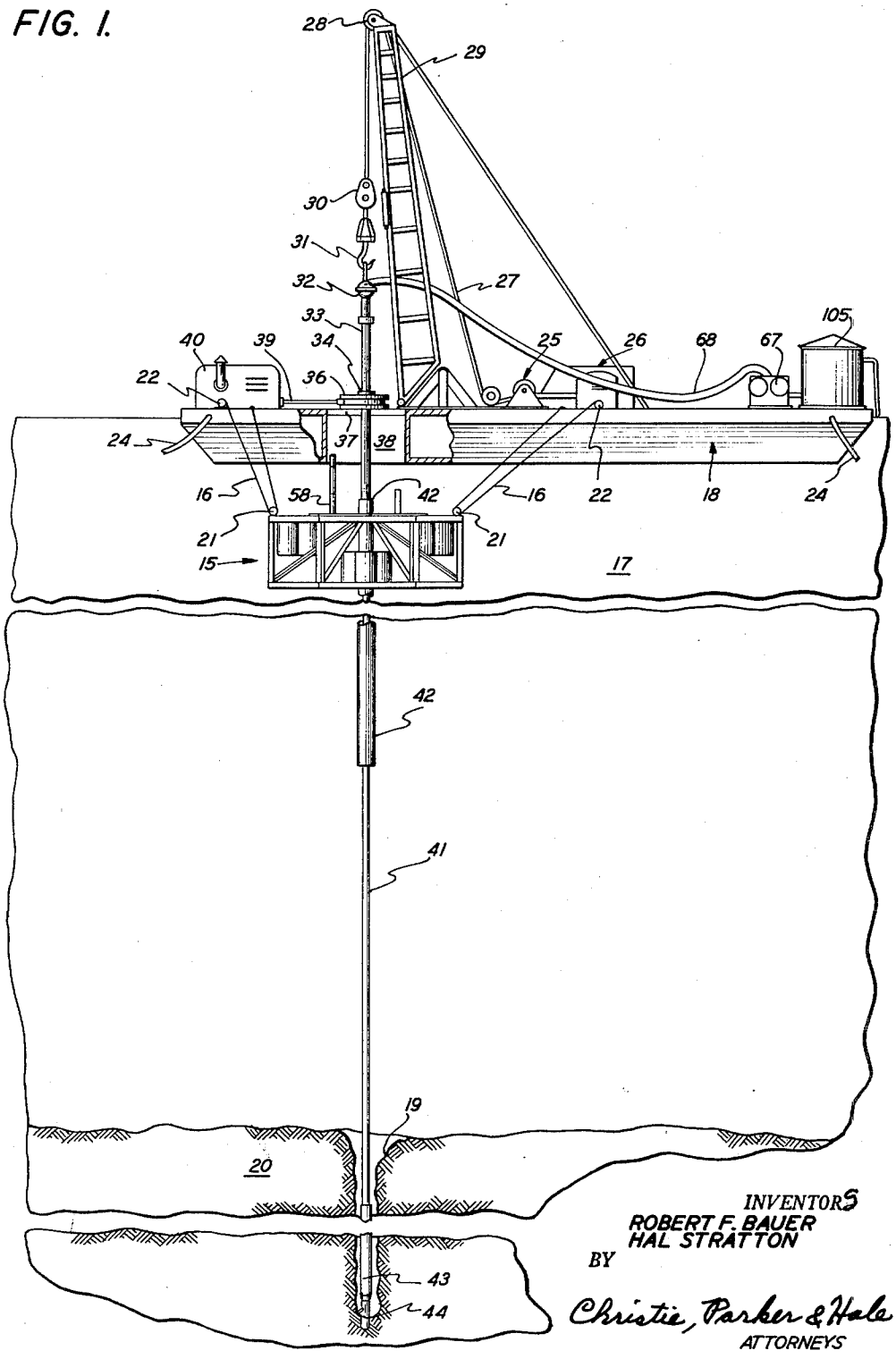
May 16, 1961 R. F. BAUER ET AL 2,984,308

UNDERWATER DRILLING GUIDE

Filed Sept. 4, 1956 4 Sheets-Sheet 1

FIG. 1.



