

Jan. 3, 1961

P. A. WOLFF
DRILLING APPARATUS

2,966,994

Filed March 14, 1956

2 Sheets-Sheet 1

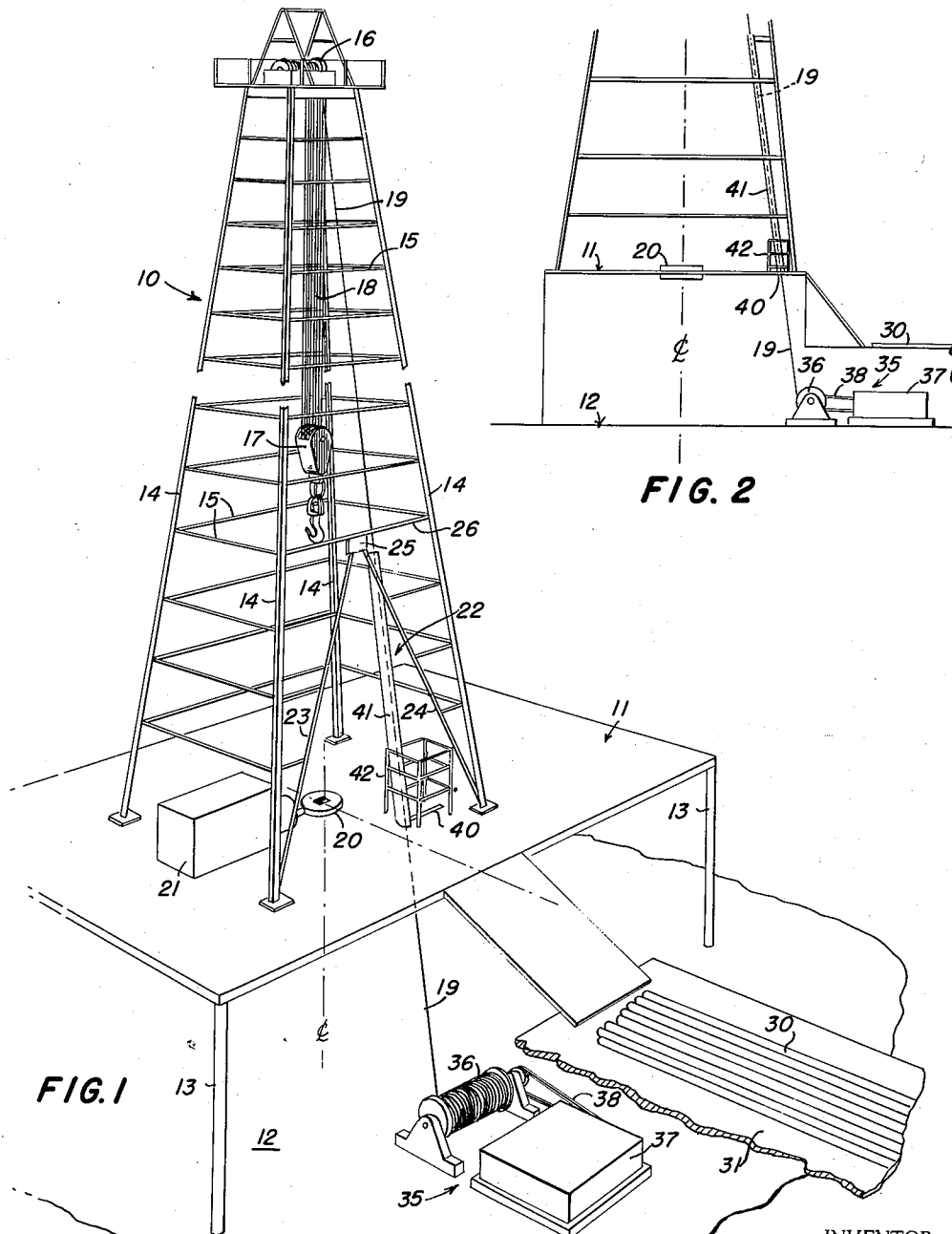


FIG. 1

FIG. 2

INVENTOR

PAUL A. WOLFF

BY

Paul A. Wolff

ATTORNEY

Jan. 3, 1961

P. A. WOLFF
DRILLING APPARATUS

2,966,994

Filed March 14, 1956

2 Sheets-Sheet 2

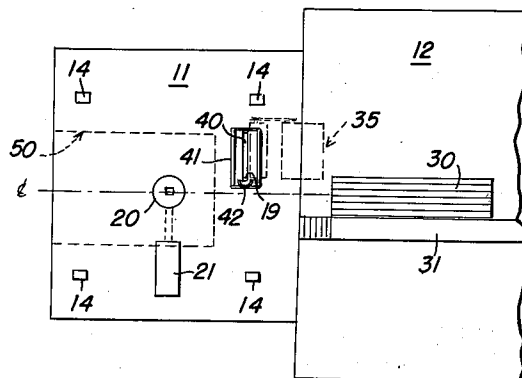


FIG. 3

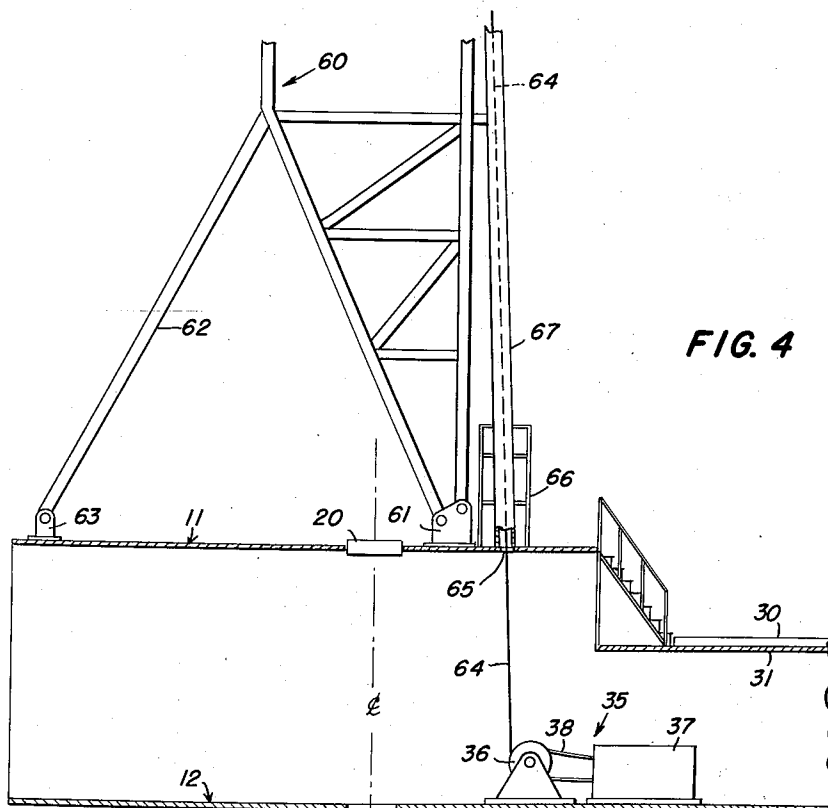


FIG. 4

INVENTOR

PAUL A. WOLFF

BY

James J. Shanley
Ruxton Neil

ATTORNEY

1

2,966,994

DRILLING APPARATUS

Paul A. Wolff, Morgan City, La., assignor to Kerr-McGee Oil Industries, Inc., a corporation of Delaware

Filed Mar. 14, 1956, Ser. No. 571,492

6 Claims. (Cl. 214—2.5)

This invention relates to subterranean drilling apparatus and more particularly to improved arrangements of operating equipment of the drilling apparatus.

