SUBMERSIBLE DEEPWATER DRILLING APPARATUS

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11 Claims. (Cl. 61—46)

1 The present invention relates to marine vessels such as floating barges for use in sub-aqueous operations and, more particularly, to new and improved submersible means for supporting the operating equipment firmly in position above the surface of the water during oil drilling operations and the like.

An important object is to provide a floating barge with one or more submersible ground anchors having means when the vessel is submerged to rest on the ground below the surface of the water, to provide a strong, durable base or foundation for firmly supporting above the high-wave level of the water, the superstructure such as a derrick and other large and heavy equipment used in deep water oil well drilling and other subaqueous operations.

Devices hereinafter used in drilling oil wells in shallow water have not been found practical or efficient for drilling wells in deep water. At present, the drilling of oil wells under deep water is usually accomplished by driving a number of costly and extra long, thin pilings up to about thirty feet above the normal water surface and mounting on these pilings a suitable operation platform. If after the cost of such a construction, it is found that the well is non-productive and location must be abandoned, a greater cost is incurred in dismantling the parts and removing the costly steel pilings so as not to create a hazard or menace to navigation. Moreover, it is extremely difficult to drive such long pilings due to their slenderness and the strong wave action to which they are subjected in deep water.

Accordingly, a further object is to overcome the deficiencies and objectional features found in apparatus previously used for deep water drilling operations, and includes associating with the working platform of a floating barge, a buoyant submersible ground anchor having one or more tubular columns or tanks slidably and adjustably connected to the platform so as to be movable vertically relative thereto. Additionally, spuds or pilings axially movable in the columns are arranged to be forced into the ground below the water surface to assist in maintaining the anchors firmly in a fixed position and prevent lateral sway or creeping movement due to wave actions or irregularities in the surface of the ground on which the anchor rests. Each ground anchor is of sufficient size and shape so that when resting on the ground below the surface of the water, it provides ample bearing surface and stability for supporting the working platform and the heavy drilling or other equipment carried thereon.

2 A further object comprehends the provision of a new and improved submersible hollow ground anchor having a tubular water-tight column or trunk extending upwardly from the bottom thereof and through its top, and which is of such length as to project above the surface of the water so as to support the working platform and its associated parts above the water. The bottom of the anchor is provided with a tubular sleeve extending inwardly into the column and arranged to constitute a guide for a spud or piling arranged to be forced into the bottom ground to maintain the anchor in a fixed position and prevent the same from skidding, particularly on sloping ground. Additionally, means are provided for conducting water or compressed air through the bottom, sides and tops of the anchor for the purpose of washing off mud, grit and other sediment material that might collect on the outer surface of the anchor member and thus facilitate the raising of the latter from the ground when such operation is necessary. Further, in order to impart additional weight to the submersible ground anchor after the same has been gradually filled with water and lowered on the bottom ground, suction means are provided for communicating with the chamber in the anchor for allowing mud, sand, and other heavy material to be pumped into the ground anchor so that this heavy material will replace the water which may be forced out through a suitable pressure valve, and thus impart additional weight to the ground anchor in order to firmly and securely maintain the same in engagement with the bottom ground.

Other objects and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying claims and drawings.

Referring to the drawings in which, for the purpose of illustration, are shown several preferred embodiments the invention may assume:

Figure 1 is a side elevational view of an assembled drilling unit or apparatus constructed in accordance with the present invention.

Figure 2 is a front view of Figure 1 showing the entire drilling unit in its floating position.

Figure 3 is a view similar to Figure 2 showing the operating or working platform in its floating position and the buoyant ground anchors lowered to engage the bottom ground.

Figure 4 is a view similar to Figure 3 but showing the operating platform and its associated parts raised above the water and the anchors resting on the ground and in the position the parts assume during the drilling operation.

Figure 5 is an enlarged longitudinal sectional
view of a ground anchor and its associated tubular column or trunk. Figure 6 is a detailed sectional view showing means for releasably maintaining the operating platform in a fixed position relative to a ground anchor.

Figure 7 is a sectional view of a modified form of a means for locking the platform to a column of the ground anchor.