INVENTORS
ROBERT F. BAUER
HAL STRATTON

BY

Christie, Parker & Hale
ATTORNEYS

May 16, 1961 R. F. BAUER ET AL 2,984,308

UNDERWATER DRILLING GUIDE

Filed Sept. 4, 1956

4 Sheets-Sheet 2

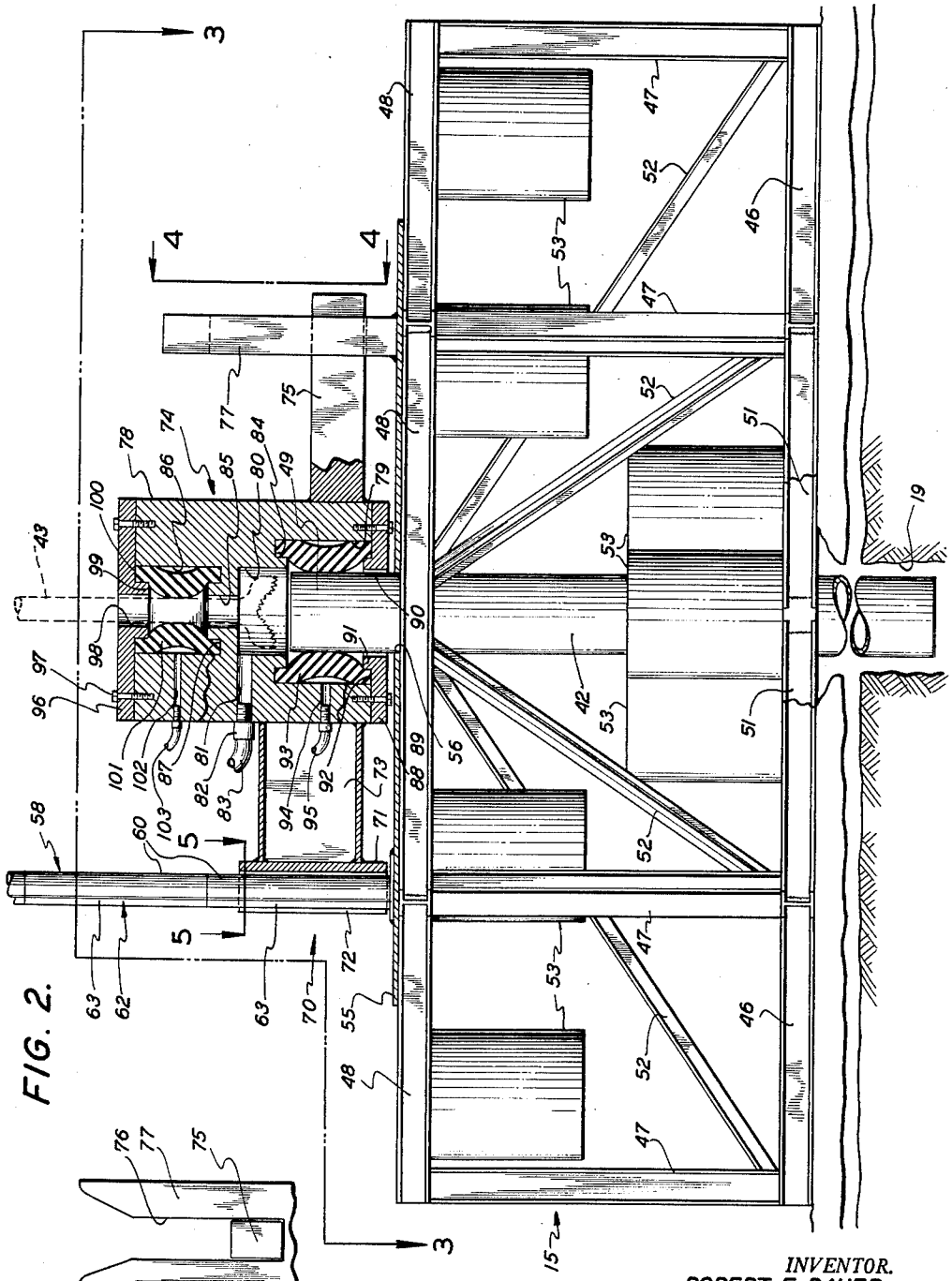


FIG. 2.

FIG. 4.

