through pipe 39 and sea chest 40 back into the water body outside end wall 17. This circulation of water will create...
a reduced pressure in rib 18a which will extend outwardly through openings 34 on both sides of rib 18a and thereby create a reduced pressure in the closely confined space between the bottom surface of the barge hull and the adjacent land surface which will cause the barge bottom to cling with increasing tightness to the land surface in contact therewith. The magnitude of the suction effect may be regulated by suitably throttling valves 38 and 40 which may be drawn in rib 18a from beneath the barge hull will be continuously washed out of the rib by the stream of relatively clean water which is circulated through the rib by the pump 35. As circulation of water is continued, the suction effect created thereby will extend over an increasingly large area beneath the hull bottom, although in many cases the continued maintenance of only a relatively small reduced pressure area is all that is required to hold the barge in place. The reduced pressure, increasing the gripping engagement between the hull bottom and the land, will not only augment the frictional resistance to lateral movement but will also act to resist any tendency of the barge to lift off of the land.

Pumped upon the fact that there is more, the ribs 18 may also be constructed in a form similar to rib 18a and connected to similar water-circulating apparatus in a like manner to provide additional suction effect beneath various positions of the barge hull.

The suction creating apparatus may also be employed to "break" the barge loose from the land bottom when it is desired to refloat the barge. This may be accomplished simply by reversing the direction of the flow of water through rib 18a or other ribs which may be connected in the same manner to the water circulating apparatus. In this instance pump 42 will take suction through sea chest 46 and pump the water through rib 18a toward pipe 35 and ultimate discharge through sea chest 36. By suitable throttling of valve 38, the water will be forced to discharge laterally out of rib 18a through openings 34 and between the bottom surface of the hull and the land surface, thereby freeing the hull bottom from the adhering land. Ordinarily, this operation will be performed concurrently with the increase in buoyancy of the hull by removal of ballast so that the freeing of the hull may be effected quickly and with minimum positive buoyancy applied to the hull.

Fig. 10 illustrates still another embodiment of apparatus whereby the gripping engagement between the hull and the land may be augmented and which may also be employed to readily free the hull from adherence to the land. In accordance with this embodiment an electrical method and apparatus is employed for the described purposes. The apparatus comprises a suitable source of direct current, such as a battery 45, or any suitable direct current generator. One terminal of the battery is connected by a conventional electrical conductor 46 to a suitable electrical contact member 47 which is placed in direct electrical contact with steel plates forming the bottom of the barge hull. A second conductor 48 connects the opposite terminal of battery 45 to an electrode 49 which may be a piece of ordinary steel pipe or any other piece of metal which is placed in contact with land bottom 1 at a suitable distance from hull 10 to serve as a ground connection.

The method in accordance with this embodiment is based on a principle whereby the portion of land which normally comprises land bottom 1, ordinarily bear electrical charges, generally negative charges. By establishing an electrical field across the interface between the hull bottom and the land surface by controlling the direction of the field relative to the charge on the mud particles, the mud particles will be caused to be attracted to the hull bottom or repelled therefrom. By making the polarity of the hull bottom opposite that of the mud particles in contact therewith, the particles will be caused to adhere strongly thereto, thereby increasing the gripping engagement between the hull bottom and the land with which it is in contact. Conversely by making the polarity of the hull bottom of like sign to that of the mud particles the latter will be repelled from and an effective release of the hull bottom from the normal clamping or gripping action of the land.

As illustrated in Fig. 10, an electrical field, indicated by lines of force 50, is established between the ground connection formed by electrode 49 and the hull bottom and across the interface between hull bottom 11 and land surface L. By connecting the positive terminal of battery 45 to electrode 47 and the negative terminal of the battery to electrode 49, the direction of the electrical force by the land, it is not only necessary to reverse the direction of the field, as by reversing the connections at the battery terminals, whereupon the mud particles will be repelled from the hull bottom. The converse of these connections may be employed in the event it is determined that the particles comprising land bottom L bear positive charges.

It is ordinarily desirable to make the electrical connection of contact 47 to the inside of the hull bottom and not to other parts of the hull in order to reduce the electrical current which is particularly important for placed as shown, most of the current will flow across the interface between the hull bottom and the ground, and only a comparatively small amount will leak along the relatively thin steel plate forming the hull bottom and thence to the side plates of the hull where its effect would be lost. Similar electrical connections may be made at various points on the hull bottom to increase the gripping effect or, conversely, the releasing effect described.

This embodiment is particularly effective for use in connection with the method of raising the hull and first as described in my aforementioned co-pending application Serial No. 65,475. The electrical releasing force may thus be applied at one end only, and as that end rises with removal of ballast, the upward movement will readily pull the remainder of the hull loose from the adhering land as the buoyancy is increased by removal of additional ballast.

The electrical current requirements for the present embodiment will vary generally with the area to which the field is to be applied. Amperages of the order of 0.01 amperes per square foot at voltages of from 1 to 5 are suitable for most cases.