Figure 8 is a longitudinal sectional plan view taken substantially along the line 8-8 of Figure 2.

Figure 9 is a sectional plan view of a modified form of an operating platform showing the slidable guiding connection of the columns therewith.

Figure 10 is an enlarged detail sectional view of the packing box shown in Figure 9 for receiving the spud or piling.

Figure 11 is a detail sectional view of a modified form of packing box.

Figure 12 is a detail sectional view of a modified form of ground anchor.

Figure 13 is a detail sectional view of a further modification of the ground anchor.

Figure 14 is a side elevation of a modified form of a deep water drilling apparatus.

Figure 15 is a side view of a further modification of drilling apparatus.

Figure 16 shows another form of the drilling apparatus may assume.

Figure 17 is a modification of a combined supporting platform and buoyant float which may be associated with the apparatus.

Figure 18 is a detail side elevation view of a modified form of ground anchor, and

Figure 19 is a transverse sectional view showing the slidable connection of the column and ground anchor, disclosed in Figure 18, to one side of an operating platform.

Referring to the drawings in which like numerals indicate like parts in the several views, there is shown, for the purpose of illustration, a floating barge or the like 20 (Fig. 1) constructed in accordance with the present invention and capable of supporting the necessary heavy equipment used for drilling oil wells into the ground under deep bodies of water and other subaqueous operations. The barge 20 includes a combined buoyant float and operating platform 21 of such size and shape as to float on the water and to contain therein the derrick 22, derrick casing 23 and the other equipment required for drilling under deep water. The buoyant operating platform 21 is provided with an elongated slot or bay 24 (Fig. 8) through which loosely extends the drilling tube 23 when the derrick is in operation. Below the platform 21, as shown in Figures 1 and 2, may be positioned four ground anchor members 25, 26, 27 and 28 (Fig. 8). The ground anchors are preferably formed of metal or other suitable durable material and are hollow so as to form a buoyant compartment or chamber 29 (Fig. 5). Extending upwardly from the bottom 30 and through the top 31 of each anchor member is one or more tubular columns or trunks 32 which preferably are circular in cross section and may be welded at 33 to the adjacent inner walls of each of the anchor members.

As shown in Figure 1, a pair of tubular columns 32 extend upwardly from each of the anchor members and loosely through vertically spaced guide members 34 and 35 that extend laterally from opposite sides of the operating platform 21 (Fig. 4). The lower guide members 34 (Fig. 8) may each be in the form of a tubular sleeve or collar having opposed flanges 36 which bear against the adjacent side of the platform 21 and are secured thereto by the bolts 37 (Fig. 1).

The upper guide members 35 are in the form of sleeves having flanges 38 connected by the bolts 39 to a bracket 40 having a base 41 which rests on top of the platform 21 and may be secured thereto by the bolts 42 (Fig. 6). A rack bar 43 may be carried by each of the columns 32 (Fig. 6) and positioned so as to coact with a pawl 44 pivoted as at 45 to a housing 46 mounted on the top of the bracket 40. The pawl 44 at its outer end is preferably provided with a weight 47 so as normally to urge the pawl into engagement with the teeth of the rack bar. Thus, it will be seen that simple and efficient means are provided for raising and maintaining the operating platform in any desired locked position above the surface of the water.

Instead of the rack bar and pawl safety arrangement shown in Figure 6, other suitable means may be provided for releasably maintaining the working platform and its associated parts in an adjusted and safe position, as shown in Figure 7. In this figure, a block 48 is slidably mounted in a substantially U-shaped casing 49 which is welded or otherwise suitably connected to the bracket 40. The block 48 at its outer end has teeth 50 which are arranged to move into locking engagement with the adjacent teeth of the rack bar 43 so as to maintain the latter in an adjusted vertical position. The inner end of the block 48 is formed with an axially disposed T-shaped slot or recess 51 in which is mounted the head of a bolt 52 that has an externally threaded portion 53 engaging a complementary threaded opening 54 in the outer casing 55 of the casing. The outer exposed end of the bolt 53 is formed with a polygonal portion 56 arranged to be engaged by a suitable tool so as to move the teeth 50 of the block 48 into and out of locking engagement with the rack bar 43.