INVENTOR.
ROBERT F. BAUER
HAL STRATTON

BY

Christie, Parker & Hale
ATTORNEYS

May 16, 1961 R. F. BAUER ET AL 2,984,308

UNDERWATER DRILLING GUIDE

Filed Sept. 4, 1956 4 Sheets-Sheet 3

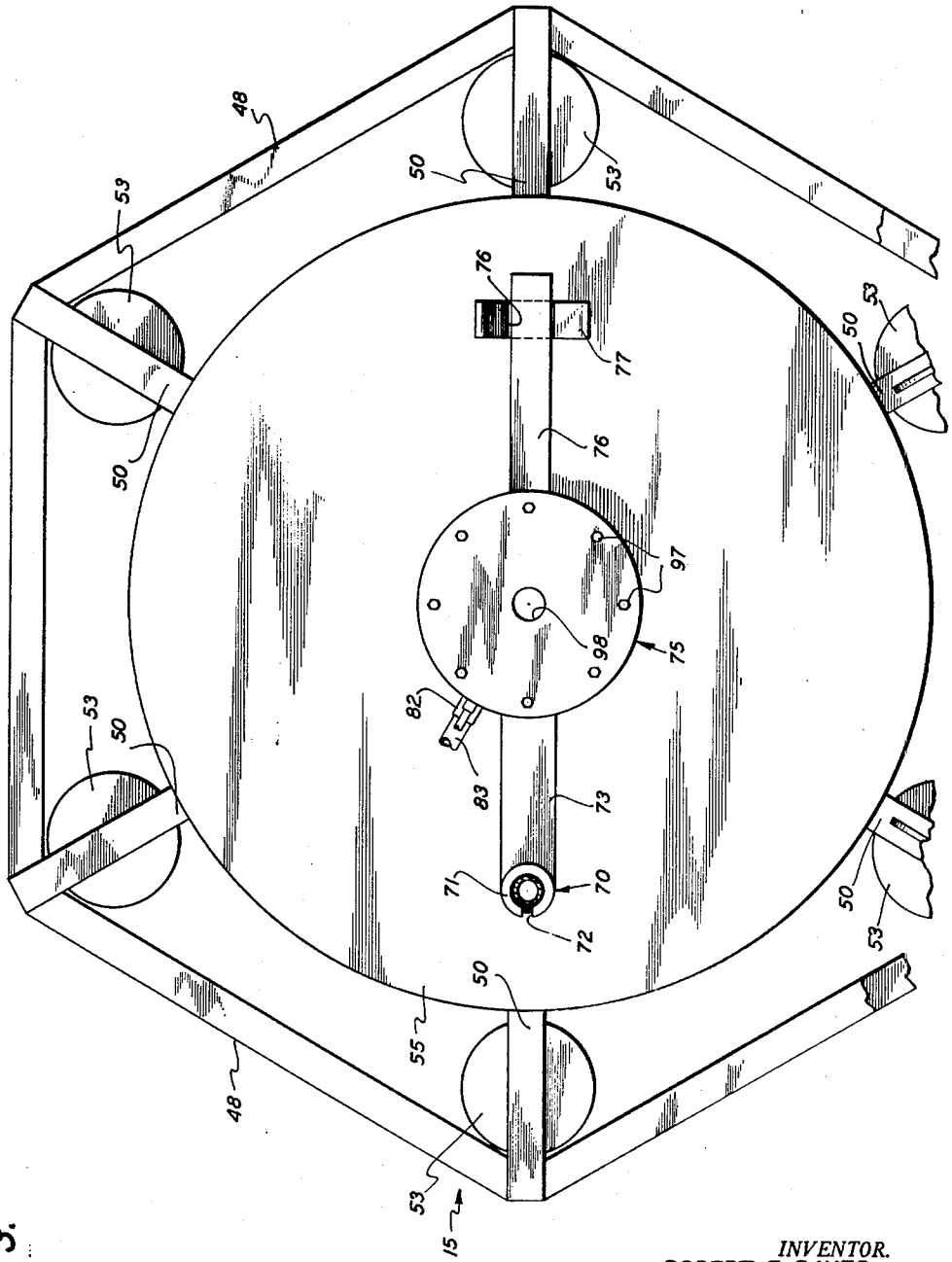


FIG. 3.

INVENTOR.
ROBERT F. BAUER
HAL STRATTON

BY

Christie, Parker & Hale
ATTORNEYS

May 16, 1961 R. F. BAUER ET AL 2,984,308

UNDERWATER DRILLING GUIDE

Filed Sept. 4, 1956 4 Sheets-Sheet 4

FIG. 6

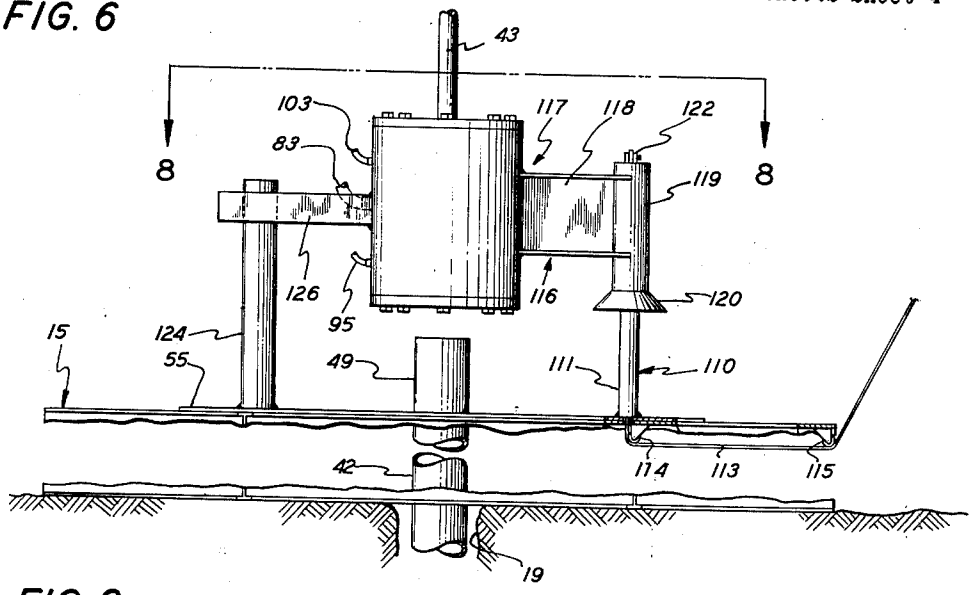


FIG. 8.

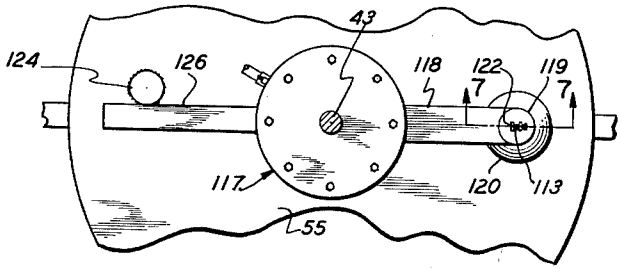


FIG. 7.

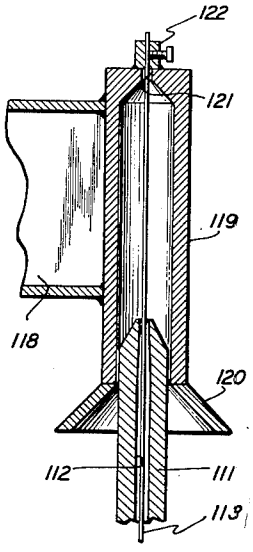
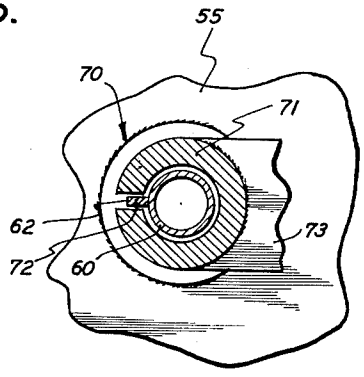


FIG. 5.



INVENTOR.
ROBERT F. BAUER
HAL STRATTON

BY

Christie, Parker & Hale
ATTORNEYS

United States Patent Office 2,984,308 Patented May 16, 1961

2,984,308

UNDERWATER DRILLING GUIDE

Robert F. Bauer, Whittier, and Hal Stratton, La Habra, Calif., assignors to Shell Oil Company, Los Angeles, Calif., a corporation of Delaware, Continental Oil Company, Los Angeles, Calif., a corporation of Delaware, and The Superior Oil Company, Los Angeles, Calif., and Union Oil Company of California, Los Angeles, Calif., both corporations of California

Filed Sept. 4, 1956, Ser. No. 607,633
12 Claims. (Cl. 175—7)

This invention relates to apparatus for drilling underwater wells and may be used in connection with wells under any kind of water, whether marine or fresh, but to simplify the explanation of the invention, the apparatus is described as being in an ocean.

