

Sept. 12, 1961

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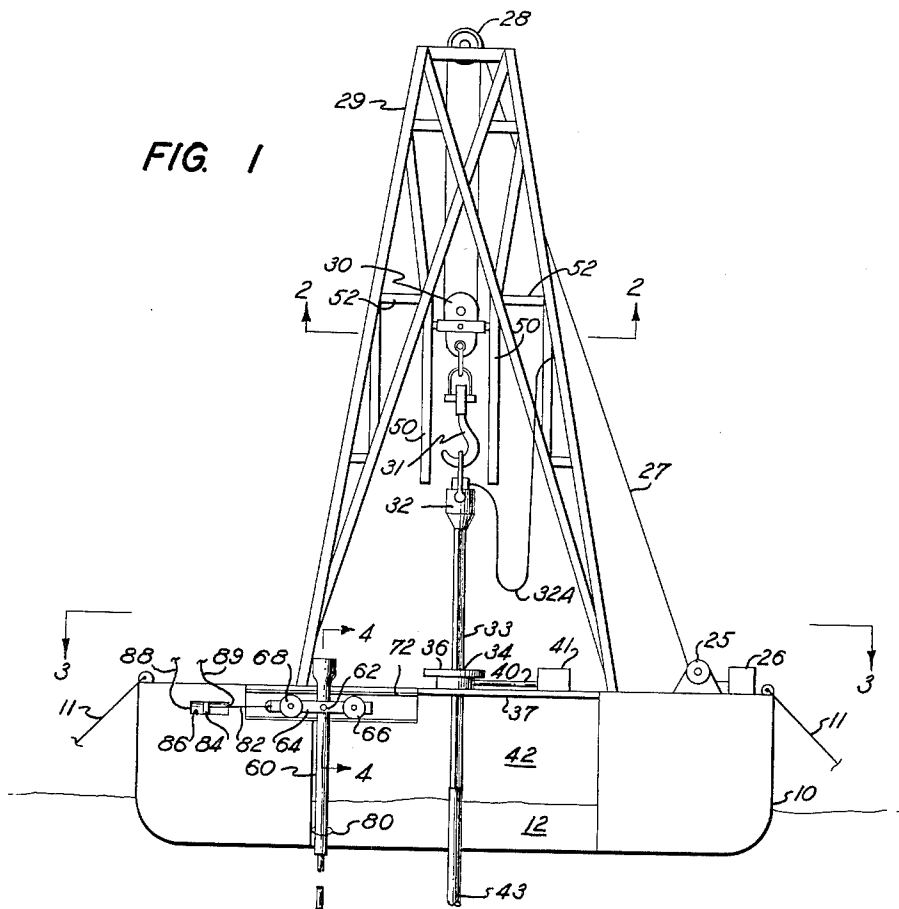
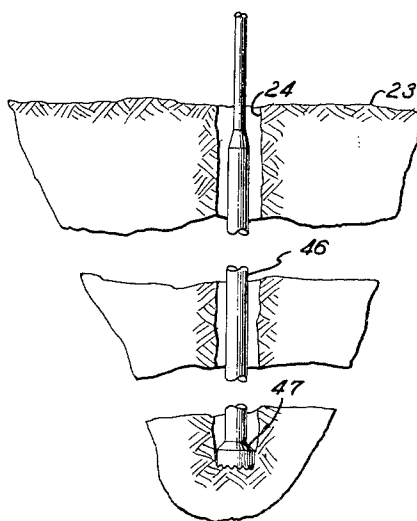
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DRILLING