As shown in Figure 9, the tubular columns 32 that extend upwardly from each of the ground anchors 25, 26, 27 and 28 may be positioned to project through vertical openings 54 formed in the operating platform 21, instead of having the guide members 31 which extend through the operating platform as previously described.

Water from any suitable source may be introduced into the chamber 29 of each of the ground anchor members through a pipe 55 (Fig. 5) which extends through one side of the tubular column 32 so as to communicate with a main supply pipe 56 and which is controlled by a valve 57. The pipe 56 may be connected to any suitable pumping means, such as the reversible pump 58 that may be supported by a bracket 59 secured to the inner side of the column 32 and has an inlet pipe 60 for conducting river or sea water to the pipe 56 under pressure. Jet pipes 61 communicate with the supply pipe 56 and extend outwardly through the bottom, sides and top of each of the ground anchor members and are provided at their outer ends with nozzles 62, for the purpose of washing off mud, silt and other bottom ground sediment that may collect on the outer surface of the anchor member when the latter is submerged to rest on the ground. Valves 62 control the flow of the fluid through the pipe 61. One or more branch pipes 63 communicating with the pipe 56 may extend through the wall of the column 32 above the ground anchor 25 so
as to further assist in removal of sediment from the top of the latter. The chamber 29 is com-
pletely cut off from the discharge pump 52 and can be filled with water for lowering and
grounding purposes by the pipe 55 when the valve
57 is opened. Further, water can be removed from the chamber 29 for raising or lifting the anchor member by any suitable piping or pumping
system, such as the reversible pump 67, subsequently to be described. Each tubular column 32 is water-tight and may vary as to
its shape and size. Further, the length of the column 32 is such that when its associated anchor
25 rests on the ground it will extend above the surface of the water to provide a firm support-
ing foundation for the operating platform 21 above the water (Fig. 4).

It is of the utmost importance in deep water drilling operations to obtain a rigid and safe
ground anchor condition especially when using the submersible type of ground anchor. For this
reason, it is essential that each ground anchor be of sufficient weight and have a lower center of
gravity in order to facilitate the lowering or raising of the same. Accordingly, the inside of each hollow ground anchor 25 may have its sides and bottom coated with concrete 64 (Fig. 5) or other suitable non-shifting heavy material to
any suitable height or level above the bottom of the anchor member that will impart sufficient
buoyancy to the anchor. In order to give addi-
tional weight to each of the ground anchors
after the same has been gradually filled with
water and lowered onto the bottom ground, spaced suction pipes 65 may extend through
the bottom 30 of each anchor member 25 and com-
 municate through a pipe 66 with a combined
suction and pressure pump 67 that connects with
discharge pipe 56 in the chamber 29. Thus, it
will be seen that when the reversible pump
67 functions as a suction pump to draw mud, sand and other ground material into the cham-
ber 29, the water previously introduced into the
class 29 through pipe 65 will be forced up-
wardly and through the one-way pressure valves
69 located in the top of the hollow anchor mem-
bers, so as to further increase the weight of
these members. The heavy material in the com-
partment 25 can be removed to raise the anchor member by reversing the operation of the pump
67 to operate as a pressure pump so that the
heavy material now in the compartment 29 is
withdrawn through the pipe 68 and discharged
from the anchor member through the pipe 65.

Pump 67 may also operate to withdraw the water
from the chamber 29.

Extending axially within the column or trunk
32 is a tubular spud or piling 76 which is pre-
ferably formed with a tapered or pointed lower
end 71 and is movable vertically within the column 32 by any suitable means not shown.
The bottom of the cross section of the anchor members is formed with an opening 72 and has extending
upwardly above the bottom 30 into the chamber or buoyance space 28 and in axial alignment with the spud 70, a sleeve 73 which constitutes a
guide for the movable spud 70 and which is formed with a lower annular flange 74 secured to the bottom or base of the flexible packing members 78 that are secured together by the threaded bolts 79 extend-

In Figure 11, a modified form of packing box is shown in which the sleeve 73 is provided at its upper end with a chamber 81 in which is posi-
tioned the flexible packing 83. The upper end of the sleeve 73 has an annular flange 82 to
which is connected the packing gland 84 by the threaded bolts 85 secured in position by the nuts 86. The

gland 84 has a centrally depending annular
flange 84' which engages the packing 83 so as to
force the same in water-tight engagement with
the spud 70 when the parts are assembled.

