

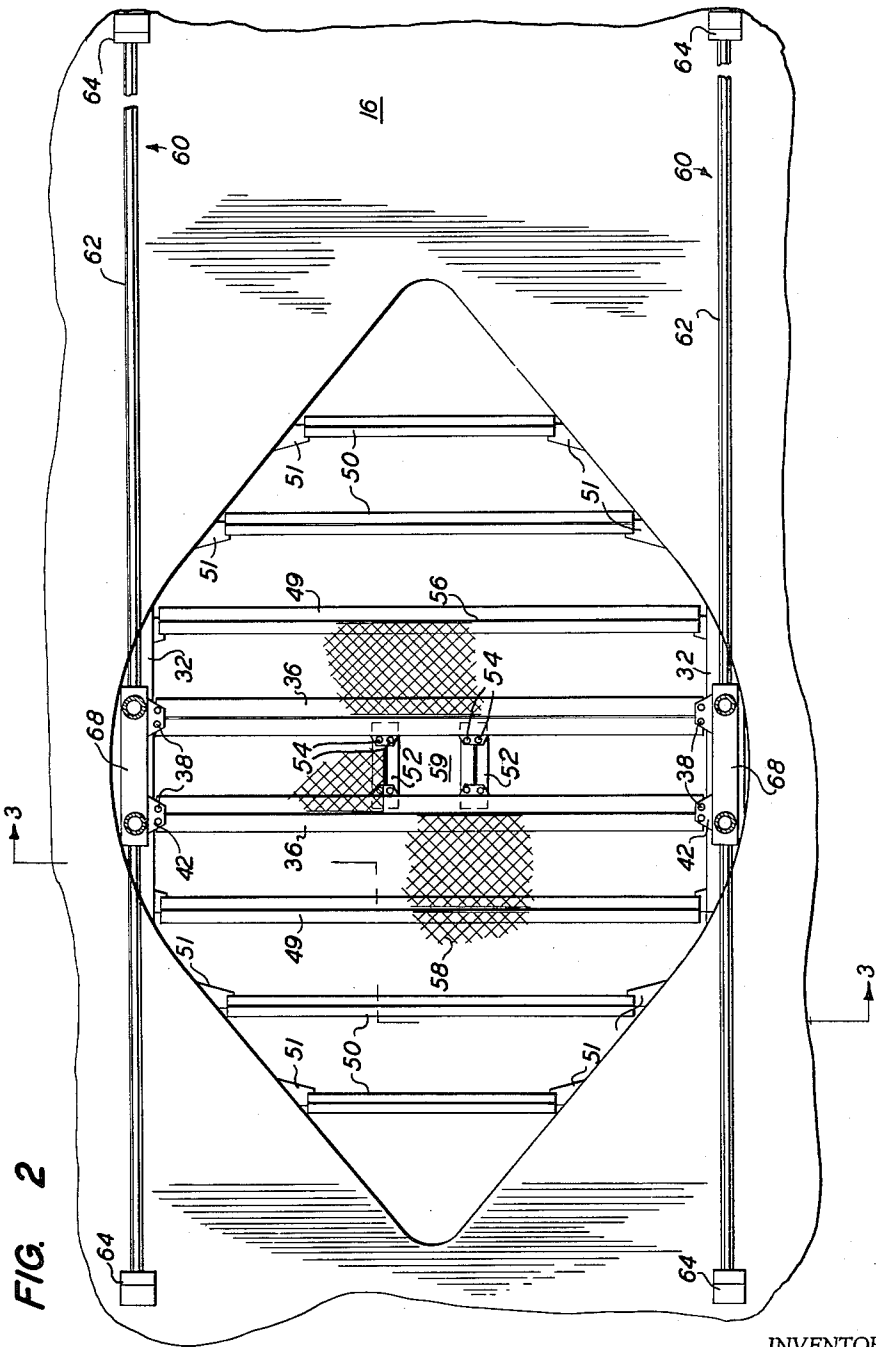
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DRILLING