Drilling apparatus may employ a derrick or mast type rig, each of which includes an opening in one of its sides and adjacent the floor upon which the derrick or mast is mounted, through which strings of casing or pipe are pulled to within the rig by means of an auxiliary line and upwardly on the rig by means of a travelling block under control of a fast line passing over the crown block and leading to draw works. The opening in the side of the rig through which strings of pipe are pulled to within the rig is referred to in the art as the "V-window," although the opening is not necessarily in the form of a V. A rack for the pipe is located adjacent the V-window side of the rig, and in the prior drilling apparatus the draw works is located adjacent the side of the rig opposite its side including the V-window. Therefore, in conventional drilling apparatus the fast line extends from the draw works to the crown block on one side of a plane passing through the drilling line opposite the side of the plane on which the V-window is located, the plane being perpendicular to the sides of the rig adjacent its side including the V-window. The prior arrangements include a drilling floor, that is, the floor upon which the rig is mounted, suitable to support the draw works and its prime mover outboard the side of the rig opposite the V-window side, as well as supporting space for a rotary table and its driving equipment. In these arrangements a pipe rack and a catwalk extend outwardly from the V-window side of the rig.

The foregoing requirements present problems in connection with recent developments of mobile drilling apparatus for water or land use. For example, it has proven advantageous to employ a short wide slot in offshore drilling barges. However, it is not possible to utilize conventional arrangements of drilling equipment with a short wide drilling slot for the reason a drilling rig, whether it is in the form of a derrick or a mast, is positioned about the perimeter of the drilling slot and adjacent the open end of the slot. This arrangement necessitates location of the side of the drilling rig including the V-window inboard with the pipe rack and its associated catwalk extending inboard of the drilling rig, and there is no space on the drilling floor for supporting the drill works in accordance with conventional practice. One attempt has been made to solve this problem by providing draw works and a prime mover of special design which allows the draw works to be positioned adjacent a side of the drilling rig next to the side including the V-window. This solution has not proven successful since specially designed equipment required materially increases the cost of the drilling apparatus.

The present invention provides a novel arrangement of the operating equipment of a drilling apparatus which overcomes the problems outlined above while allowing utilization of conventional draw works. In general, according to the principles of the present invention, the

2

draw works together with its prime mover are located adjacent the V-window side of the drilling rig on a supporting base beneath the derrick floor. The fast line leading from the crown block is passed through an opening provided in the derrick floor and is connected to the draw works. Elongated guard means are positioned in the region of the V-window and parallel to the path of the fast line between the drilling floor and the upper end of the V-window to prevent strings of pipe drawn into the rig through the V-window from contacting the fast line and from becoming entangled therewith. Also, it is contemplated by the present invention to provide guard means around the opening in the drilling floor and extending upwardly therefrom to protect men working about the drilling floor during drilling operations. With the novel arrangement provided by the present invention, draw works of conventional construction may be employed yet there results no interference with conventional operations of introducing and removing strings of pipe through the V-window of the drilling rig. The novel features of the present invention have special utility in connection with drilling barges inasmuch as conventional draw works may be employed without creating barge stability problems.

The foregoing will be more fully understood from the following detailed description considered in connection with the accompanying drawings which disclose several embodiments of the invention. It is to be expressly understood, however, that the drawings are designed for purposes of illustration only and not as a definition of the limits of the invention, reference for the latter purpose being had to the appended claims.

In the drawings, in which similar reference characters denote similar elements throughout the several views:

Fig. 1 is a perspective view of a drilling apparatus constructed in accordance with the principles of the present invention;

Fig. 2 is a view in side elevation of the drilling apparatus shown in Fig. 1;

Fig. 3 is a plan view of a drilling apparatus embodying the principles of the present invention shown in the embodiment of an offshore drilling barge; and

Fig. 4 is a side elevational view of another embodiment of the present invention.

With reference more particularly to Fig. 1 of the drawings, a drilling apparatus embodying the principles of the present invention is disclosed therein including a drilling rig 10 mounted on a drilling platform 11 supported above a subflooring 12 by means of vertical column members 13. The drilling rig 10 is shown in the form of a drilling derrick of conventional construction including four upright corner members 14 interconnected by horizontal members 15 to form a four sided truncated pyramidal structure of square horizontal cross-section. A crown block 16 is located at the upper end of the derrick and a travelling block 17 is located within the derrick and supported from the crown block by cables 18. A fast line 19 is provided for controlling upward and downward movement of the travelling block in a manner to be described more fully below. A rotary table is mounted on the drilling floor 11 together with its prime mover 21 positioned on one side of the drilling floor.