Extending axially within the spud 70 is a pipe 87 which at its lower end 88 may be provided
with one or more outlets 89 which extend through the tapered lower end 71 of the spud 70 (Fig. 5).
The pipe 87 is for the purpose of jetting down or
jetting up the spud 70 and is movable axially
with the spud. A supply of water or compressed
air may be introduced into the pipe 87 from any
suitable source preferably located in the column
32. The hollow column or trunk 32 is of sufficient
size and diameter as to have mounted therein
the necessary machinery for operating the various parts, and a workman may be lowered into the
column 32 to control the operation of the valves and the pumps. The tubular column 32,
spud 70 and supply pipe 87 are of extensible
length in order to be movable with the anchor members to the under-water surface irrespective of the depth of the water in which the barge is operating. By reason of the column 32 being
water-tight, the spud or piling 70 can be forced into the bottom ground from any suitable height or
level inside of the column 32. Consequently, the
spud 70, if so required, may be forced into the
ground from a level below the outside water
surface. In other words, by reason of the pro-
vision of the hollow water-tight column 32, com-
paratively short and less expensive spuds or pil-
ings 70 can be forced into the bottom ground at
great depths of water. However, if required, long
spuds may be forced into the bottom ground from
the top of the column 32 and the spud may be
pulled out of the ground from any suitable height or
level in the column 32. Instead of jetting the
spud 70, the column 32 was designed for raising or lowering the working platform upon operation of the

In Figure 12, a ground anchor 95 is shown so
constructed as to have a low center of gravity and with the bottom wall 96 of greater thickness than the side wall 97 and the top 98 of a single tubular column or trunk 99 extends upwardly from the inner wall 100 of the bottom 96 through the closed chamber 101 and is of extendible length so as to extend through and be guided by a buoyant working platform member. Figure 12 shows a buoyant member 102 in which the inner wall of the bottom may be downwardly and centrally inclined as at 103 and the side wall 104 tapered upwardly and connected to the top 105 through which the tubular column 106 extends. The side members may be of any suitable size and shape and formed of any suitable material so as to have a low center of gravity in order to insure full buoyancy being obtained. It will, of course, be appreciated that the size of a floating barge is such as to require the working platform 21 and the submarine ground anchors to be of such size and construction as to be capable of supporting the derrick and other heavy and large equipment carried by the platform 21, so that the barge may be conveniently floated and moved from place to place for offshore deep water drilling operations and the like.

In Figure 14, a non-buoyant operating platform 107 has secured thereto one or more depending tubular columns or trunks 108 which are connected at their lower ends to a floating and submersible ground anchor 109 having a low center of gravity. The columns 108 are of such length as to extend above the level of the water when the anchors are moved to engage the bottom ground, so as to support and protect the working platform 21 and its associated parts against heavy wave action in stormy weather. Inside each of the ground anchors 109 and columns 108 may be fitted a spud 110 and a piping arrangement similar to what is shown in Figure 5.

The single buoyant anchor 105 may be shaped as shown in Figure 17 and provided with a slot or bay 111. A derrick or other suitable subaqueous operating member 112 may be mounted on a base 113 supported by the platform 107, and the equipment, after the drilling operation is completed, may be floated and moved to any other suitable point of use.