3,043,255

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3 Sheets-Sheet 2



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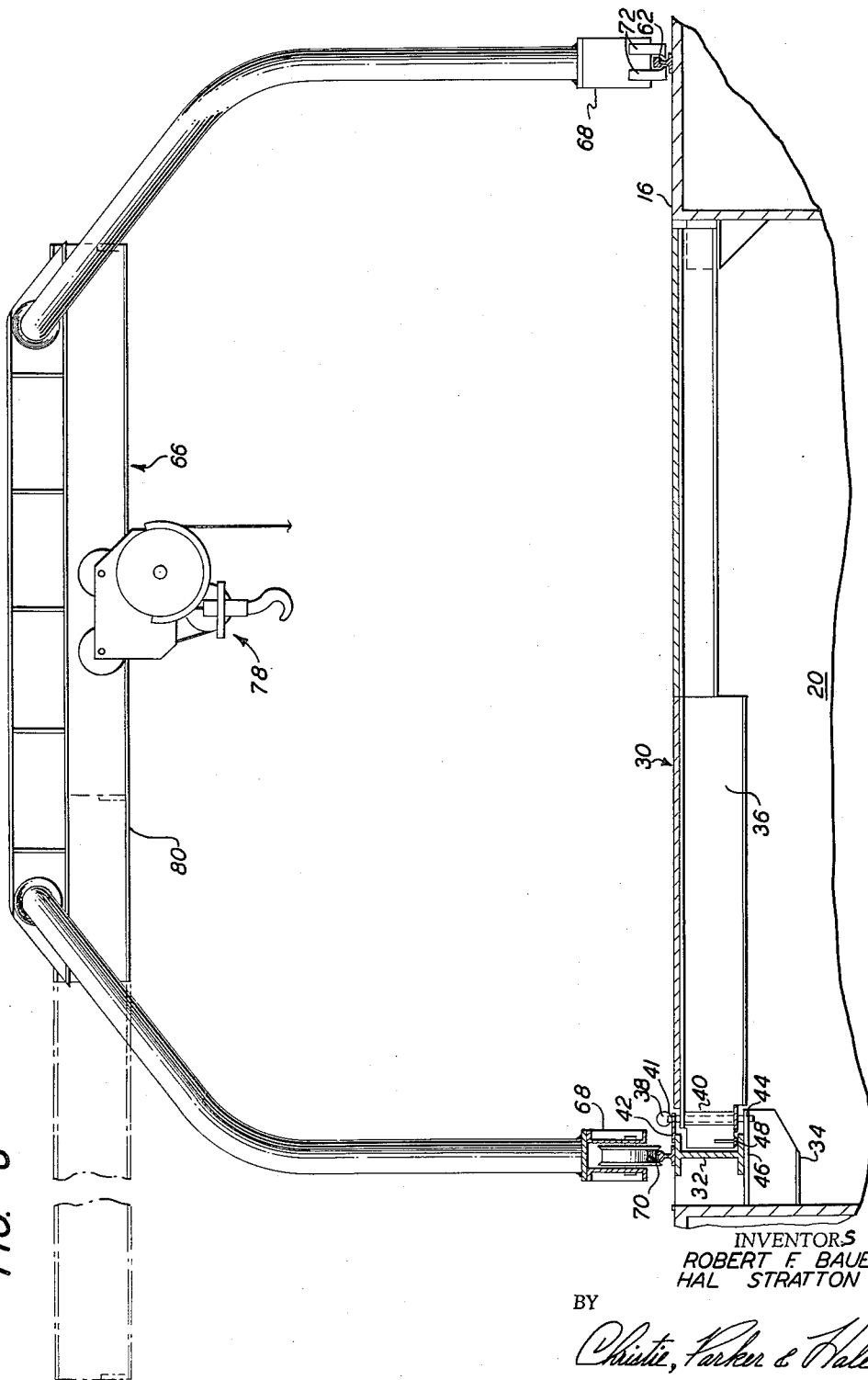
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FIG. 3



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6 Claims. (Cl. 114—5)

This invention relates to apparatus for drilling wells in underwater formations.

At the present time a considerable amount of offshore drilling and exploration work is being done from floating vessels. In the course of such operations, it is usually necessary to handle large pieces of specially designed equipment, such as well head bases adapted to be mounted under water. A typical floating drilling vessel has a cellar or "well" opening out of its bottom through which drilling operations are conducted. The size of the vessel is usually limited for economic reasons, and space aboard the vessel is always at a premium. Because of the bulky, unconventional equipment and heavy loads which must be handled, the vessel is of rugged construction and strong load-bearing members are provided at relatively close spacings. Yet such construction often limits the size of the equipment which can conveniently be used. This invention provides an economical and rugged structure for conveniently handling bulky unconventional equipment and heavy loads required for drilling underwater wells.

Briefly, the invention contemplates a floating vessel and means for anchoring the vessel over an underwater formation. The vessel has a cellar which opens out of its bottom into the water, and a drilling rig platform is mounted over the cellar. A working platform is mounted in the cellar under the drilling rig platform, and the space between the two platforms is sufficient to accommodate underwater equipment of practically any dimensions. In addition, the working platform is removable so that underwater equipment of various odd sizes can be lowered or raised through the cellar and the water.