A V-window 22 is located in one side of the derrick adjacent its base. The V-window 22 is formed by members 23 and 24 joined to the base of a pair of coplanar corner members 14 and extending upwardly and inwardly toward each other and being joined together by a gusset plate 25 secured to a horizontal member 26 at a level above the level of the drilling floor 11. Although the members 23 and 24 are positioned to form a V-window shaped like an inverted V, it is to be expressly understood that openings of other shape may be provided and that the term "V-window" used in the specification is in-

3

tended to encompass all shapes of V-window openings and is not limited to openings of a V configuration.

A pipe rack 30 and catwalk 31 are positioned adjacent the side of the derrick including the V-window 22 with the longitudinal axes of the pipe rack and the catwalk being substantially perpendicular to the plane of the V-window. With this arrangement, pipe from the pipe rack may be pulled through the V-window to within the derrick by an auxiliary line, and the pipe may be moved upwardly in the derrick by means of the travelling block 17 under control of the fast line.

As mentioned above, the present invention provides a novel arrangement of equipment employed for a drilling operation which eliminates the necessity of positioning the draw works and its prime mover adjacent the side of the derrick opposite the derrick side including the V-window without necessitating the use of specialized draw works equipment. As shown in the drawing, a draw works 35 is mounted on the subfloor 12 beneath the derrick floor 11 and on the side of the derrick including the V-window 22. The draw works 35 is of conventional construction and includes a drum 36 and a prime mover 37 operatively connected to the drum through a chain drive 38. The draw works is mounted on one side of a plane bisecting the V-window and passing through the center line of the derrick with the longitudinal axis of the drum 36 parallel to the plane of the V-window 22. This position of the draw works is shown more clearly in Figs. 2 and 3 of the drawings. An elongated slot 40 is provided in the drilling floor 11 in the path of the fast line 19 leading from the crown block 16 to the drum 36 and traversing a projection of the V-window located between the pipe rack and the center of the derrick. The elongated slot 40 is positioned with its long dimension parallel to the axis of the drum 36 and is sufficiently elongated to provide a passageway in the drilling floor 11 for all positions of the fast line 19 as the travelling block 37 is moved upwardly and downwardly within the derrick.

The present invention also provides fast line guard means located in a plane substantially parallel to the path of the fast line and positioned to traverse the projection of the V-window in a manner substantially corresponding to the manner the path of the fast line also traverses the projection of the V-window. As shown in the drawing, an elongated guard means is supported by the derrick and positioned parallel to the path of the fast line with its lower end located adjacent the inside end of the elongated opening 40 and its upper end terminated within the derrick at a level above the upper end of the V-window. The guard means 41 may comprise an elongated member of U-shaped cross section, formed by splitting a section of pipe for example, the elongated member being positioned with its open side facing in a direction away from the center of the V-window toward the outside end of the elongated opening 40. The guard means 41 functions as a stop to prevent contact between the fast line 19 and strings of pipe that may be pulled into the derrick through the V-window. Since the draw works 35 and the elongated opening 40 are positioned to one side of a plane passing through the center line of the drilling derrick and the center of the V-window, the guard means 41 is positioned off-center with respect to the V-window and its presence does not interfere with normal pulling of strings of pipe through the V-window.

The present invention also provides a guard 42 around the elongated slot 40 and extending upwardly from the derrick floor. The guard 42 provides protection for men working on the derrick floor and should extend upwardly from the derrick floor a sufficient distance for this purpose. The guard 42 may be constructed of sheets of expanded metal or other suitable material. In the structure shown in the drawings the portion of the elongated guard means 41 extending inside the guard 42 does not function as stop means for preventing contact with the fast line and a string of pipe being pulled through the

4

V-opening, the latter function being performed by the inside end portion of the guard 42. Thus with structure of the type shown in the drawings the guard means 41 and the guard 42 jointly function to prevent contact between the fast line and strings of pipe passing through the V-window, while the guard 42 also provides protection for workmen. The guard 42 should therefore be of sufficient strength to withstand repeated contact with strings of pipe. It is to be expressly understood that the present invention is not limited to an arrangement in which the guard means 41 and the guard 42 are jointly required to provide a stop to prevent contact between the fast line and strings of pipe, but the guard means 41 and the guard 42 may be constructed so that the guard means 41 alone provides a stop extending from the upper end of the V-window to the drilling floor. Thus, the guard means 41 and the inside end of the guard 42 may be considered as a single means providing the stop.