The form of the invention shown in Figure 15 is substantially similar to that shown in Figure 14, with the exception that instead of a single buoyant anchor, two spaced buoyant anchors 114 and 115 are provided, which are connected to the non-buoyant operating platform 116 by the spaced tubular columns or trunks 117 that may be substantially similar in construction to the column 32 previously described, and which are provided with the spuds 118 arranged to be forced into the ground when the anchors are in the lowermost position. The columns 117 may be stiffened and reinforced by trusses members 119 so as to insure the columns being maintained firmly in a fixed and rigid position. A derrick or other suitable subaqueous machine 120 may have a base 121 arranged to be mounted on the platform 116. The assembled type of drilling units shown in Figures 14 and 15 can be used for deep water drilling operations where the bottom ground is substantially parallel with the normal water level above the same. The grounding and drilling operations are substantially similar to the parts previously described with the exception of the omission of the guiding members 34 and 35.

In a unit or combination of units of a floating movable and submersible drilling apparatus for offshore deep water oil drilling operations, the buoyant member 21 is, of course, of sufficient size and buoyancy to support one or more ground anchors and in certain instances the ground anchors may be made non-buoyant or of solid and heavy material and provided with one or more hollow anchor members 122 and supply pipes and motors for forcing water through drilled openings in the solid ground anchor, in a manner similar to that shown in Figure 5, for the purpose of removing sediment collected on the outer surface of the ground anchor.

Referring particularly to Figures 2, 3 and 4, 122 indicates the approximate water level and 123 the approximate bottom ground level below the deep water surface. In Figure 2, the entire drilling assembly or unit is shown in a floating position and may be moved to any suitable location for drilling of under water ground or for other subaqueous operations. The ground anchors are guided by the members 34 and 35 and the spuds 78, and each may be independently lowered to seek its own ground level. The buoyant platform 21 now contacts with the anchor members 16, 21 and 28 to carry the load on the barge. In Figure 3, the operating platform 21 and its associated parts are in a floating position and the columns 32 and anchor members have been submerged so that the latter are in firm engagement with the bottom ground 123. The lowering operation of the anchor members is accomplished by forcing water into the buoyant chamber 29 of each of these members (Fig. 5) through the pipes 59 to party or fully fill the chamber and in such amount that the members can be safely lowered. In their downward movement the anchors are guided by the slidable connection of the columns 32 with the spaced sleeves or sockets 34 and 35. When the ground anchors rest on the bottom ground 123, the spuds 70 are forced into the bottom ground to give additional guidance to the ground anchors and prevent the anchors from moving or skidding on sloping ground. When the ground anchors are in this position, it may be useful to force water or compressed air or both through the bottom jet pipes 61 in order to wash away the soft top surface of the bottom ground and thereby facilitate the lowering of the ground anchors onto firmer and more stable ground.

After the ground anchors are moved and firmly maintained in engagement with the ground surface 123 (Fig. 3), the buoyant platform 21 may be raised slightly in the water so as to impose additional load on the columns 32 and the ground anchors 25, 26, 27 and 28, so that each ground anchor will thereby be forced deeper into the bottom ground 123 and each anchor will seek its own level depending upon the firmness and level of the harder bottom ground. When the anchors rest on the ground 123, the spuds 70 may be forced into the bottom ground. The platform 21 may now be gradually raised in the water and the ground anchors will automatically obtain better bearing against the bottom ground. At this time the platform 21 is raised out of the water to the desired height, the ground anchors are on safe, firm ground and the platform 21 may be locked by the pawl 44 (Fig. 6) engaging the teeth of the rack bar 43, or the sliding block 48 (Fig. 7) and the units be used in order to maintain the platform and the derrick equipment at the level of the water to efficiently perform the drilling operation at the selected point (Fig. 4).
Whenever it is desired to move the drilling apparatus to a new drilling site or for any other purpose, the anchor members may be raised by withdrawing the fluid from the chambers 20 so that the parts are moved from the position shown in Figures 3 and 4, to that in Figure 2, at a minimum expenditure of time and effort, and the apparatus when floated may be moved away from the drilling well casing 23 without disturbing the same. While the ground anchors are preferably made of metal and may be given additional weight if necessary, it will be manifest that the anchors may be formed of other suitable materials or combinations of such materials in order to have a low center of gravity and insure full buoyancy when the anchors are associated with an operating platform for supporting the same.