The preferred form of the invention includes a pair of longitudinal support beams disposed on opposite sides of the cellar and a set of transverse support beams detachably connected to their opposite ends at spaced locations to the longitudinal beams. A removable grating is laid on the beams to provide a stable but removable working platform. Also in the preferred form a track is disposed under the rig platform and a crane is adapted to ride on the track and extend over the water so that heavy equipment can easily be raised, lowered, and moved laterally.

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 fragmentary sectional view along the longitudinal axis of a floating vessel incorporating the preferred embodiment of the invention;

FIG. 2 is a view taken on line 2—2 of FIG. 1, and FIG. 3 is a view taken on line 3—3 of FIG. 2.

Referring to FIG. 1, a floating vessel 10 is anchored by lines 11 in a body of water 12 over an underwater formation 13. The vessel includes a main deck 14, a lower deck 16, and a bottom 18. A cellar 20 opens through the central portion of the vessel from the top deck out through the bottom. A drilling rig platform 22 is mounted on supports 24 on the main deck over the upper end of the cellar. A rotary drilling rig 25, which may be of conventional type, is mounted over the

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drilling rig platform and includes the usual rotary table 26, Kelly joint 27, and the other usual associated equipment (not shown). A removable working platform 30 is mounted across the cellar at the same level as the lower deck.

As can be seen in FIG. 2, the cellar is approximately oval in cross section, with its main axis extending in the same direction as the longitudinal axis of the floating vessel. A pair of relatively short longitudinal support beams 32, which preferably are I-beams (see FIG. 3), are disposed along the central edge portion of the cellar on opposite sides of the longitudinal axis of the vessel. As shown more clearly in FIG. 3, the longitudinal beams are welded to the sides of the cellar with brackets 34, so that the top flanges of the longitudinal beams are substantially flush with the top of the lower deck.

Returning to FIG. 2, a pair of adjacent central transverse support beams 36, which preferably are I-beams, extend across the cellar perpendicular to the longitudinal beams. The two central transverse support beams are disposed on opposite sides of the transverse axis of the cellar and are attached at their respective ends by vertical pins 38 to the intermediate portions of the longitudinal beams. As shown more clearly in FIG. 3, each end of the pin-connected transverse support beam is notched and provided with a vertical eye 40 in which a separate pin is disposed. The upper end of each pin extends up through a hole 41 in the inner portion of an inwardly extending plate 42 welded to the top of the upper flange of each longitudinal beam. The lower end of each pin extends down through a hole 44 provided in a horizontal flange 46 on the upper edge of bracket 34. A separate slidable longitudinal strip or flat bar 48 is welded to the bottom edge of the notched end portion of each central transverse beam and rests on the inner portion of the lower flange of a respective longitudinal support beam. Each flat bar extends for a suitable distance on each side of each respective transverse support beam to prevent the beam from becoming "cocked" as the beam is slid longitudinally on its respective bars, as described in detail below.

Adjacent each central transverse beam is a transverse intermediate support beam 49 which is welded at each end to a respective end of the longitudinal beams. Two additional pairs of transverse support beams 50 at opposite ends of the cellar are welded at their respective ends to brackets 51 on the sides of the cellar.

A pair of relatively short cross beams 52, which preferably are I-beams, are disposed on opposite sides of the longitudinal axis of the cellar and connected by vertical pins 54 at each end to the intermediate portions of the transverse central support beams.

A separate rib 56 is welded to the center of the top flange of each transverse support beam and extends for substantially the entire length of its respective beam. A plurality of grating sections 58 rest on the upper surfaces of the transverse beam flanges and are prevented from sliding laterally by the ribs. The grating sections can be picked up and removed from the cellar area when desired, but are ordinarily arranged as shown fragmentarily in FIG. 2, so that there is an opening 59 in the center of the working platform collinear with the hole in the rotary table to permit the free passage of drill pipe, casing, tubing, and other relatively small equipment.

A crane track 60 includes a pair of longitudinal rails 62 welded to the top of the upper flange of each longitudinal support beam to extend collinearly past each end of each longitudinal beam for a substantial distance over the lower deck. The rails are also welded to the lower deck. An upright stop 64 is at each end of each rail. Referring to FIG. 1, a bridge crane 66 is mounted on a

pair of trucks 68 (FIG. 2) each having front and rear wheels 70 adapted to ride on a respective rail. Each rail is of enlarged cross-section at its upper surface so that a pair of downwardly and inwardly extending preventors 72 welded to the forward and rear ends of each truck fit under the upper portion of the track to prevent tipping of the crane.

As can be seen more clearly in FIG. 3, the crane includes a hook and pulley arrangement 78 adapted to be moved transversely across the cellar on a track 80 supported at the upper end of the crane. Thus, the bridge crane can be rolled on its trucks longitudinally of the cellar and the supporting hook can be moved transversely of the cellar so that a load can be picked up off the lower deck and be moved to and supported at any point in the cellar.

