

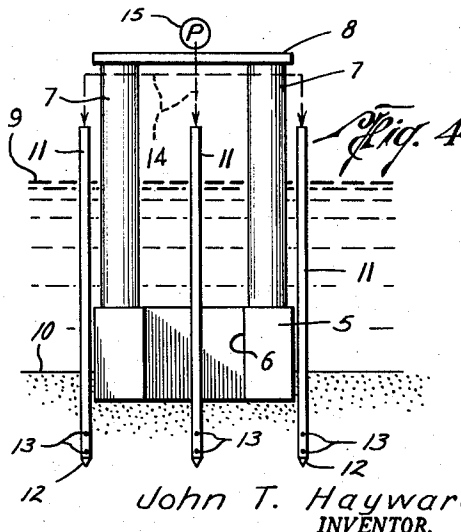
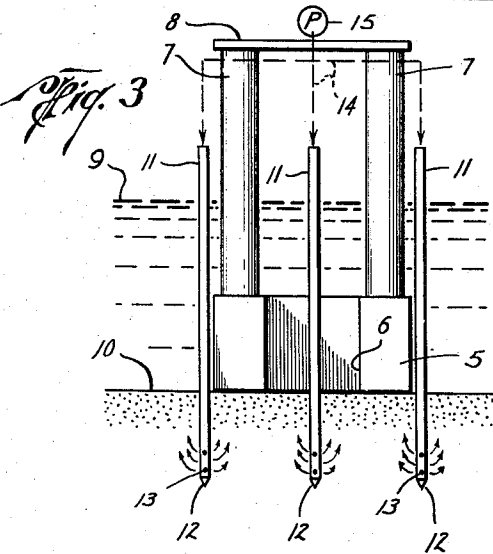
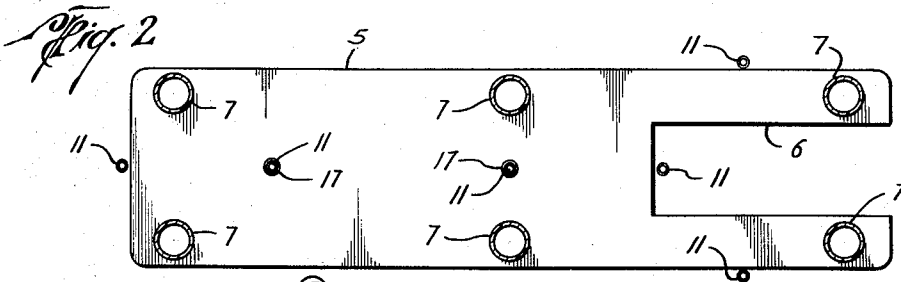
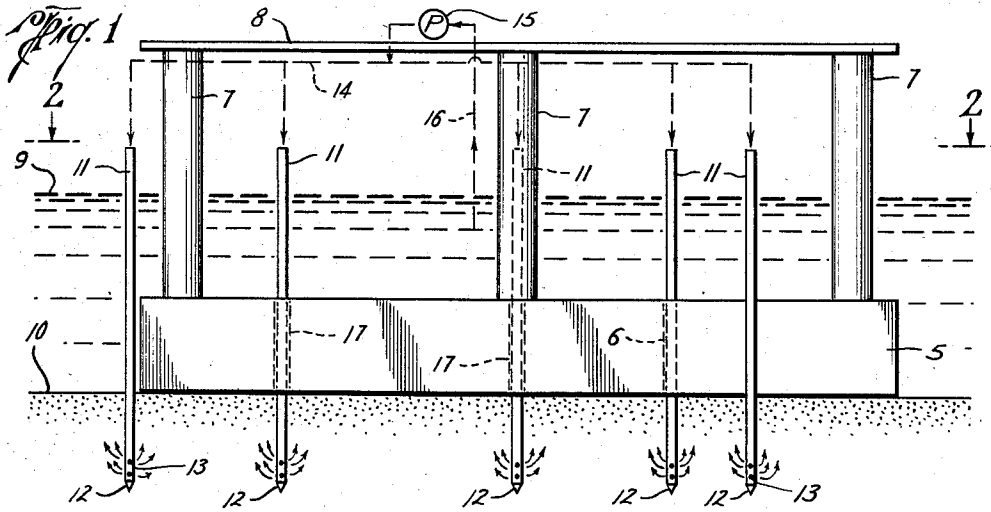
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J. T. HAYWARD

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METHOD OF STABILIZING SUBMERGED HULLS ON SAND BOTTOMS

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John T. Hayward
INVENTOR.