In the modification shown in Figure 16, a floating apparatus is provided for imparting greater stability to the drilling platform 124 by slidably connecting the latter to the ground anchors 125 by inclined tubular columns or trunks 126 so that a much wider base can be obtained when the anchors 125 are lowered onto the bottom ground 123. The platform 124 may be connected to the columns 126 by the tubular vertically spaced guide sleeves 127 and 128 and provides a firm support for the derrick or operating equipment 129. The platform 124 may be reinforced by transverse truss members 130. It will be seen that by reason of the downwardly angular spread of the columns 126, much greater stability to the working platform 124 can be obtained as compared to a construction in which the columns extend vertically and at substantially right angles to the ground anchors 125. This type of column construction may be used as auxiliary stiffening means with the vertical columns 32 previously described, and by reason of the angle spread of the columns 126 and the side bottom spread of the ground anchors 125, provide a firmer and safer drilling condition in rough seas and winds. When so used as auxiliary stiffening means, the columns 126 and the ground anchors 125 are lowered onto the bottom ground after the operating platform 21 has been raised to a desired height above the water, as shown in Figure 2, and when it is required to move the drilling unit from one location to another, this operation is reversed.

Any number of anchor members 25 may be used and may be arranged in spaced longitudinal transverse pairs or groups of suitable size, shape and construction, as the best operating conditions may require. Further, any number of columns 32 may be associated with each of the anchor members and the columns may be hollow or solid. Preferably, the columns are circular in cross section so as to give less resistance to the wave action of the water and less motion to the working platform during the drilling operation. It will be noted that each column 32 is connected to the anchor member to provide a unitary structure and that the column serves as means for affording access into the chamber 29. Each of the spuds may be clamped or otherwise fastened inside the column 32 and may be raised or removed when it is desired to lift the anchor from the ground. The ground anchors and their tubular columns are quite adaptable for use to anchor other types of marine vessels or devices which require an efficient and positive means for firmly maintaining subaqueous supporting members in position.

In the modified forms of the invention shown in Figures 18 and 19, the ground anchor 130 has extending upwardly therefrom a tapered tubular column 131 which is widest at its base or lower end 132. The column is cylindrical or curved in cross sections (Figure 19) and has extending outwardly from one side thereof the vertically disposed spaced arms 133 that may be welded or otherwise suitably connected to the column, and are provided with laterally disposed flanges 134 which slidably engage complementary recesses 135 formed by the guide lugs 136 that are connected as at 137 to the adjacent side of an operating platform 138 of a barge or the like. By tapering the column 131 and having its widest portion adjacent the ground anchor 130, the column is made stronger and more rigid than an evenly shaped one and also has a lower center of gravity. Moreover, by reducing the width of the upper end portion of the column, the wave action thereon will have less rocking effect on the ground anchor 130. While parts of the floating barge are shown bolted or welded together, it will be manifest that the column may be connected by other suitable fastening means such as rivets or the like.

It will be understood that the several forms of the invention shown are merely illustrative and that the floating barge may be associated with various types of equipment for subaqueous operations in deep water and with various types of marine vessels without departing from the spirit of the invention and the scope of the following claims.

I claim:
1. In a floating barge for subaqueous operations, a buoyant working platform, a submersible ground anchor below the platform and having a buoyant chamber therein, a tubular column extending upwardly from the bottom of said anchor and through said chamber and the top thereof, said platform having guide means through which said column loosely extends, the bottom of said anchor having a guide sleeve projecting upwardly into said column, a spud extending axially through said column and slidably engaging said sleeve, said spud being engaged by the anchor is submerged to rest on the underwater ground arranged to be forced into the ground to retain the anchor in a fixed position, and means for introducing water into the chamber for moving the column and anchor downwardly relative to the platform.
2. In a floating barge for subaqueous operations as called for in claim 1 including means for forcing fluid under pressure against the outer sides of the anchor when the latter rests on the ground to remove sediment from the anchor in order to facilitate raising or lowering of the same.
3. In a floating barge for subaqueous operations as called for in claim 1 including means for introducing fluid under pressure through the lower end of the spud for jetting down or jetting up the spud.
4. In a floating barge for subaqueous operations as called for in claim 1 having means when the chamber is filled with water for introducing heavy material into the chamber to replace the water, and pressure-operated valve means within the chamber for allowing the water to be withdrawn as the introduced material is being introduced into the chamber.
5. In a floating barge for subaqueous operations as called for in claim 1 having spaced pipes
in the bottom of the anchor for introducing heavy ground material into the chamber to replace the water therein, a suction pump communicating with the spaced pipes, pressure operating means in the top of the anchor and extending into said chamber for allowing the water to escape therefrom when the heavy ground material is pumped into the chamber, and means for withdrawing the heavy ground material from the chamber.