When it becomes necessary to raise or lower underwater equipment such as that described in co-pending application, Serial No. 468,214, filed November 12, 1954, (now U.S. Patent 2,808,229), which is too large to fit through the opening ordinarily provided with the transverse beams in the position shown in FIG. 2, the necessary grating is removed and the pins are pulled from the cross-beams 52, which are then removed. The pins are then pulled from the respective ends of the transverse central beams, and each beam is pushed longitudinally until it abuts respective adjacent intermediate transverse beam, thereby approximately tripling the opening in the working platform through which equipment can pass. It should be noted at this point that the flat bars welded to the ends of the longitudinal support beams slide on the lower flanges of the longitudinal support beams and are of sufficient length to prevent the central transverse support beams from becoming "cocked" at such an angle to permit the transverse beam to slide off the longitudinal beams and into the water.

The crane is rolled over the lower deck to where the equipment is stored, and the equipment is picked up and carried by the crane over the enlarged area in the cellar lying between the spread central transverse beams and the longitudinal beams. The equipment is then lowered to and suitably supported in the desired position in the water, at which time the crane is disconnected from the equipment and moved out of the way. Once the equipment is lowered below the lower deck, the transverse beams and grating are restored to the original conditions shown in FIG. 2, and operations continued as before.

An important advantage of the removable grating and slidable support beams is that a sturdy working platform is available around a relatively small opening when small equipment is in use and it is necessary for workmen to have safe access to the equipment. Yet, when needed, the working platform can be temporarily and substantially enlarged to accommodate larger equipment. Thus, the invention provides apparatus which facilitates the handling of large and cumbersome equipment frequently required for underwater drilling operations, including the completion of underwater wells.

We claim:

1. Apparatus for use in drilling a hole in an underwater formation comprising a floating vessel having a cellar opening out of its bottom into the water, a drilling rig platform mounted over the cellar, a first set of elongated supports mounted on the floating vessel on opposite sides of the cellar and spaced a substantial distance under the drilling rig platform, a second set of elongated supports extending transverse to and disposed between the first set of supports so the opposite ends of each support in the second set are adjacent a respective support in the first set, means connecting the supports in the second set to be slidable toward and away from each other in a direction generally parallel to the direction in which the supports of the first set extend.

2. Apparatus according to claim 1 which includes

means for releasably securing the second set of supports to the first set.

3. Apparatus according to claim 2 which includes means for limiting the change in angle between the supports in the second set and those in the first set.

4. Apparatus for use in drilling a hole in an underwater formation comprising a floating vessel having a cellar opening out of its bottom into the water, a drilling rig platform mounted over the cellar, a first pair of elongated supports mounted on the floating vessel on opposite sides of the cellar and spaced a substantial distance under the drilling rig platform, each support in the first pair having a longitudinally extending channel opening toward the other, a second set of elongated supports extending transverse to and disposed between the first set of supports so the opposite ends of each support in the second set rest in a respective channel in a support in the first set to be slidable toward and away from each other in a direction generally parallel to the direction in which the supports of the first set extend.

5. Apparatus for use in drilling a hole in an underwater formation comprising a floating vessel having a cellar opening out of its bottom into the water, a drilling rig platform mounted over the cellar, a first pair of elongated supports mounted on the floating vessel on opposite sides of the cellar and spaced a substantial distance under the drilling rig platform, each support in the first pair having a longitudinally extending channel opening toward the other, a second set of elongated supports extending transverse to and disposed between the first set of supports so the opposite ends of each support in the second set rest in a respective channel in a support in the first set to be slidable toward and away from each other in a direction generally parallel to the direction in which the supports of the first set extend, and a projection secured to at least one end of each support in the second set to extend away from the support to which it is secured and in the direction of the channel in which the said end rests to prevent the said end from slipping out of the said channel.

6. Apparatus for use in drilling a hole in an underwater formation comprising a floating vessel having a cellar opening out of its bottom into the water, a drilling rig platform mounted over the cellar, a first set of elongated supports mounted on the floating vessel on opposite sides of the cellar and spaced a substantial distance under the drilling rig platform, a second set of elongated supports extending transverse to and disposed between the first set of supports so the opposite ends of each support in the second set are adjacent a respective support in the first set, means connecting the supports in the second set to be slidable toward and away from each other in a direction generally parallel to the direction in which the supports of the first set extend, the supports of the second set having substantially flat top surfaces, a separate longitudinal rib in the central portion of the top surface of each support in the second set, and a plurality of removable grating sections disposed with their edges adjacent the ribs and resting on the flat top surfaces of the support of the second set.

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