At the present time underwater or off-shore well drilling is usually accomplished from stationary structures rigidly anchored to the underwater formation. These structures provide static bases for the drilling equipment and are satisfactory for shallow water, for example, depths of fifty feet or less. However, for deeper water, stationary structures are not always economically practical. Furthermore, these structures are sometimes permanent installations which may be navigation hazards.

This invention overcomes the disadvantages of stationary bases for off-shore drilling by providing improved apparatus for drilling and working on wells from a floating vessel which can readily be moved from one location to another, and which can be used in water of practically unlimited depth.

The principal difficulty in drilling or working on an underwater well from a floating vessel is in making trips to and from the well, e.g., withdrawing drilling or other equipment from the well and subsequently re-entering the well with such equipment. The movement of a floating vessel due to wind and wave action, which are almost invariably present, makes it difficult to re-locate the well once equipment is removed from it.

Previous to this invention apparatus and methods for drilling underwater wells from a floating vessel have been used to overcome the disadvantage of static structures. Such previous apparatus and methods use a plurality of laterally spaced flexible guide lines or cables anchored at their lower ends around an underwater well, and the cables are used to guide equipment from a floating vessel to a fixed and reproducible location at the well. Such apparatus works well under many circumstances, but under particularly adverse conditions, such as strong current or wind action in relatively deep water, the guide lines sometimes become fouled with each other or with equipment which is to be moved to and from the well. Also, whenever it might be necessary to move the floating vessel temporarily from the well site, it is necessary to buoy the guide lines and preferably secure them in oppositely extending directions by the use of anchors to prevent the fouling of the lines while the operation on the well is temporarily suspended. This required handling of the lines delays the leaving of the well site, which sometimes must be done quickly and on short notice, e.g., due to a sudden storm.

This invention provides improved apparatus for guiding equipment from a floating vessel to an underwater well which permits the use of only a single guide member extending from the underwater formation upwardly toward the floating vessel. The use of only one guide member eliminates the possibility of the guide member becoming fouled with other guide members and greatly reduces the possibility of the guide member becoming fouled with equipment being moved to and from the well. Moreover, the use of a single guide member reduces the amount of time required to abandon a well site, and is of particular importance when the well site must be abandoned quickly, as in the event of a sudden storm.

Briefly, this invention provides apparatus for guiding equipment to and from a well in a formation covered with a body of water. The apparatus includes an upwardly extending elongated guide member disposed adjacent the well. A guide assembly is adapted to slide up and down on the guide member between an upper and a lower position and carry equipment to and from the well. Registering means are provided adjacent the well and registering means are provided on the guide assembly to mate with the registering means adjacent the well so that the guide assembly and equipment are registered in a fixed and reproducible position with respect to the well when the guide assembly is moved into its lower position.

These and other aspects of the invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a schematic fragmentary elevation, partially in section and partially broken away, of apparatus in accordance with the invention being lowered from a floating vessel to a well being drilled in an ocean floor;

Fig. 2 is a schematic fragmentary elevation, partly in section and partly broken away, of the apparatus landed on the ocean floor and being used for guiding drilling equipment in and out of the well;

Fig. 3 is a plan view of the apparatus taken on line 3—3 of Fig. 2;

Fig. 4 is an end elevation taken on line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 2;

Fig. 6 is a schematic elevation partly in section of an alternate embodiment of the invention for guiding equipment to the well;

Fig. 7 is an enlarged view taken on line 7—7 of Fig. 8; and

Fig. 8 is a view taken on line 8—8 of Fig. 6.

Referring to Fig. 1, a well head base 15 is lowered by a plurality of supporting lines 16 in a body of water 17 from a floating barge 18 toward a well 19 being drilled from the barge in an underwater formation 20. Each line 16 is looped around a separate respective sheave 21 attached to the top of the well head base. One end of each line is connected to the barge, and the other is connected to a separate respective winch 22 on the barge, which is anchored over the well by a plurality of suitable anchor lines 24 extending in opposite directions from the barge and connected to anchors (not shown). A draw works 25 and a power unit 26, which may be of conventional type, are mounted on the barge to operate a hoisting cable 27 carried over a crown block 28 located at the upper end of a drilling mast 29, which is also mounted on the barge. The traveling end of the hoisting cable carries a traveling block 30 and a hook 31 which supports a swivel joint 32. A kelly joint 33 extends downwardly from the swivel through a kelly bushing 34 in the center of a rotary table 36 mounted on gimbals (not shown), as for example in a manner similar to that described in U.S. Patent No. 2,606,003.

The rotary table is supported on a platform 37 directly over a cellar 38 in the barge, and is open at its bottom. Power is supplied to the rotary table through a shaft 39 turned by a rotary table power unit 40.

A string of drill pipe 41 is connected to the lower end of the kelly and extends down through the cellar, the water, a vertical conductor pipe 42 mounted in the well head base, and down into the well. A drill collar 43

and an under reamer drill bit 44 are attached to the lower end of the drill pipe for boring the well to a diameter slightly larger than the outside diameter of the conductor pipe 42 which is welded to the well head base to project upwardly a relatively short distance above, and downwardly a relatively great distance from the well head base.