BY

R. W. [Signature]
ATTORNEY

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METHOD OF STABILIZING SUBMERGED HULLS ON SAND BOTTOMS

John Thomson Hayward, Tulsa, Okla.

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4 Claims. (Cl. 61—46.5)

This invention relates to a method for stabilizing drilling barges of the totally submersible type when on bottom.

Drilling barges of the totally submersible type are employed for drilling in open water areas, as in the submerged marginal lands along the coast of the Gulf of Mexico. In general such barges comprise a flat bottomed hull which is adapted to be totally submerged in the water body to rest on the underlying land. The hull carries an open superstructure including a deck or working platform which is elevated sufficiently above the hull to be well above the water surface and the crests of any waves which may occur therein when the hull is on bottom. Drilling operations are conducted from the platform through a suitable opening, such as a drilling slot, in the hull. Drilling barges of this general character and their operation are described in my U.S. Patent No. 2,551,375, issued May 1, 1951.

It is an essential requisite in employing such barges that they remain substantially immovable on bottom during drilling. It is, therefore, a primary object of the present invention to provide a method whereby totally submerged barges may be effectively stabilized or anchored to the land on which they rest so as to render them substantially immovable during the conduct of drilling operations.

An important object of this invention is the prevention of erosion or under-cutting about and under the barge hull.

This invention is particularly applicable to situations where the barge is set down on a sandy bottom. Such bottoms are usually relatively hard, even though they may be water-logged, and the hull usually will not sink into such bottoms. Under these conditions the hull is subject to possible sidewise displacement during heavy storms. Erosion is also likely to occur because sand is easily eroded and with the bottom slightly uneven and at the same time relatively hard, the hull of the barge may not be in contact with the sand bottom at all points. Tunnels may, therefore, be formed in the sand beneath the hull because of water movement due to wave action, or currents may cause circulation under the hull bottom and resulting washouts which may cause the hull to shift or heel or otherwise become displaced with consequent serious hazard to the drilling operation.

All of these conditions can be greatly improved if the bottom of the hull can be worked to a position below the surface of the sea bed. If the hull can be embedded to a distance of even a foot or two, the possibility of lateral movement is practically abolished and the liability of tunneling or serious erosion greatly reduced.

According to the present invention the hull is caused to sink evenly into hard sand bottoms by creating beneath the hull controlled quick-sand conditions. Water-logged sands are quite firm, but if there is any upward flow of water at even very low rates through the sand bottom, quick-sand conditions will be created which will

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allow an object pressing on the sand surface to sink therein.

The method in accordance with the present invention comprises creating quick-sand conditions beneath the barge hull after it has been set on bottom by causing an upward flow of water in the sand structure beneath and adjacent the periphery of the hull bottom. By creating such quick-sand conditions the hull will be caused to sink into the underlying sand. By suitably regulating the rate of water flow in the sand at suitably distributed points beneath the hull, even sinking can be achieved. Moreover, by suitable regulation of the water flow, the depth to which the hull is embedded in the sand may be effectively controlled.

The various objects and advantages of the present invention will become more readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates more or less schematically a drilling barge and apparatus suitable for performing the method in accordance with this invention.

In the drawing:

Fig. 1 is a side elevational view showing a drilling barge with its hull totally submerged and resting on the bottom underlying a water body;

Fig. 2 is a transverse cross-sectional view taken generally along line 2—2 of Fig. 1;

Fig. 3 is an end elevation of the barge of Fig. 1; and

Fig. 4 is a view similar to Fig. 3 showing the hull partially embedded in the land.

Referring to the drawing, there is shown a drilling barge comprising a box-like hull 5 of elongated generally rectangular shape having a substantially flat bottom. It will be understood that the interior of hull 5 will be suitably compartmented and provided with conventional ballast handling gear for filling and emptying the hull compartments for the purpose of submerging and raising the hull in accordance with well-known practices, the details of the hull construction and of such gear being no part of the present invention, which is applicable to various types of hull which are adapted to be totally submerged in a water body to rest on the underlying land. Hull 5 will preferably be provided with the usual elongated slot 6 extending vertically through the hull and opening to one end thereof. Slot 6 is commonly referred to as a drilling slot, as it is employed as an opening through which drilling operations may be conducted in the underlying land.