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FIG. 1



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FIG. 3

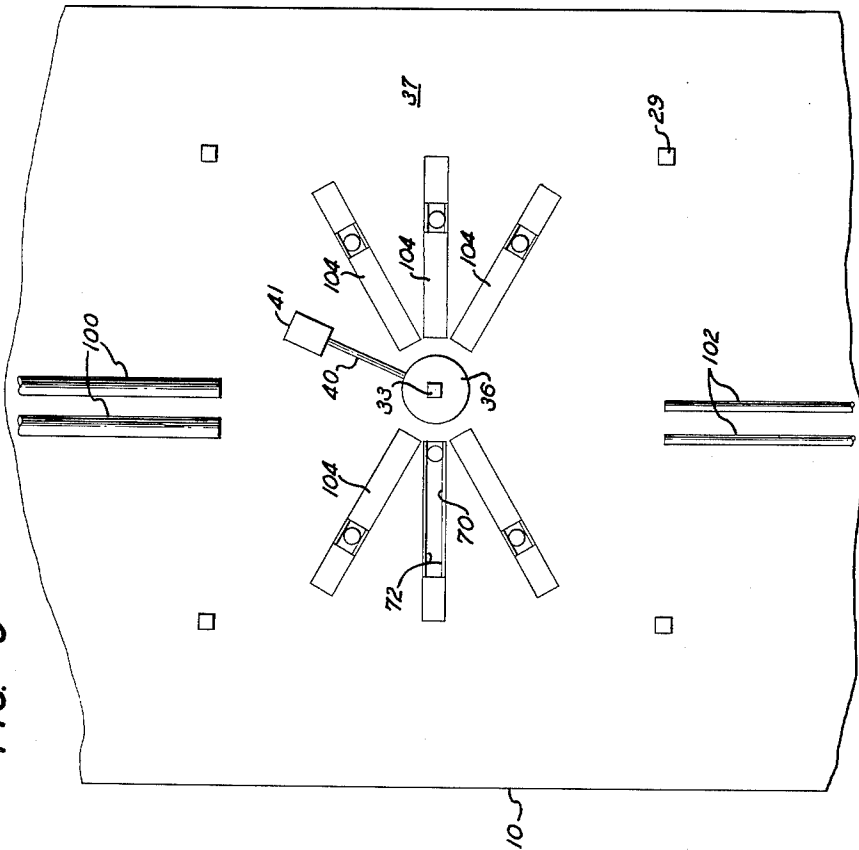
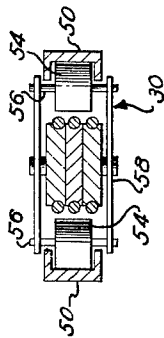


FIG. 2



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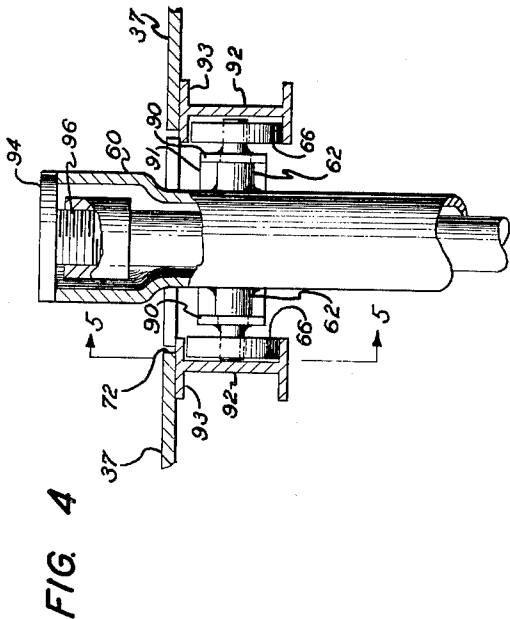
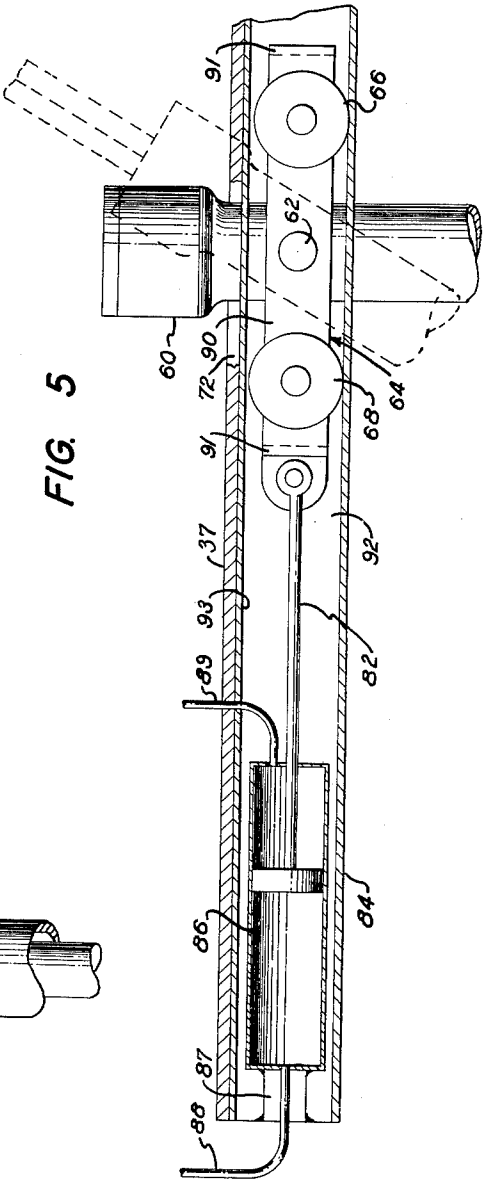
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DRILLING

