

Oct. 17, 1950

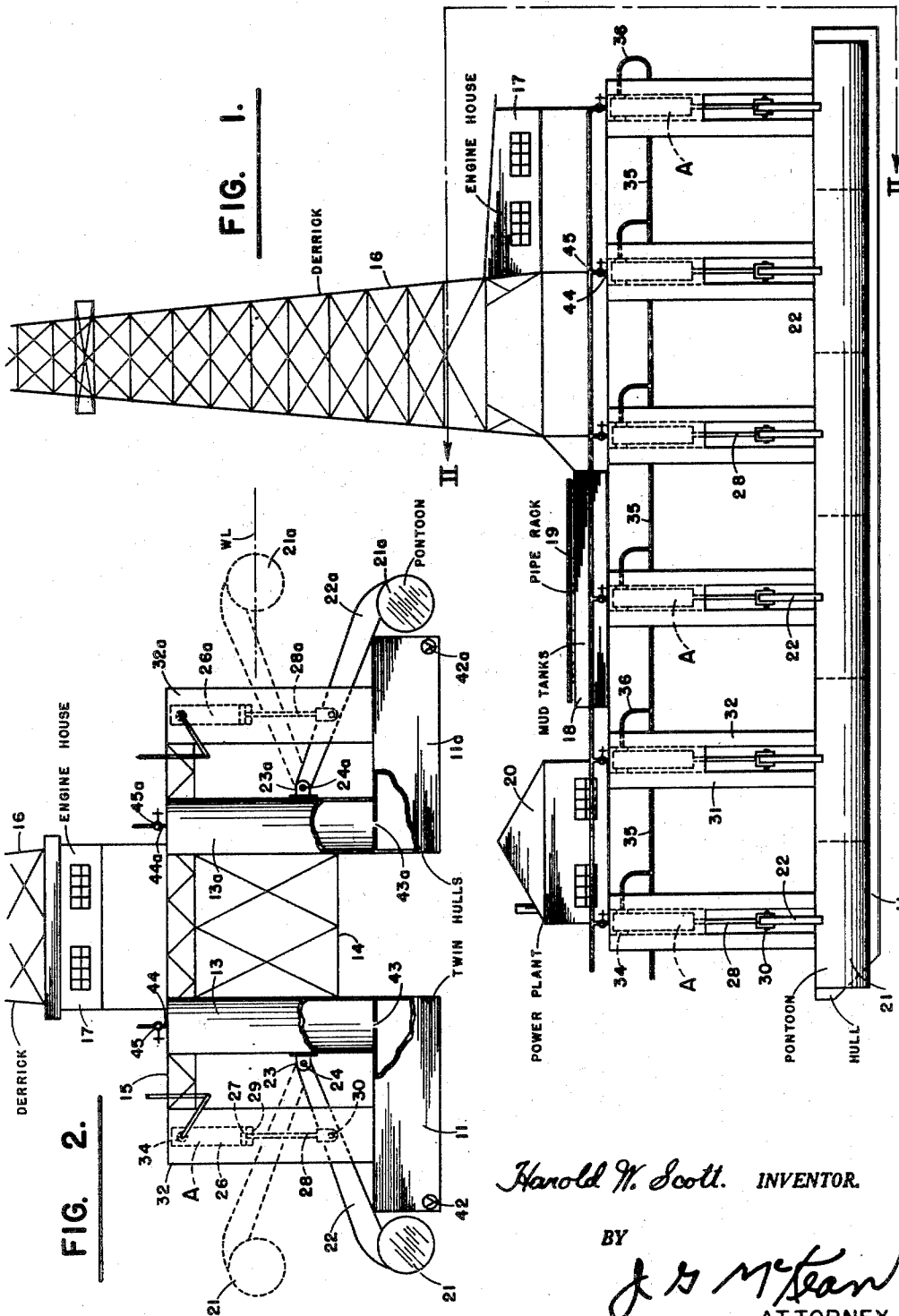
H. W. SCOTT

2,525,955

APPARATUS FOR SUBMARINE DRILLING

Filed March 21, 1947

2 Sheets-Sheet 1



Harold W. Scott. INVENTOR.