A superstructure is mounted on the hull and comprises a plurality of vertically disposed spaced-apart columns 7, the upper ends of which support a deck or platform 8 from which drilling operations and the like may be conducted. The height of columns 7 will ordinarily be made such that when hull 5 is submerged in a water body 9 to rest on the underlying land 10, platform 8 will be well above the surface of the water body and above the crests of any waves which might occur therein.

The barge structure including hull 5 may be submerged and refloated in any suitable manner. Suitable methods for effecting safe submersion and raising are described in detail in my aforementioned U.S. Patent No. 2,551,375, as well as in my U.S. Patent No. 2,540,878, issued February 6, 1951.

Where the surface beds comprising land 10 are composed of relatively firm sand, as will be the case in many locations, the sand will ordinarily be firm enough to support the weight of the barge structures so that the submerged hull will rest on the surface of the sand bed and, as previously noted, will be subject to lateral shifting by water movements. Also erosion and undercutting of the supporting sand bed may occur which could produce

heeling or shifting of the hull which would be hazardous to the barge structure and to the drilling operations conducted therefrom.

The present invention provides a relatively simple but highly effective method for embedding the hull to a suitable depth in such sand beds whereby the barge structure will be firmly anchored against lateral movement relative to the land and the danger of erosion and undercutting will be largely obviated.

In accordance with the present invention, after the hull has been submerged to rest on land 10, currents of water are caused to flow upwardly in the sand bed underlying the hull whereby to loosen the sand and make it relatively unstable, thereby creating what corresponds to quick-sand conditions beneath the hull. The weight of the barge structure pressing on the loosened sand will cause the hull to sink into the sand and become embedded therein. When the hull has embedded itself to the desired depth, further sinking may be prevented by stopping the flow of the water currents through the sand, whereupon the sand will promptly regain its stability and firmness sufficient to effectively support the barge structure in its embedded position.

Various means may be employed to produce and control the desired water movements in the sand beds. The drawing illustrates one embodiment of apparatus which may be effectively employed for carrying out the method of this invention. In accordance with the illustrative embodiment when the hull has come to rest on land 10, a number of "sand-points" 11 are driven into the land immediately adjacent the perimeter of the hull and beneath its bottom. As understood in the marine arts, and for purposes of this description, a sand point is a tubular pile having a pointed end 12 to enable the pile to be readily forced or driven into the land underlying a water body.

In the present embodiment the sand points will have their upper ends extending above the surface of water body 9 and a plurality of openings 13 are provided in the lower end portions of the sand points. The several sand points are suitably connected to a pipe manifold, indicated by the broken lines 14, which is connected to a circulating pump 15, which has its suction pipe 16 extending into water body 9.

Water is circulated by means of pump 15 through manifold 14 to the interiors of the several sand points and thence through openings 13 into the surrounding sand, as indicated by the arrows in Figs. 1 and 3. The water will then flow upwardly through the sand toward its surface and this movement of water through the sand will effectively loosen it and create the desired quick-sand conditions beneath the hull. The weight of the barge structure pressing on the loosened sand will cause the hull to sink through the surface of the sand bed and embed itself therein, as best seen in Fig. 4. As soon as the hull has embedded itself to the desired depth, pumping of water through the sand-points is stopped, thereby stopping the flow of water through the sand. As soon as the flow of water through the sand ceases, the sand will immediately become re-stabilized and regain its original firm character so that it will again strongly support the barge structure and prevent its further downward movement. The hull being now embedded in the sand will be firmly anchored thereby against lateral movement and the surface of the sand bed being now well above the level of the hull bottom, erosive action and undercutting of the hull will be effectively obviated.

It will be understood that a sufficient number of sand points will be employed and will be positioned relative to the hull bottom so as to assure relatively uniform quick-sand conditions throughout the area underlying the hull bottom. As illustrated, some of the sand points may be driven into the land at spaced points about the hull perimeter and adjacent thereto. Others may be driven through wells 17 extending through the hull along

its center line. One or more sand points may be driven through slot 6 adjacent its inner end wall as shown.