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14 Claims. (Cl. 175-5)

This invention relates to drilling, and more particularly, to equipment for drilling wells in underwater formations from a floating vessel.

At the present time, floating drilling vessels or barges are used to drill exploratory wells at offshore locations. A typical floating drilling barge uses a rotary drilling rig, which employs a string of drill pipes and drill collars extending from the floating vessel down to the underwater formation. The drilling string is turned by a rotary table through which extends an elongated kelly joint of square cross section. The lower end of the kelly joint is connected to the upper end of the uppermost drill pipe, and the drilling string is lengthened or shortened by temporarily uncoupling the kelly joint and adding or removing a section of drill pipe. The drilling string is raised and lowered on a traveling block.

In conventional rotary drilling at offshore locations, "rat" and "mouse" holes are provided at the rig for the temporary storage of drill pipe or the kelly joint. A typical rat or mouse hole includes an upright scabbard closed at its bottom and set in a hole drilled at the well site. The scabbard is usually of sufficient length to accommodate one joint or section of drill pipe. Ordinarily, the term "rat hole" is used to designate the storage space for the kelly joint, and the term "mouse hole" is descriptive of the storage space for a section of drill pipe either just removed from the well or about to be placed into the well.

It is often desirable to use a traveling block guide with floating drilling rigs to prevent the traveling block from swinging dangerously when the vessel is pitched or rolled due to wave action. Ordinarily, the guide extends down relatively close to the rotary table, and therefore requires the location of the upper end of a rat or mouse hole fairly close to the rotary table to permit the equipment to be placed in or removed from the rat or mouse holes. However, permanent installation of a rat or mouse hole closely adjacent the rotary table takes up valuable working space and hampers other drilling operations.

This invention overcomes the above difficulty by providing a movable scabbard for a rat or mouse hole which is provided with means for moving its upper end toward and away from the rotary table. Thus, the upper end of the scabbard can be moved toward the rotary table to facilitate equipment being stored in or removed from the scabbard, and can be moved away from the rotary table when not in use.

In the preferred form, the invention contemplates apparatus for drilling a hole in a formation underlying a body of water which includes a floating vessel and means for anchoring the vessel over the formation. A rotary drilling rig is mounted on the vessel over the water, and a derrick floor is disposed over the water. A rotary table is mounted on the derrick floor and an outwardly extending track is mounted on the vessel with one end of the track nearer the rotary table than the other. A carriage is adapted to move on the track and an elongated and downwardly extending scabbard is connected to the carriage. Means are provided for moving the carriage on the track to carry the scabbard toward and away from the rotary table.

Preferably, the invention also includes a guide for

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limiting lateral movement of the traveling block used to raise and lower drilling equipment, and the scabbard is connected to the carriage by a horizontal pivot so the lower end of the scabbard can remain in a relatively fixed position as the upper end is moved with the carriage. Also in the preferred form, the lower end of the scabbard is open and extends below the bottom of the vessel. Thus, the length of equipment stored in the scabbard is not limited by the length of the scabbard as with conventional arrangements. This latter feature is of particular value in handling drill collars when making trips in or out of the well. Drill collars are usually so heavy that they must be uncoupled at relatively short intervals to prevent possible damage to them due to bending. With the open-bottom scabbard of this invention, substantial lengths of drill collars can easily be stored in the scabbard without requiring uncoupling, resulting in substantial saving of valuable rig time.

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 transverse section of a floating vessel embodying the presently preferred form of the invention;

FIG. 2 is a view taken on line 2-2 of FIG. 1, certain non-essential elements not being shown for simplicity;

FIG. 3 is a view taken on line 3-3 of FIG. 1, certain non-essential elements not being shown for simplicity;

FIG. 4 is a view taken on line 4-4 of FIG. 1; and

FIG. 5 is a view taken on line 5-5 of FIG. 4 and partially broken away.