BY

J. S. McLean
ATTORNEY.

Oct. 17, 1950

H. W. SCOTT

2,525,955

APPARATUS FOR SUBMARINE DRILLING

Filed March 21, 1947

2 Sheets-Sheet 2

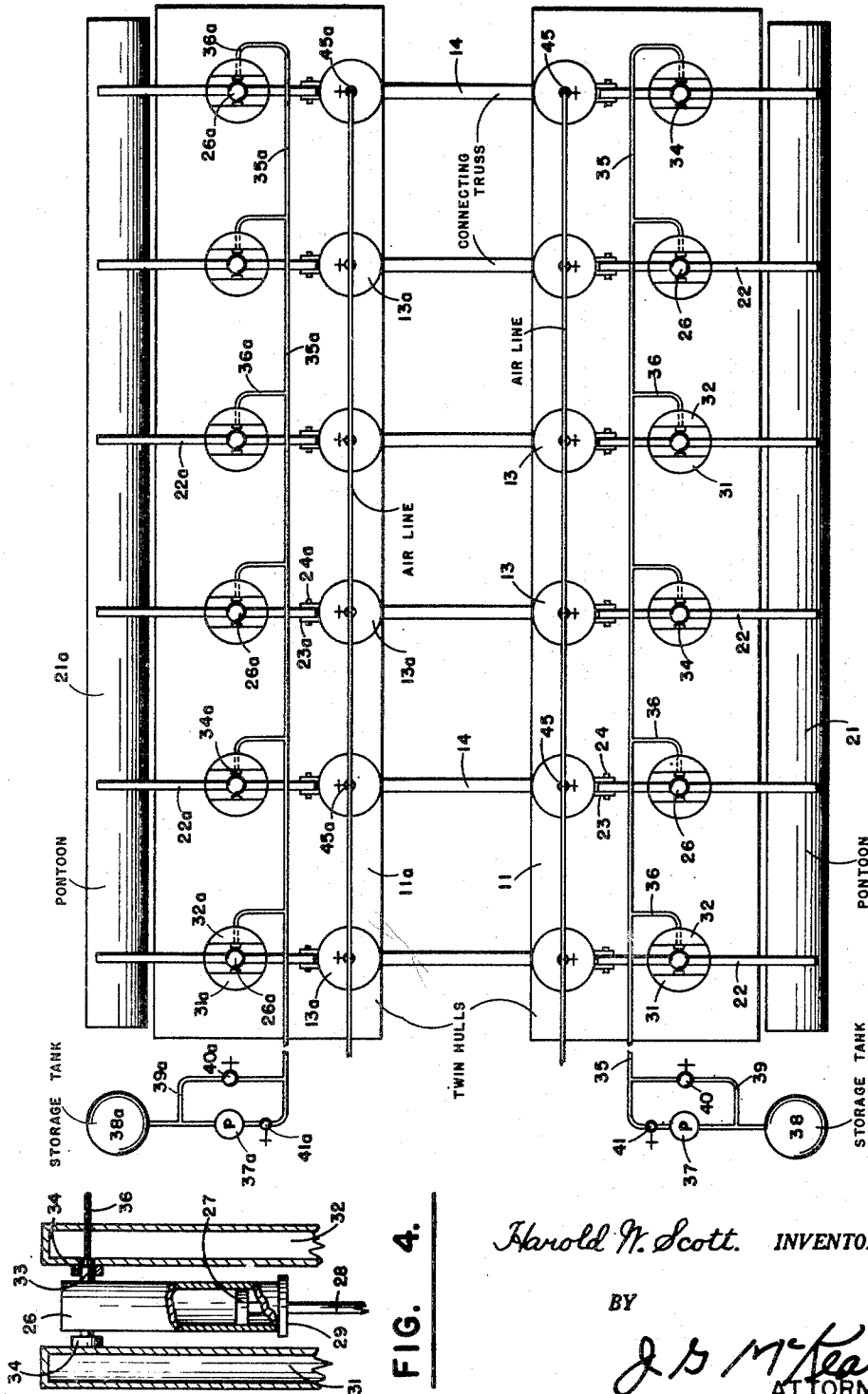


FIG. 3.

FIG. 4.

Harold W. Scott. INVENTOR.

BY

J. B. McLean
ATTORNEY.

UNITED STATES PATENT OFFICE

2,525,955

APPARATUS FOR SUBMARINE DRILLING

Harold W. Scott, Houston, Tex.

Application March 21, 1947, Serial No. 736,289

1 Claim. (Cl. 61—46)

1

The present invention is directed to a submersible barge structure particularly adapted for drilling submarine wells.