In Fig. 3 of the drawings the principles of the present invention are disclosed in the environment of a drilling barge provided with a short, wide drilling slot 50 symmetrically positioned with respect to the fore-aft axis of the barge and located at one end of the barge. The drilling floor 11 is spaced above the deck 12 of the barge (equivalent to the subfloor of Fig. 1) with the derrick positioned relative to the slot 50 in a manner shown by the position of the column members 14 of the derrick. The draw works 35 is located inboard of the drilling slot on the deck beneath the drilling floor and adjacent the side of the derrick including a V-window with the longitudinal axis of the draw works parallel to the plane of the V-window and perpendicular to the fore-aft axis of the barge and located to one side of a plane passing through the latter axis. Thus, the elongated opening 40 in the drilling floor, the elongated guard means 41 and the guard means 42 are located to one side of a vertical plane passing through the fore-aft axis of the barge. This arrangement permits positioning of the draw works 35 close to the fore-aft axis of the barge and permits employing of draw works of conventional construction without creating problems concerning stability of the barge. It should be noted in Fig. 3 that the prime mover 21 for the rotary table 20 is located on the side of the fore-aft axis opposite the side at which the draw works 35 are located to thus aid in balancing moments about the fore-aft axis due to mass of the equipment.

The embodiment of the invention shown in Fig. 4 of the drawings illustrates application of the principles of the present invention to a drilling apparatus including a drilling rig of the mast type. As shown, mast 60 is mounted on the drilling floor 11 in a conventional manner by means of supports 61 and gin poles 62 connected between the mast and supports 63 secured to the drilling floor. A fast line 64 extends from the crown block, not shown, outside the mast and passes in front of the V-window of the mast and through an elongated slot 65 formed in the drilling floor 11 and onto the drum 36 of the draw works 35 located on the subfloor 12 beneath the drilling floor. The elongated slot 65 is enclosed by a housing 66, and an elongated guard 67, positioned outside the mast, extends from the inside end of the elongated slot 65 upwardly towards the crown block, in parallel relation with the plane of the path of the fast line, to at least the level of the top of the V-window. As in the previous embodiment, the pipe rack 30 and the catwalk 31 are located outwardly from the side of the mast including the V-window. The draw works 35 is positioned with the axis of rotation of the drum 36 parallel to the plane of the V-window and to one side of a plane bisecting the V-window and passing through the drilling line of the mast in a manner similar to the arrangement shown in Fig. 1. Also, the elongated opening 65 is positioned parallel to the plane of the V-window and is of sufficient length to provide a path for the fast line 64 throughout all phases of operation of the draw works.

5

Thus, the elongated guard 67 is positioned to one side of the plane bisecting the V-window and passing through the drilling line of the mast to provide an arrangement in which strings of pipe may be passed through the V-window by following conventional practices in spite of the location of the fast line in the region of the V-opening.

In both of the embodiments of the invention the draw works may be remotely controlled from the drilling station which may be located on the drilling floor 11.

Both of the embodiments of the invention may be operated in a similar manner. When it is desired to move a string of pipe from the pipe rack 30 to within the drilling rig, an auxiliary line is attached to a string of pipe on the pipe rack, and by means of a cathead driven by the rotary table prime mover, for example, the auxiliary line is operated to pull the string of pipe through the V-window to within the rig for connection with the travelling block. Inasmuch as the string of pipe is pulled through the V-window on center, the string of pipe is located on the inside of the elongated guard means 41 of Fig. 1, or 67 of Fig. 4, and the presence of the guard means does not interfere with normal operations. The guard means 41 and 67 function as stops to prevent outward movement of the pipe into the path of the fast line. Passage of the fast line through the drilling floor 11 to the draw works located therebelow does not interfere with normal working operations about the drilling floor and does not constitute a hazard to the workmen inasmuch as the elongated openings 40 or 65 and the fast lines are enclosed by rectangular guards or cages 42 and 66 of sufficient height to provide adequate protection.