The well head base may be positioned in the well by any one of several suitable means, for example, it may be suspended by lines 16 underneath the cellar of the barge while the drill pipe is extended down through the well conduit to drill the well in the formation. After the well is drilled to a sufficient depth to receive the conductor pipe, the well head base is lowered from the barge so that the conductor pipe slides down the drill pipe and into the well, the bottom of the well head base resting on the earth formation around the upper end of the well as shown in Fig. 2. The lines 16 are then disconnected from the barge and withdrawn from the sheaves on the well head base. If desired, the conductor pipe may be firmly anchored in the well by pumping cement down the drill pipe to fill the annular space between the conductor pipe and the well. The under reamer may then be retracted and the drill pipe, drill collar and drill bit removed from the well bore, or drilling may be continued without removing the drill bit from the well until some later period of the drilling operation.

The well head base may take many forms, and the details of a suitable well head base are shown most clearly in Figs. 2 and 3. The well head base is a relatively flat and wide structure which is hexagonal in shape as viewed in plan. The periphery of the bottom of the well head base is made up of six sections 46 of I-beams of equal length welded together end to end to form a hexagon. A separate vertical brace 47 is welded to the junctions of the ends of each of the I-beam sections 46 and connects the bottom of the well head base to the top of the well head base, which is also formed in six sections 48 of I-beams welded together end to end to form a hexagon identical in size and shape to the bottom of the well head base.

The upper end 49 of the conductor pipe 42 extends a short distance, about two or three feet, above the upper surface of the well head base. The conductor pipe extends below the bottom of the well head base for any suitable length, say twenty to a hundred feet. An upper set of horizontal and radially extending braces 50 (see Fig. 3) are welded at their outer ends to respective joints of the ends of the peripheral sections of the top of the well head base, and are welded at their inner ends to the outside of the conductor pipe. A lower set of horizontal radially extending braces 51 are welded at their outer end to the joints of the ends of the peripheral sections of the bottom of the well head base and are welded at their inner ends to the conductor pipe.

Referring to Fig. 2, a set of six diagonal braces 52 extending upwardly and inwardly from the joints of the ends of the peripheral sections of the bottom of the well head base are welded at their lower ends to the base bottom and at their upper ends to the conductor pipe just below the inner ends of respective upper radial braces 50.

A plurality of separate water tight compartments 53 are attached to the interior of the well head base so that it may be floated and towed to any desired location.

An annular circular plate 55 having a central opening 56 equal in diameter to the outside diameter of the upper end of the conductor pipe is welded to the top surfaces of the radially extending braces in the top of the well head base. The outer diameter of the plate is approximately one half the maximum dimension of the well head base top.

An upwardly extending tubular guide member 58 is rigidly attached, e.g., by welding, at its lower end to the periphery of the plate. The guide member is made up of a plurality of joints 60 of pipe, each joint being threaded at each end to permit it to be coupled to another joint. The threaded joints are made so that when coupled together, they present smooth external and internal surfaces. The guide member is of sufficient length to extend above the water surface and into the cellar of the barge when the well head base is landed on the ocean floor as shown in Fig. 2.

Because of the length of the guide member, it is flexible enough to accommodate, without breaking or permanent deformation, any normal movement imparted to it at the surface by the floating barge, wave, current and wind action, etc.

The guide member may also be pivotally connected to the well head base, the rigid connection being preferred for deep water and the pivotal connection being preferred for shallow water.

A longitudinal and external key 62 is attached to the outer portion of the guide member and extends from the well head base to the upper end of the guide member. The key is made up of a plurality of collinear key sections 63, each section being attached to a respective joint of pipe in the guide member.

With the exception of the two bottom joints in the guide member, all of the joints have right hand threads at each end. The joint of pipe attached to the well head base has a left hand thread at its upper end to form a back-off joint with the next joint, which has a left hand thread at its lower end only. The back-off joint permits the guide member to be uncoupled near the well head base during a later stage of the drilling operation, if desired.

A drilling operation as illustrated in Fig. 1 is conducted as follows:

The well head base is towed to the desired location, and the drilling barge is firmly anchored over the well site. The supporting lines 16 are connected to the well head base, only the bottom joint of the guide member being in place at this time, and the tow line is disconnected. The buoyant compartments in the well head base are then flooded either by puncturing the walls of the compartments or by opening valves (not shown).

The upper ends of the supporting lines being controlled from the drilling barge, the well head base is allowed to sink and swing under the cellar in the barge, where it is held by the lines at a shallow depth below the cellar. The drill bit, drill collar and drill pipe are then made up on the barge and lowered through the conductor pipe in the well head base to the ocean floor.

A pump 67 on the barge picks up sea water from an inlet (not shown) and forces it through a flexible drilling mud hose 68 into the swivel, down through the kelly, drill pipe and out the under reamer bit. The pressure of the water forces the under reamer blades out into the position shown in Fig. 1, and the drill pipe is rotated by the rotary table turning the kelly joint so that the well is drilled. The bit is lowered by controlling the hoisting cable, and cuttings are washed out of the well by the sea water flowing from the bit up the annular space between the drill pipe and the well bore, no attempt being made to obtain return circulation of a drilling fluid at this time.

The drilling operation proceeds as described above until a sufficient depth is reached to permit the conductor pipe to be lowered into the well and allow the bottom of the well head base to rest on the ocean floor. Before the base is lowered the guide member joint with the left hand thread at its lower end is screwed into the joint attached to the base, and additional joints with right hand threads are also coupled to the guide member until it extends up into the cellar above the water line. The base is then slowly lowered with the winches 22 to the position shown in Fig. 2, additional guide member joints being coupled during the lowering operation so that the guide member projects above water level when the base rests firmly on the ocean bottom. Each joint may already have its re-

spective section of the key attached to it, or each key section may be attached, e.g. by welding, as the guide member is assembled. The ends of the lines attached to the barge are then released and the lines are withdrawn from their respective sheaves.