For a number of years it has been the practice to drill submarine wells in the search for minerals and particularly for petroleum. By submarine drilling is meant the drilling of a well in an area where the surface of the upper formation is covered with a body of water. Heretofore such submarine wells have either been drilled relatively close to shore so that it has been practical to drive piles into the body of water for the purpose of supporting the derrick structure or in relatively shallow areas, such as in lakes or bays, where it has been practical to employ drilling barges of such dimensions that the upper deck of the barge is above the water level when the barge has been submerged so that its bottom rests upon the surface of the formation forming the bottom of the body of water.

It is believed that valuable pools of petroleum may be discovered under water a considerable greater distance from shore than submarine drilling operations heretofore attempted. For example, it is believed that bodies of petroleum may be found in the Gulf of Mexico along the Continental Shelf where the methods heretofore employed for drilling submarine wells may not be satisfactorily used.

It is an object of the present invention to devise a submersible barge structure adapted for drilling submarine wells. More particularly, it is an object of the present invention to devise a submersible barge structure for drilling submarine wells under wind and wave conditions prevalent in open water such as in the Gulf of Mexico.

It is another object of the present invention to devise a method for lowering and raising a drilling barge structure under the wind and water conditions which may be encountered in open water.

The device of the present invention may be described briefly as involving a submersible barge structure having pontoons or float chambers permanently attached thereto with the pontoons mechanically arranged to allow a maximum area of the pontoons to be exposed to the surface of the water as the barge structure is being lowered into position for drilling or as the barge structure is being raised after a drilling operation has been completed.

The method of the present invention may be described briefly as involving the maintenance of a substantially uniform force on pontoons or

2

float chambers permanently attached to a submersible drilling barge structure whereby the structure may be lowered or raised at a substantially uniform rate and the stability thereof maintained.

The present invention will now be described in greater detail in connection with the drawing which illustrates one embodiment of the device of the present invention and in which

Fig. 1 is in the form of an elevation;

Fig. 2 is a view along line II—II of Fig. 1,

Fig. 3 is a top view of the apparatus of Fig. 1 with conventional parts of the drilling equipment removed to show more clearly the features of the present invention, and

Fig. 4 is a fragmentary view showing a portion of the apparatus of Figs. 1 and 3 in greater detail.

Turning now specifically to the drawing, it will be seen that the device includes two hulls 11 and 11a which are laterally spaced. Mounted on hull 11 at spaced intervals are tubular structural members 13 and similarly tubular structural members 13a are mounted on hull member 11a at spaced intervals. It will be understood that hull members 11 and 11a may be identical and tubular members 13 and 13a may be identical but are designated differently in order to explain the connection of the structure.

The assembly 11 and 13 comprising one hull structure and the assembly 11a and 13a comprising the other hull structure are connected together by a connecting truss structure 14. The upper portion of tubular members 13 and 13a and connecting truss 14 serve to support a deck 15 upon which may be mounted the conventional equipment employed for drilling wells such as derrick 16, engine house 17, mud tanks 18, pipe rack 19 above the mud tanks and a power plant 20. It will be understood that the conventional drilling equipment, such as the derrick, engine house, mud tanks, pipe rack and power plant are shown in simplified form since these pieces of equipment are well known to the art. It will be understood that various other pieces of drilling equipment, such as draw-works, rotary table and the like, which are customary for the rotary drilling operations of wells generally, will be provided.

It is to be pointed out that the hulls 11 and 11a are designed to be completely submerged when the apparatus is in position for drilling. It is well-known to those versed in the art that when the hull structures 11 and 11a are completely submerged, there is no way to use these hulls

to control the downward movement of the structure before the bottoms of the hulls come into contact with the bottom upon which the structure is to rest. According to the present invention, means is provided for controlling the downward movement of the structure after the upper surfaces of hulls 11 and 11a are covered with water.

In accordance with the present invention, a pair of pontoons 21 and 21a are provided. The longitudinal axis of pontoon 21 is arranged parallel to the longitudinal axis of hull 11 and the longitudinal axis of pontoon 21a is arranged parallel to the longitudinal axis of hull 11a. A plurality of levers 22 is provided with one end of each lever 22 attached to pontoon 21 and the other end of each lever pivoted to a member 13 by suitable means which may include, for example, a hinge member 23 with a pin 24 passing through a laterally extending opening in the end of lever arm 22. Pontoon 21a is similarly secured to hull structure 11 by lever arms 22a and hinge members 23a, with each lever arm 22a secured by a hinge member to a column 13a. Each hinge member 23a includes a pin 24a passing through a suitable opening 25a in arm 22a.