Referring to FIG. 1, a floating vessel 10, such as a barge or ship, is anchored by lines 11 in a body of water 12 over an underwater formation 23 in which a well 24 is being drilled. A draw works 25 and power unit 26, which may be of conventional type, are mounted on the deck of the vessel to operate a hoisting cable 27 carried over a crown block 28 at the upper end of a derrick 29. The traveling end of the hoisting cable carries a traveling block 30 and a hook 31 which supports a swivel joint 32 supplied with drilling fluid through a mud hose 32A connected to a pump (not shown). A kelly joint 33 extends downwardly from the swivel through a kelly bushing 34 in the center of a rotary table 36 mounted in a derrick floor 37, which extends across the base of the derrick. Preferably, the rotary table is mounted on gimbals in a manner such as that described in U.S. Reissue Patent No. 24,083. Power is supplied to the rotary table through a shaft 40 turned by a rotary table power unit 41. As can be seen most clearly from FIGS. 1 and 3, the rotary table is supported directly over a cellar 42 located in the center of the vessel. The cellar opens at its bottom into the water in which the vessel is floating.

A string of drill pipe 43 is connected to the lower end of the kelly and extends down through the cellar, the water and into the well. A plurality of drill collars 46 are attached to the lower end of the drill pipe and a drill bit 47 is connected to the lower end of the drill collars.

If desired, equipment such as that described in co-pending application Serial No. 468,214, filed November 12, 1954 (now U.S. Patent No. 2,808,229) can be used to guide the drill pipe in making trips between the floating vessel and the well.

Referring to FIG. 1, the derrick includes a pair of laterally spaced and vertical traveling block guides 50 which are attached to the derrick at their upper ends by horizontal sections 52. As shown most clearly in FIG. 2, each guide is an inwardly opening channel section adapted to receive a separate rotatable wheel 54 mounted on a respective shaft 56 between the outer ends of a guide bracket 58 connected at its center to the traveling

block. Thus, the traveling block is free to move vertically but is prevented from swinging laterally if the vessel should pitch or roll due to wave action.

A substantially upright scabbard 60 is disposed in the cellar 42. Preferably, the scabbard is a piece of pipe or casing open at both ends and connected near its upper end by a horizontal pivot 62 to a carriage 64 having a pair of inboard wheels 66 and a pair of outboard wheels 68 adapted to ride on an outwardly extending track 70 attached to the underside of the derrick floor with the inner end of the track adjacent the rotary table. The upper end of the scabbard is of increased diameter and projects up through a transverse scabbard slot 72 in the derrick floor. The lower end of the scabbard extends down below the bottom of the vessel through a loosely fitting loop 80 attached to the lower edge of the cellar. The inner end of a piston rod 82 is connected to the outboard end of the carriage and the outboard end of the piston rod is connected to a piston 84 disposed in a horizontal cylinder 86 secured by a brace 87 (FIG. 5) to the track 70 and adapted to be supplied air at opposite ends by outboard and inboard air lines 88, 89 respectively, connected to a source of air pressure (not shown).

As shown most clearly in FIG. 4, the carriage includes a pair of laterally spaced and horizontal longitudinal beams 90 joined at their respective ends by cross beams 91. The track is made up of a pair of horizontal and laterally spaced I-beams or rails 92 having upper horizontal flanges 93 welded to the bottom of the derrick platform. Thus, the scabbard is adapted to pivot between the rails in a vertical plane perpendicular to the longitudinal axis of the vessel as the carriage is moved inwardly and outwardly with respect to the rotary table. As shown in FIG. 1, the carriage is in the outboard or retracted position so that the upper end of the scabbard is remote from the rotary table. A string of drill pipe is disposed in the scabbard and supported at its upper end by a supporting ring 94 having a downwardly extending and externally threaded boss 96 screwed into the upper end of the drill pipe as shown most clearly in FIG. 4. The supporting ring is of sufficient diameter to rest on the upper end of the scabbard and prevent the drill pipe, kelly joint, etc., from slipping down and out of the bottom of the scabbard.