The drill bit and drill pipe are left in the well while the base is lowered so that the conductor pipe is readily guided into the well. The conductor pipe is then cemented in place, or the formation is allowed to settle around the conductor pipe to seal it in the well. The drill bit may then be either removed immediately or drilling may proceed to whatever depth it becomes necessary to replace the bit or provide for return circulation of drilling mud. At this point it is necessary to have apparatus which will permit equipment to be guided accurately to the well bore. One suitable form of such apparatus is shown in Fig. 2.

Referring to Figs. 2 and 5, a guide assembly **70** is adapted to slide up and down the guide member. The guide assembly includes a sleeve **71** adapted to slide up and down the guide member. The sleeve has a longitudinal slot **72** which slides on the key and prevents the sleeve from rotating with respect to the guide member.

A radially extending bracket **73** is welded at its outer end to the sleeve and at its inner end to a circulating head **74**.

A radially extending aligning bar **75** is attached at its inner end to the circulating head diametrically opposed to the bracket. The outer end of the bar is adapted to slide up and down in a vertical slot **76** in a vertical secondary guide member **77** welded at its lower end to the periphery of the plate on the well head base. The upper end of the slot **76** is tapered outwardly and upwardly to provide an enlarged entrance to the slot for the aligning bar. Thus, as the guide assembly is raised and lowered on the drill pipe, as described below, the sleeve and key on the tubular guide member prevent the drill pipe from winding around the tubular guide member. As the guide assembly approaches the position shown in Fig. 2, the aligning bar fits into slot **76** to provide any final alignment necessary to locate the circulating head directly over the well.

The circulating head includes an upright cylindrical body **78** having a relatively large first vertical bore **79** beginning in the bottom of the body and extending almost half way into the body. The first bore is stepped down to a second vertical bore **80** which joins a horizontal bore **81**, which opens out the left side (as viewed in Fig. 2) of the body. A nipple **82** is screwed into the outer end of the horizontal bore, and a flexible drilling mud return line **83** is connected to the nipple and extends up to the barge. A downwardly opening annular channel **84** is provided in the shoulder formed between the first and second vertical bores.

The second bore is stepped down to a third vertical bore **85** which extends for a relatively short distance and is then stepped up to a fourth vertical bore **86**, which opens out the top of the body. An upwardly opening annular channel **87** is formed in the shoulder between the third and fourth vertical bores.

An annular bottom closure **88** is secured by bolts **89** to the bottom of the main body of the circulating head. The central opening **90** in the bottom closure is of slightly larger diameter than the outside diameter of the conductor pipe **42** so that the circulating head may be slipped over the upper end of the conductor pipe, as shown in Fig. 2. An annular upwardly turned lip **91** on the inner periphery of the bottom closure forms an annular channel **92** with the lower end of the first vertical bore. A heavy flexible rubber sleeve **93** is molded at each end into annular channels **84** and **92**, and forms a well conduit seal. A horizontal well conduit seal bore **94** in the body permits fluid pressure to be applied to the outer surface of the sleeve **93** from a line **95** extending to the floating barge.

An annular upper closure **96** is secured by bolts **97** to the upper end of the main body of the circulating head. The central opening **98** in the upper closure is of sufficient diameter to permit the drill collars, but not the drill bit, to pass through it. An annular downwardly extending lip **99** on the inner periphery of the upper closure forms a downwardly opening channel **100** with the upper end of the fourth vertical bore. A heavy flexible rubber sleeve **101** is molded at each end into annular grooves **87** and **100** to form a drill pipe seal. A horizontal drill pipe seal bore **102** permits fluid pressure to be applied to the outside of the drill pipe seal through a line **103** connected to the floating barge.

As can be seen in Fig. 2, the circulating head is adapted to permit the drill pipe and drill collars to pass through it, but the bore **85** is smaller than the maximum diameter of the drill bit (shown only in phantom line) so that the drill bit, which is screwed on to the lower end of the drill pipe, engages the shoulder formed between the second and third vertical bores to provide means for raising and lowering the circulating head with the drill pipe.

When it is necessary to obtain return circulation, the guide assembly is lowered on the drill pipe, the circulating head resting on the drill bit during the lowering operation, and the sleeve slides down the tubular guide member to locate the circulating head accurately around the upper end of the conductor pipe as shown in Fig. 2, final alignment being insured by the aligning bar and the slot in the secondary guide member.

Fluid pressure is applied to the circulating head through line **95** to seal the circulating head to the upper end of the conductor pipe. Once the circulating head is sealed as shown in Fig. 2, the drill pipe is lowered further so that it enters the conductor pipe and finally reaches the bottom of the well. The drill pipe seal is then pressured through line **103** to permit the drill pipe to rotate within the seal and yet prevent excessive leakage of drilling mud, some leakage being desirable for lubrication between the drill pipe and the drill pipe seal.

With the return circulation equipment properly sealed to the conductor pipe as shown in Fig. 2, a closed circuit is provided for circulating drilling mud from a mud tank **105** on the barge (see Fig. 1), through the mud pump **67**, the flexible drilling hose **68**, the swivel **32**, down the center of the kelly joint and drill pipe, out the end of the drill bit, up the annulus between the drill pipe and the well bore, and back to the floating barge through the drilling mud return line **83** connected to the circulating head.

Figs. 6, 7 and 8 show an alternate embodiment of the invention with the well head base and conductor pipe located in a well in the ocean floor as previously described. A spindle **110** in the form of a vertical post **111** is welded at its lower end to the upper surface of the well head base. The post has a central bore **112** extending through it, and in which a guide line or cable **113** is disposed to slide. The upper end of the post is tapered to a reduced diameter. The guide line passes out the lower end of the post and around a first pulley **114** mounted to rotate about a horizontal axis and lie in a plane extending away from the well bore. A second pulley **115**, mounted at the outer right hand edge (as viewed in Fig. 6) of the well head base to rotate in a vertical plane, receives the guide line so that the guide line then extends to the surface clear of the area directly above the well.