Still another method of restraining lateral movement of the hull, particularly when in partially buoyant condition, may be effected by initially adjusting the buoyancy of the submerged hull to a value such as will impose sufficient weight on the land to cause the hull to sink into the land for a depth of, say, one or two feet, and by then adjusting ballast to reduce the imposed weight to a smaller value sufficient to check further sinking of the hull and maintain it at the desired embedded depth. The ballast may then be additionally varied as required in accordance with variations in the lateral forces in the manner previously described, to continue to maintain the bottom-supported weight substantially constant at the smaller value. Since the hull will now be partially embedded in the land, it will thus be effectively restrained against lateral movement.

From the foregoing it will be seen that novel methods and apparatus are disclosed whereby a portable drilling rig may be usefully employed in areas remote from the open ocean drilling, and which may be rendered completely stable and substantially immovable when on bottom without the employment of conventional anchor drilling, or other expensive and generally cumbersome and inefficient anchoring means. As a result submergence and re-floating of the structure may be very quickly and simply accomplished, thereby greatly enhancing the features of complete portability for movement from one location to another.

It will be understood the numerous alteration and variations in the apparatus and method of doing the improvements herein described may be made without departing from the scope of the appended claims but within the spirit of this invention.

What is claimed is:

1. In the method of drilling wells through a water body by the employment of a drilling structure mounted on a submerged hull having a plurality of ballast compartments and ballast-handling means for transferring ballast to and from said compartments, the improvements
which comprise the steps of totally submerging said hull beneath the surface of said water body into supporting engagement with the underlying land, adjusting the buoyancy of the submerged hull to buoyantly support a substantial portion of the total weight of the entire structure whereby to impose only a portion of said total weight directly on said land, and maintaining said hull in engagement with said land.

2. In the method of drilling wells through a water body by the employment of a drilling structure mounted on a submersible hull having a plurality of ballast compartments and ballast handling means for transferring ballast to and from said compartments, the improvements which comprise the steps of totally submerging said hull beneath the surface of said water body into supporting engagement with the underlying land, adjusting the buoyancy of the submerged hull to buoyantly support a substantial portion of the total weight of the entire structure whereby to impose only a portion of said total weight directly on said land, and maintaining said hull in engagement with said land.

3. In the method of drilling wells through a water body by the employment of a drilling structure mounted on a submersible hull having a plurality of ballast compartments and ballast handling means for transferring ballast to and from said compartments, the improvements which comprise the steps of totally submerging said hull beneath the surface of said water body into supporting engagement with the underlying land, and creating a reduced pressure area between the hull bottom and the contiguous land surface to thereby increase the gripping engagement therebetween.

4. The method of stabilizing a hollow hull which is resting on a land surface beneath a water body, comprising, regulating the buoyancy of the hull to provide buoyant support for a substantial portion of the total weight of said hull while maintaining said hull in engagement with the land surface, and effecting supplementary gripping engagement between the hull bottom and the contiguous land surface independently of the change in weight of said hull.

5. The method of stabilizing a hollow hull which is resting on a land surface beneath a water body, comprising, regulating the buoyancy of the hull to provide buoyant support for a substantial portion of the total weight of said hull while maintaining said hull in engagement with the land surface, and creating a reduced pressure area between the hull bottom and the contiguous land surface to thereby increase the gripping engagement therebetween.

6. In the method of drilling wells through a water body by the employment of a drilling structure mounted on a submersible hull, the improvements which comprise the steps of totally submerging said hull beneath the surface of a water body into supporting engagement with the underlying land, regulating the buoyancy of said hull to provide buoyant support for a substantial portion of the total weight of the entire drilling structure while maintaining said hull totally submersed and in engagement with said land, and creating an electric field between the hull bottom and said land in one direction to increase gripping engagement between said hull and said land, and in the opposite direction to reduce said gripping engagement.

7. In the method of drilling wells through a water body by the employment of a drilling structure mounted on a submersible hull, the improvements which comprise the steps of totally submerging said hull beneath the surface of a water body into supporting engagement with the underlying land, and creating a reduced pressure area between the hull bottom and the contiguous land surface to thereby increase the gripping engagement therebetween.

8. The method of stabilizing a hollow hull which is resting on a land surface beneath a water body, comprising, regulating the buoyancy of the hull to provide buoyant support for a substantial portion of the total weight of said hull while maintaining said hull in engagement with the land surface, and effecting supplementary gripping engagement between the hull bottom and the contiguous land surface independently of the change in weight of said hull.
members and said water body, pump means interposed in one of said conduits and a throttle valve in the other of said conduits.

15. A portable marine foundation for a well drilling rig and the like, comprising, a hollow generally flat bottomed hull adapted to be totally submerged beneath the surface of a water body with said bottom resting on the underlying land, ballast compartments in said hull, ballast handling means for transferring ballast to and from said compartments operative to vary the buoyancy of said hull, and means for creating a directionally controlled electric field across the interface between said hull bottom and said land, including means for directing said field in one direction to effect adherence of said hull bottom to said land and in the opposite direction to effect release between said hull bottom and said land.

16. A portable marine foundation for a well drilling rig and the like, comprising, a hollow generally flat bottomed hull adapted to be totally submerged beneath the surface of a water body with said bottom resting on the underlying land, ballast compartments in said hull, ballast handling means for transferring ballast to and from said compartments operative to vary the buoyancy of said hull, and means for creating a directionally controlled electric field across the interface between said hull bottom and said land.

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