6. In a floating barge for subaqueous operations, a working platform, a submersible ground anchor below the platform and having a chamber therein, a tubular water-tight column extending upwardly from the bottom of said anchor and through the top thereof, said platform having guide means through which said column loosely extends, said column being of such length as to project above the surface of the water when the anchor is submerged and resting on the ground, means for releasably maintaining the platform in a vertically adjusted position relative to said anchor, the bottom of said anchor having a guide sleeve projecting upwardly into said column, a tubular retaining spud having a closed tapered lower end extending axially through said column and slidably engaging said sleeve, packing means for forming a water-tight seal between the spud and sleeve, means for introducing fluid under pressure into said spud and through the tapered end thereof for jetting down or jetting up the spud, said spud when the anchor is submerged to rest on the underwater ground arranged to be forced into the ground to retain the anchor in a fixed position, and a supply pipe in said column and communicating with said chamber for introducing water into the chamber to flood the same.

7. In a floating barge for subaqueous operations as claimed in claim 6 in which the sides, top and bottom of the anchor and the wall of said column have spaced jet openings, branch pipes communicating with the supply pipe for conducting fluid outwardly through said jet openings to remove sediment from the outer surface of the anchor, an pump operatively connected to the supply pipe for forcing fluid under pressure through said pipe.

8. In a floating barge for subaqueous operations, a working platform, a submersible ground anchor below the platform and having a chamber therein, a tubular column extending upwardly from the bottom of said anchor and through said chamber, guide means on said platform through which said column loosely extends, the bottom of said anchor having a guide sleeve projecting upwardly into said column, a spud extending axially through said column and slidably engaging said sleeve, said spud having a tapered lower end provided with at least one opening, a pipe disposed axially in said spud and communicating with said opening for discharging fluid through the lower end of the spud, said spud when the anchor is submerged to rest on the underwater ground arranged to be forced into the ground to retain the anchor in a fixed position, a main supply pipe mounted in said column, a pump for forcing water through said pipe, a valve control pipe communicating with the main pipe for introducing water into said chamber to fill the same, the sides, top and bottom of said anchor having spaced jet openings, and branch pipes communicating with the main supply pipe and said branch openings for conducting fluid through said openings to remove sediment from the outer surface of the anchor so as to facilitate the raising of the anchor from the ground or lowering the same into the ground.

9. In a floating barge for subaqueous operations, a working platform, spaced submersible ground anchors below the platform and having buoyant chambers therein, each of said anchors having spaced pairs of tubular columns extending upwardly from the bottom and through the chamber and top thereof, said platform having guide means through which said columns loosely extend, the bottom of each anchor having spaced guide sleeves extending upwardly into an adjacent column, a spud axially movable in each of said columns and slidably engaging a guide sleeve therein, the spuds when the anchors are submerged to rest on the underwater ground arranged to be forced into the ground to maintain the anchors in a fixed position, and fluid supply means in each of said columns communicating with its associated chamber for flooding the latter to lower the anchor so as to rest on the underwater ground.

10. In a floating barge as called for in claim 9 in which means mounted on the columns are operatively connected to the platform for raising the latter relative to the anchors and above the surface of the water when the anchors are submerged to engage the underwater ground.

11. In a floating barge for subaqueous operations as called for in claim 9 including means for introducing fluid under pressure through the lower end of the spud for jetting down or jetting up the same.

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