A guide assembly **116** is adapted to carry the drill pipe or other equipment to and from the well as previously described. The guide assembly includes a circulating head **117** similar in construction to the air circulating head shown in Fig. 2. An outwardly extending bracket **118** on the right hand side is welded at its inner end to the circulating head and is welded at its outer end to a vertical and hollow guide sleeve **119** which has a frusto-conical projection **120** at its lower end to facilitate registry with spindle **110** as the guide assembly is lowered on the drill pipe. The upper end of the guide

sleeve is closed except for a relatively small bore 121 in which one end of the guide line is disposed to project a short distance above the guide sleeve. A clamp 122 is welded to the top of the guide sleeve around the bore and is clamped to the guide line so that the guide line is rigidly attached to the guide sleeve. The other end of the guide line is connected to a winch (not shown) on the floating vessel.

A vertical secondary guide post 124 is welded at its lower end to the well head base and projects upwardly for a distance of several feet. A radial horizontal aligning bar 126 is welded at its inner end to the circulating head and projects out beyond the secondary guide post. The secondary guide post is laterally offset from the radial line passing through the respective centers of the well and post 111, as shown in Fig. 8, so that when the guide assembly is rotated in a clockwise direction (as viewed in Fig. 8) to bring the aligning bar 126 to bear against the secondary guide post 124, the circulating head is centered over the upper end of the well conduit.

The operation of the apparatus of Figs. 6, 7 and 8 is as follows:

Starting with the circulating head at the surface, it is lowered on the drill pipe, and at the same time the guide line is put under tension with the winch on the floating vessel. By keeping an adequate strain on the guide line, the guide sleeve is pulled down over the upper end of the spindle to the position shown in Fig. 6. This position is easily determined by knowing the distance between the floating vessel and the pivot mount and making suitable measurements of the amount of drill pipe lowered through the rotary table. Any up and down movement of the ship due to wave action is compensated for by either automatically or manually controlling the operation of the hoisting cable to keep the circulating head the required distance above the well head base. Fluid line 103 is then actuated to force the drill pipe seal against the drill pipe and thereby fix the drill pipe to circulating head. The drill pipe is then slowly rotated clockwise (as viewed in Fig. 8) from the surface until the aligning bar contacts the secondary guide post. The circulating head is then directly over the well conduit, and the drill pipe is lowered from the surface to seat the circulating head around the conductor pipe. The drilling operation is then conducted as previously described.

Thus, the spindle operates as a pivot mount for the hollow guide sleeve and the guide assembly. It will be apparent that the relative positions of these two elements may be reversed without departing from the scope of the invention.

To remove the circulating head and drill pipe from the well, slack is given to the guide line, and the guide assembly is lifted by raising the drill pipe, carrying the guide line up with it to the surface. With this arrangement the guide line is kept out of the proximity of the well when equipment is in or around the well.

The guide line is made up in the position shown before the well head base is lowered to the ocean floor, and sufficient length of guide line is reeled off the winch as the well head base is lowered.

I claim:

1. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including an upwardly extending elongated guide member extending upwardly from a fixed location adjacent the well and terminating at its upper end at the floating vessel, a guide assembly means connecting the guide assembly to the guide member to let the guide assembly rotate about and slide up and down the guide member to an upper and a lower position, means on the guide assembly for carrying equipment to and from the well, aligning means adjacent the well, aligning means on the guide assembly, the first and second aligning means being out of engagement with each other when the guide assembly is in its upper position, and means rotating the guide assembly to register the two aligning means with each other and limit the rotation of the guide assembly when the guide assembly is lowered to its lower position.

2. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including an upwardly extending elongated guide member anchored at its lower end adjacent the well and terminating at its upper end at the floating vessel, a guide assembly attached to the guide member so the guide assembly is free to slide up and down the guide member to an upper and a lower position, means on the guide assembly for carrying equipment to and from the well, first aligning means on the guide member for substantially the entire length of the guide member, second aligning means on the guide assembly registering with the first aligning means so that the guide assembly and equipment move to a fixed position with respect to the well when the guide assembly is in its lower position.

3. Apparatus according to claim 2 in which the secondary guide member is an upright post having a slot to receive the aligning bar when the guide assembly is moved into its lower position.

4. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including an elongated guide member disposed adjacent the well and extending from the well to the floating vessel, a guide assembly, means connecting the guide assembly to the guide member so the guide assembly is movable up and down on the guide member to an upper and a lower position, means for connecting the guide assembly to the equipment, aligning means adjacent the well, aligning means attached to the equipment, and means for rotating the guide assembly when it is in its lower position to register the two aligning means and locate the equipment in a fixed position with respect to the well.

5. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including a pulley disposed adjacent the well, an upwardly extending elongated guide line disposed around the pulley, a guide assembly connected to the guide line on one side of the pulley, means for raising and lowering the guide line on the other side of the pulley so that the guide member may be moved to a lower and an upper position, means for connecting the guide assembly to the equipment for carrying it to and from the well, a pivot mount adjacent the well to receive the guide assembly when moved to its lower position, aligning means adjacent the well, aligning means carried by the equipment, and means for rotating the guide assembly when in its lower position about the pivot mount to register the two aligning means and locate the equipment in a fixed position with respect to the well.

6. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including a pulley disposed adjacent the well, an upwardly extending elongated guide line disposed around the pulley, a guide assembly connected to the guide line on one side of the pulley, means for raising and lowering the guide line on the other side of the pulley so that the guide member may be moved to an upper and a lower position, means for connecting the guide assembly equipment and for carrying the equipment to and from the well, a pivot mount adjacent the well to receive the guide assembly when moved to its lower position, an upright bar mounted adjacent the well and spaced from the pivot mount, an outwardly extending aligning bar connected to the guide assembly, and means for rotating the guide assembly when in its lower position about the pivot mount to cause the aligning bar to engage the upright bar and locate the equipment in a fixed position with respect to the well.

7. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including a pulley disposed adjacent the well, an upwardly extending elongated guide line disposed around the pulley, a guide assembly connected to the guide line on one side of the pulley, means for raising and lowering the guide on the other side of the pulley so that the guide member may be moved to an upper and a lower position, means for connecting the guide assembly to equipment to be carried to and from the well, an upright pivot mount adjacent the well to receive the guide assembly when moved to its lower position, an upright bar mounted adjacent the well and spaced from the pivot mount, an outwardly extending aligning bar connected to the guide assembly, and means for rotating the guide assembly about the pivot when in its lower position to cause the aligning bar to engage the upright bar and locate the equipment in a fixed position with respect to the well.

8. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including an elongated guide extending upwardly from a fixed location adjacent the well and terminating at the floating vessel, a guide assembly, means connecting the guide assembly to the guide so that the guide assembly is movable between an upper position adjacent the floating vessel and a lower position adjacent the well, means on the guide assembly for connecting equipment to it, first aligning means fixed in position so as to be adjacent the well and spaced from the guide, second aligning means attached to the guide assembly and adapted to register with the first aligning means as the guide assembly is lowered to its lower position, the first and second aligning means being out of registration when the guide assembly is in its upper position, and means connected to the guide assembly independent of the first aligning means for holding a portion of the guide assembly in a substantially fixed disposition with respect to the well so that the two aligning means are registerable with each other as the guide assembly is lowered to its lower position to locate the guide assembly and equipment connected to it in a fixed position.

9. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including a laterally flexible, elongated guide member extending upwardly from a first fixed location adjacent the well and terminating at the floating vessel, a guide assembly, means connecting the guide assembly to the guide member so that the guide assembly is movable between a lower position adjacent the well and an upper position adjacent the vessel, means for lowering and raising the guide assembly between the lower and the upper positions, means on the guide assembly for connecting equipment to it, first aligning means disposed in a second fixed location adjacent the well and spaced from the guide member, second aligning means attached to the guide assembly and adapted to register with the first aligning means as the guide assembly is lowered to its lower position, the first and second aligning means being out of registration when the guide assembly is in its upper position, and means connected to the guide assembly independent of the first aligning means for holding a portion of the guide assembly in a substantially fixed disposition with respect to the well so that the two aligning means are registerable with each other as the guide assembly is lowered into its lower position to locate the guide assembly and equipment in a fixed position.

10. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of a water, the apparatus including an upwardly extending, elongated guide member anchored at its lower end adjacent the well and terminating at its upper end at the floating vessel, a guide assembly connected to the guide member so that the guide assembly is movable between an upper position adjacent the vessel and a lower position adjacent the well, means for lowering and raising the guide assembly, means on the guide assembly for connecting equipment to it, first aligning means disposed at a fixed location adjacent the well and spaced from the guide member, second aligning means attached to the guide assembly and constructed and arranged to register with the first aligning means when the guide assembly is in its lower position, the first and second aligning means being out of registration with each other when the guide assembly is in its upper position, and means connected to the guide assembly independent of the first aligning means for holding a portion of the guide assembly in a substantially fixed disposition with respect to the well so that the two aligning means are registerable with each other when the guide assembly is lowered to its lower position to locate the guide assembly and equipment in a fixed position.

11. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including an upwardly extending elongated guide member anchored at its lower end adjacent the well and terminating at its upper end at the floating vessel, a guide assembly connected to the guide member so that the guide assembly is slidable up and down the guide member between an upper and a lower position, means on the guide assembly for connecting equipment to it, means for lowering and raising the guide assembly, first aligning means disposed in a fixed location adjacent the well and spaced from the guide member, second aligning means on the guide assembly constructed and arranged to register with the first aligning means when the guide assembly is lowered to its lower position, the first and second aligning means being out of registration with each other when the guide assembly is in its upper position, and means connected to the guide assembly independent of the first aligning means for holding a portion of the guide assembly in a substantially fixed disposition with respect to the well so that the two aligning means are registerable with each other as the guide assembly is lowered into its lower position to locate the guide assembly and equipment in a fixed position.

12. Apparatus for guiding equipment from a floating vessel to and from a well in a formation covered with a body of water, the apparatus including an upwardly extending elongated primary guide member anchored at its lower end adjacent the well and terminating at its upper end at the floating vessel, a guide assembly connected to the primary guide member so that the guide assembly is free to slide up and down the primary guide member between an upper and a lower position, means for connecting the guide assembly to equipment to be carried to and from the well, a secondary guide member adjacent the well, an outwardly extending aligning bar connected to the guide assembly and constructed and arranged to register with the secondary guide member when the guide assembly is lowered into its lower position, the secondary guide member and aligning bar being out of registration with each other when the guide assembly is in its upper position, and means connected to the guide assembly independent of the secondary guide member for holding a portion of the guide assembly in a substantially fixed disposition with respect to the well so that the aligning bar is registerable with the secondary guide member as the guide assembly is lowered to its lower position to locate the guide assembly and the equipment connected to it in a fixed position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,598,439	Hansen	Aug. 31, 1926
2,187,871	Voorhees	Jan. 23, 1940
2,665,885	Gignoux	Jan. 12, 1954
2,669,431	Crowell	Feb. 16, 1954
2,808,229	Bauer et al.	Oct. 1, 1957