Although for the sake of simplicity, only one scabbard and carriage arrangement is shown in FIG. 1, FIG. 3 shows how a plurality of scabbards can be mounted around the rotary table to slide in a direction transverse to the longitudinal axis of the floating vessel. This arrangement is preferred because it leaves a longitudinal space clear for the handling of casing 100 and drill pipe 102 longitudinally disposed on the deck of the vessel on either side of the derrick. If desired, the scabbard slots in the derrick floor for the various scabbards are covered with plates 104, when the scabbards are in their respective outboard positions, to provide a continuous working platform. When a scabbard is to be advanced toward the rotary table, its respective cover plate is first removed. As shown in FIG. 3, the center scabbard on the left hand side of the rotary table, which is the scabbard shown in FIGS. 1, 4 and 5, is in the inboard position i.e., moved in to be adjacent the rotary table.

The operation of the apparatus shown in the accompanying drawings is relatively simple. Whenever it is desired to store the kelly joint or other equipment such as the drill pipe or drill collars in the scabbard shown in FIGS. 1, 4 and 5, the drill string is secured in the rotary table by a set of slips (not shown). The cover plate (if used) for the scabbard slot is removed, the drill string disconnected above the slips, and air is supplied through the outboard line 88 to drive the piston inwardly and carry the upper end of the scabbard closely adjacent the rotary table, the carriage rolling on the track 70. The lower end of the scabbard is held by the loop 80 near the bottom edge of the cellar and is free

to slide up or down slightly as the scabbard moves inwardly or outwardly, the scabbard also being free to pivot in a vertical plane (as shown by the dotted line position of the scabbard in FIG. 5).

With the upper end of the scabbard adjacent the rotary table, as shown in FIG. 3, the lower end of the disconnected drill string above the rotary table, say the lower end of the kelly joint, is guided manually into the scabbard, and the draw works are actuated to lower the traveling block so that the kelly joint enters the scabbard. A pair of slips (not shown) are set to hold the kelly while it is disconnected from the swivel. The ring 94 is screwed into the upper end of the kelly, which is then lowered into the scabbard until the ring rests on the upper end of the scabbard as shown in FIGS. 1 and 4. Air pressure is then supplied to the cylinder 86 through inboard line 89 to drive the piston outwardly and carry the upper end of the scabbard in an outboard direction until it comes to rest in a substantially vertical position along the adjacent wall of the cellar as shown in FIG. 1. The cover plate is then placed over the slot to provide a continuous floor area around the rotary table.

Thereafter, the swivel is replaced by elevators adapted to latch on to drill pipe, which may be withdrawn from the well and disconnected as described above, another scabbard being advanced to receive another section of the drill string. If the water is sufficiently deep, it is possible for all of the drill string to be stored in the various scabbards located around the rotary table. However, in usual practice the kelly joint is stored in one scabbard, the drill pipe removed and stacked on the deck of the drilling vessel, and then the drill collars are stored in the remaining scabbards. The drill pipe is of lighter construction than the drill collars, and therefore can be laid out on the deck in longer sections without danger of bending.

As pointed out above, the open-bottom, slidable scabbards permit the storing of relatively long sections of drill collars, thus avoiding having to disconnect the drill collars at frequent intervals and thereby saving valuable rig time. The location of the lower end of the scabbard below the bottom of the vessel protects the sides of the vessel or cellar from being accidentally damaged, or even punctured, as equipment passes out the lower end of the scabbard. In addition, the lower end is free to move up and down so the upper end of the scabbard is carried away from the working areas around the rotary table to facilitate handling of various types of special equipment required in underwater drilling.

I claim:

1. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel having a cellar opening at its bottom into the water, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the cellar, a derrick floor disposed over the cellar, a rotary table mounted in the derrick floor, an outwardly extending track mounted on the vessel with one end nearer the rotary table than the other end, a carriage adapted to move on the track, an elongated and downwardly extending scabbard in the cellar, a pivot connecting the upper portion of the scabbard to the carriage, and means for moving the carriage to carry the scabbard toward and away from the rotary table.

2. Apparatus according to claim 1 in which the pivot is horizontal and extends in a direction transverse to the direction of the track.

3. Apparatus according to claim 1 which includes means for restraining the lower portion of the scabbard from lateral movement and for permitting its longitudinal movement.

4. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel having a cellar opening at its bottom into the water, means for

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anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the cellar, a derrick floor disposed over the cellar and having a slot, a rotary table mounted in the derrick floor, an outwardly extending track mounted on the vessel with one end nearer the rotary table than the other end, a carriage adapted to move on the track, an elongated and downwardly extending scabbard disposed in the cellar with its upper portion in the derrick floor slot, means connecting the scabbard to the carriage, and means for moving the carriage to carry the scabbard toward and away from the rotary table.

5. Apparatus according to claim 4 which includes a removable cover plate for the slot.

6. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel having a cellar opening at its bottom into the water, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the cellar, a derrick floor disposed over the cellar, a rotary table mounted in the derrick floor, a track extending transverse to the longitudinal axis of the vessel and mounted on the vessel with one end nearer the rotary table than the other end, a carriage adapted to move on the track, an elongated and downwardly extending scabbard in the cellar and connected to the carriage, and means for moving the carriage to carry the scabbard toward and away from the rotary table.

7. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel having a cellar opening at its bottom into the water, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the cellar, a derrick floor disposed over the cellar, a rotary table mounted in the derrick floor, a pair of outwardly extending, horizontal and laterally spaced rails mounted on the vessel with one end nearer the rotary table than the other end, a carriage having wheels adapted to roll on the rails, an elongated and downwardly extending scabbard in the cellar and connected to the carriage, and means for moving the carriage along the rails to carry the scabbard toward and away from the rotary table.

8. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the water, a derrick floor disposed over the water, a rotary table mounted on the derrick floor, a traveling block mounted in the derrick, means for moving the traveling block substantially vertically above the rotary table, a substantially horizontal track mounted on the vessel with one portion nearer the rotary table than another portion, a carriage adapted to move on the track toward and away from the rotary table in a direction transverse to that in which the traveling block moves, an elongated and downwardly extending scabbard connected to the carriage, the scabbard having its upper end at a level in the vicinity of the rotary table and extending downwardly at least as far as about the bottom of the vessel and means for moving the carriage on the track to carry the scabbard toward and away from the rotary table.

9. Apparatus according to claim 8 in which the scabbard is open at each end.

10. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel having a cellar opening at its bottom into the water, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the water, a derrick floor disposed over the cellar, a rotary table

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mounted on the derrick floor, a traveling block mounted in the derrick, means for moving the traveling block substantially vertically above the rotary table, a substantially horizontal track mounted on the vessel with one portion nearer the rotary table than another portion, a carriage adapted to move on the track toward and away from the rotary table in a direction transverse to that in which the traveling block moves, an elongated and downwardly extending scabbard connected to the carriage and disposed in the cellar, and means for moving the carriage on the track to carry the scabbard toward and away from the rotary table.

11. Apparatus according to claim 10 in which the lower end of the scabbard is open and projects below the bottom of the vessel.

12. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the water, a derrick floor disposed over the water, a rotary table mounted on the derrick floor, a traveling block mounted in the derrick, means for moving the traveling block substantially vertically above the rotary table, upright laterally rigid and elongated traveling block guide means disposed above the rotary table and adjacent the path traveled by the block to be immobile with respect to the derrick, and means engaging the guide means and block to permit the vertical movement of the traveling block and limit all of its lateral movement, a substantially horizontal track mounted on the vessel with one portion nearer the rotary table than another portion, a carriage adapted to move on the track toward and away from the rotary table in a direction transverse to that in which the traveling block moves, an elongated and downwardly extending scabbard connected to the carriage, and means for moving the carriage on the track to carry the scabbard toward and away from the rotary table.

13. Apparatus for drilling a hole in a formation underlying a body of water comprising a floating vessel, means for anchoring the vessel over the formation, a rotary drilling derrick mounted on the vessel over the water, a derrick floor disposed over the water, a rotary table mounted on the derrick floor, a traveling block mounted in the derrick, means for moving the traveling block along a substantially vertical path above the rotary table, upright, laterally rigid and elongated traveling block guide means disposed adjacent the path traveled by the block to be immobile with respect to the derrick, and means engaging the guide means and block to be slidable along the guide and constrain all lateral movement of the traveling block as the vessel is pitched and rolled by wave action.

14. Apparatus according to claim 13 in which the guide means includes a pair of laterally spaced guide members on opposite sides of the path traveled by the block.

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