For convenience the barge structure heretofore described and including the twin hulls 11 and 11a, columns 13 and 13a and connecting truss 14 will be termed a submersible barge structure. When this structure is being submerged or raised, its stability is controlled by hydraulic means mechanically secured to pontoons 21 and 21a. In the embodiment shown, the hydraulic means comprises a plurality of assemblies A. An assembly A is operably connected to each of lever arms 22 and 22a. Assembly A includes cylinder 26 with piston 27 slidably arranged thereon and connected to a piston rod 28 which slidably extends through a suitable opening in the head 29 with which cylinder 24 is provided. The end of piston rod 26 which extends outside cylinder 24 is bifurcated and through the bifurcated portions holes are drilled to receive a suitable pin or bolt 30.

Each hydraulic assembly A is supported by a pair of structural members. The pairs of structural members mounted on hull 11 are designated as 31, 32 and those mounted on hull 11a are designated as 31a and 32a. It will be seen that each pair of structural members 31, 32 is similar to a supporting column 13 but with the center portion removed. Mounted between each pair of members 31, 32 is a hydraulic assembly A. Cylinder 26 of the hydraulic assembly is provided with trunnions 33 which are mounted on suitable bearing members 34 attached to structural members 31 and 32.

Pairs of structural members 31a and 32a mounted on hull 11 are similar to structural members 31, 32 with each pair of members 31a, 32a having a hydraulic assembly A mounted thereon with the trunnions 33a of the hydraulic member supported by bearings 34a secured to structural members 31a and 32a.

Columns 13, 30, 31, and 13a, 30a, and 31a being water-tight cause the displacement of the structure to increase as the barge is submerged which will aid in controlling the rate of descent. It will be noted that members 13 and each pair of structural members 31, 32 are arranged to provide a support for a single lever 22 with the end of the lever pivoted to member 13 and sideways movement of the lever limited by the adjacent walls of members 31, 32. Members 13 and the pair of members 31, 32 are designed to provide a sub-

stantial cylindrical surface to reduce the resistance to wave action. Barge 11a is similarly provided with structural means 13a, 31a, and 32a with these members grouped so that each member 13a with adjacent members 31a, 32a provide a mounting means for a single lever 22a for the same purposes as heretofore described with respect to members 13, 31 and 32.

It will be understood that the cylinder 34 of each assembly A will have a suitable fluid therein, such as oil. The hydraulic members A mounted on hull 11 are fluidly connected, as through a line 35, by a suitable means, such as a connection 36 discharging through one of trunnions 32, which is made hollow for this purpose, into cylinder 26. Line 35 has arranged therein a pump 37 which discharges into a suitable storage tank 38. A line 39 by-passes pump 37 and has arranged thereon a suitable valve, such as a spring loaded relief valve 40. A valve 41 may be mounted adjacent pump 37. Similarly, hull 11a is provided with a line 35a connected through connecting lines 36a to the cylinders of assemblies A. Line 35 discharges into storage tank 38a and has pump 37a arranged therein. Line 39a by-passes pump 36a and has valve 40a arranged therein and a valve 41a is arranged in line 35 adjacent pump 37a.

Barge hull 11 is provided with a suitable valve or sea cock 42 to allow water to flow into the hull when submerging it and, similarly, hull 11a is provided with valve or sea cock 42a. It will be understood that valves for flooding submersible barges are well known to the art and details of construction of these valves will not be given in order to simplify the description of the present invention. A vent 43 is provided between hull 11 and columns 13 to allow air to be discharged from the hull into the columns and the upper ends of the columns are provided with an outlet 44 controlled by valve 45. Similarly, hull 11a is provided with a vent 43a allowing discharge from the hull to columns 13a and the upper ends of columns 13a are provided with outlet 44a controlled by valve 45a.

When it is desired to lower or submerge the structure, as when the barge has been towed to the location at which a well is to be drilled, the sea cocks 42 and 42a may be opened and with valves 45 and 45a open water enters hulls 11 and 11a and air is discharged through outlet lines 44 and 44a. As water floods the hulls 11 and 11a, the structure will gradually sink in the water while pontoons 21 and 21a are maintained full of air and will float at the surface. In order to achieve maximum effectiveness from the pontoons, it is desirable that they be submerged to substantially one-half their depth in water so that the maximum area is in contact with the surface of the water.