By selectively controlling the rate of water flow through the several points level sinking of the hull can be effected. Embedding of the barge is controlled simply by controlling the operation of the water circulating pump.

When it is desired to raise or refloat the barge, its release from the sand may be effected in various ways.

One method is to render the sand unstable by again circulating water through the sand points and at the same time de-ballasting the hull to render it buoyant. As a buoyant object will float on quick-sand the barge will rise through the sand and can be brought to the surface in the usual manner.

Another method is to equip the bottom of the barge with hollow keel flanges through which water may be pumped to the interface between the hull bottom and sand surface. Such a method and apparatus for releasing a hull is disclosed in my co-pending application Serial No. 90,694, filed April 30, 1949, and now abandoned. Other known means and methods of introducing water between the hull bottom and the sand surface may be employed. In many cases the hull will release itself when it is rendered buoyant preparatory to raising it to the surface.

From the foregoing, it will be evident that this invention provides a novel and simple method for effectively stabilizing and anchoring a totally submersible barge when resting on a sand bed underlying a water body.

It should be understood that the sand-points themselves do not constitute anchors for the barge structure and are not intended to function as such, since, ordinarily, these sand points will be withdrawn when embedding of the barge has been completed.

It will be understood that alterations and changes may be made in the illustrative embodiment within the scope of the appended claims without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. The method of stabilizing a submerged hull having a bottom of a substantial area resting on a sand bed underlying a water body in which the hull is submerged, comprising, inserting a substantial distance into the sand bed at spaced points about the lower surface area of the hull a plurality of water supply conduits movable relative to said hull and having discharge openings in the lower end portions thereof positioned below the surface of the sand bed, discharging water through said openings at rates to cause relatively slow upward flows of water through said sand bed toward its surface to create a quick-sand condition under the entire hull area to allow the hull to sink into the sand bed relative to said conduits, and stopping the introduction of the water into the sand bed when the hull has embedded itself therein to the desired depth.

2. The method of stabilizing a submerged hull having a bottom of a substantial area on a sand bed underlying a water body in which the hull is submerged, comprising, inserting a substantial distance into the sand bed at spaced points about the lower surface area of the hull a plurality of water supply conduits movable relative to the hull and having discharge openings in the lower end portions thereof positioned below the surface of the sand bed, discharging water through said openings at rates to cause relatively slow upward flows of water through said sand bed toward its surface to create a quick-sand condition under the entire hull area to allow the hull to sink into the sand bed relative to said conduits, regulating the flow of water to the several points of introduction to maintain level sinking of the hull into the sand bed, and stopping the introduction of the water into the sand bed when the hull has embedded itself therein to the desired depth.

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3. The method of stabilizing a submerged hull having a bottom of a substantial area resting on a sand bed underlying a water body in which the hull is submerged, comprising, inserting a substantial distance into the sand bed at spaced points about the lower surface area of the hull a plurality of water supply conduits movable relative to said hull and having discharge openings in the lower end portions thereof positioned below the surface of the sand bed, discharging water through said openings at rates to cause relatively slow upward flows of water through said sand bed toward its surface to create a quick-sand condition under the entire hull area to allow the hull to sink into the sand bed relative to said conduits, stopping the introduction of water into the sand bed when the hull has embedded itself therein to the desired depth, thereafter re-introducing water into the sand bed to again loosen the sand about said hull, and while said bed is in loosened condition, de-ballasting the hull to re-float the same.

4. The method of stabilizing a submerged hull having a bottom of a substantial area resting on a sand bed underlying a water body in which the hull is submerged comprising inserting a plurality of water supply conduits having discharge openings in the lower end portions thereof into the sand bed about the lower surface

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area of the hull to a depth where the discharge openings are a substantial distance below the sand bed surface, discharging water through said openings to cause relatively slow upward flows of water through said sand bed toward its surface to create a quick-sand condition throughout the entire area underlying the hull bottom to allow the hull to sink into the sand bed, and stopping the introduction of the water into the sand bed when the hull has embedded itself therein to the desired depth thereby vitiating the quick-sand condition so that the sand bed supports the hull at said desired depth.

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