As the hulls 11 and 11a sink, pontoons 21 and 21a will be maintained at the surface by movement of levers 22 and 22a. The rate at which the structure settles in the water may be regulated by controlling the hydraulic pressure above the pistons in assemblies A. This pressure may conveniently be maintained by closing valve 41 and setting relief valve 40 to open at a predetermined pressure in the hydraulic system of hull 11 and closing valve 40a and setting relief valve 40a to operate at said predetermined pressure in the hydraulic system of hull 11a. It will be understood that the relief valves 40 and 40a will keep a uniform pressure in the hydraulic assemblies A and thereby stabilize the structure and keep it on an even keel as it is submerged,

5

When the hulls 11 and 11a rest on the bottom it will usually be unnecessary to employ the pontoons 21 and 21a for stabilization purposes and the pontoons may then be filled with water and allowed to assume the position indicated by solid lines in Fig. 2. The position of the pontoons as the structure is being lowered is indicated by dotted lines in Fig. 2 with the water level at the time the device is being lowered indicated by the line designated by the legend WL.

It will be understood that when the structure is being raised to the surface, the pontoons may be utilized in a similar manner to stabilize the structure and keep it on an even keel. When the structure is being raised, it will be understood that a substantially uniform pressure must be maintained in the cylinders of hydraulic assemblies A and, accordingly, it is desirable to operate pumps 37 and 37a. In other words, valves 41 and 41a may be opened and pumps 37 and 37a started up and allowed to operate continuously; if the pumps exert more than a predetermined pressure the relief valves will operate and allow part of the output of the pumps 37 and 37a to flow through the by-pass lines 39 and 39a, respectively. It will be understood that in order to raise the assembly, some means must be provided for forcing water out of hulls 11 and 11a. Specific means for accomplishing this purpose are well known to the art and in order to simplify the drawing details of such arrangements are not shown. It may be stated, for example, that ejector means may be provided for withdrawing water through sea cocks 42 and 42a or air pressure may be used by connecting a suitable source of supply of compressed air to outlet 44 and 44a. Irrespective of the means employed for forcing the water from the hulls 11 and 11a, the uniform pressure exerted through lines 35 and 35a on the hydraulic assemblies A will cause the pontoons 21 and 21a to exert a stabilizing effect on the structure and keep it on an even keel as it rises to the surface of the water.

It will be understood that it is not essential in the practice of the present invention to employ automatic relief valves 40 and 40a for controlling the pressure on the hydraulic system. It will be evident that manually operated valves may be employed and pressure gauges provided in the system whereby an operator may manipulate the manually controlled valves to maintain a substantially constant pressure as indicated by the pressure gauges. It will also be obvious that other hydraulic arrangements may be employed which will allow the maintenance of a substantially uniform pressure on the hydraulic assem-

6

bly A during the operations of submerging or raising the structure.

While a specific embodiment of the present invention has been described, it will be apparent to a workman skilled in the art that various changes may be made without departing from the scope of the invention.

Having fully described and illustrated the present invention, what is desired to be claimed as new and useful and to be secured by Letters Patent is:

A device adapted for drilling submarine oil wells comprising a barge structure having laterally spaced hulls, a plurality of tubular structural members symmetrically spaced along each of the said hulls with the lower ends thereof secured to the hulls, structural members securing the tubular members together to form a unitary structure, a first pontoon and a second pontoon arranged parallel, with each pontoon adjacent an outside edge of a hull, a first plurality of lever arms with each arm having an end secured to a pontoon and the other end pivoted to a tubular member next adjacent the first pontoon, a second plurality of lever arms with each end connected to the second pontoon and the other end pivoted to the tubular member next adjacent said second pontoon, and hydraulic control for controlling the arcuate movement of said first plurality of lever arms, means mechanically connected to said first plurality of lever arms and second hydraulic control means for controlling the arcuate movement of said second plurality of lever arms mechanically connected to said second plurality of lever arms, each hydraulic control means including a valve for controlling the pressure therein.

HAROLD W. SCOTT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
123,402	Janicki	Feb. 6, 1872
1,316,357	Cook	Sept. 16, 1919
1,683,276	Woods	Sept. 4, 1928
1,681,533	Gillasso	Aug. 21, 1928
1,918,426	Radnor	July 18, 1933

FOREIGN PATENTS

Number	Country	Date
514	Great Britain	Feb. 11, 1875
837,730	France	Nov. 18, 1938