The present invention thus provides a novel arrangement of equipment required for drilling apparatus which does not interfere with normal drilling operations and which allows utilization of conventional draw works while eliminating the necessity present in prior constructions of positioning the draw works adjacent the side of the drilling rig opposite the side including the V-window. While the arrangement provided by the present invention has special application in connection with offshore drilling barges in which location of the drilling equipment is of importance with respect to barge stability, the features of the present invention also have utility in connection with all drilling apparatus, especially mobile drilling apparatus, since a more compact arrangement of equipment is possible requiring less equipment on the drilling floor and thereby increasing working efficiency and safety.

Although several embodiments of the invention have been disclosed and described above, it is to be expressly understood that various changes and substitutions may be made therein without departing from the spirit of the invention as well understood by those skilled in the art. Reference therefore will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In a subterranean drilling apparatus including a drilling rig having a crown block cooperating with a fast line and having a window in its side located adjacent a pipe rack so that strings of pipe from the rack may be pulled through the window into the drilling rig, the drilling rig being mounted on a structure having a main floor and a drilling floor spaced above the main floor, the combination comprising draw works mounted on the main floor beneath the drilling floor on the window side of the drilling rig, means providing an opening in the drilling floor for passage through the drilling floor of the fast line from the crown block to the draw works, the opening being located in a region beneath the window, and elongated guard means for the fast line secured to the drilling rig adjacent to the opening in the drilling floor and extending upwardly from the drilling floor in the region of the window to prevent contact between the fast

6

line and strings of pipe which may be pulled through the window.

2. In a subterranean drilling apparatus including a drilling rig having a crown block cooperating with a fast line and having a window in its side located adjacent a pipe rack so that strings of pipe from the rack may be pulled through the window into the drilling rig, the drilling rig being mounted on a structure having a main floor and a drilling floor spaced above the main floor, the combination comprising draw works mounted on the main floor on the window side of the drilling rig with the longitudinal axis of the draw works parallel to the plane of the window side of the drilling rig, means providing an elongated opening in the drilling floor substantially parallel to the longitudinal axis of the draw works drum for passage through the drilling floor of the fast line from the crown block to the draw works, the opening being located in a region beneath the window, and elongated guard means for the fast line secured to the drilling rig adjacent to the opening in the drilling floor and extending upwardly from the drilling floor in the region of the window to prevent contact between the fast line and strings of pipe which may be pulled through the window.

3. In a subterranean drilling apparatus including a drilling rig having a crown block cooperating with a fast line and having a window in its side located adjacent a pipe rack so that strings of pipe from the rack may be pulled through the window into the drilling rig, the drilling rig being mounted on a structure having a main floor and a drilling floor spaced above the main floor, the combination comprising draw works mounted on the main floor adjacent the window side of the drilling rig with the longitudinal axis of the draw works drum substantially parallel to the plane of the window side of the drilling rig and with the draw works on one side of a plane passing through the center of the window and the center of the drilling rig, means providing an elongated opening in the drilling floor substantially parallel to the longitudinal axis of the draw works drum for passage through the drilling floor of the fast line from the crown block to the draw works, the opening being located in a region beneath the window, and elongated guard means for the fast line secured to the drilling rig adjacent to the opening in the drilling floor and extending upwardly from the drilling floor in the region of the window to prevent contact between the fast line and strings of pipe which may be pulled through the window.

4. In a subterranean drilling apparatus, a structure including a platform having an open-ended drilling slot and a pipe rack located adjacent the closed end of the drilling slot, a drilling rig having a crown block provided with a fast line and a window in one of its sides through which strings of pipe may be pulled to within the drilling rig, a supporting structure for mounting the drilling rig on the platform above the drilling slot with the window side of the drilling rig being positioned adjacent the pipe rack, the supporting structure including a subfloor, draw works mounted on the subfloor beneath the drilling floor on the window side of the drilling rig, means providing an opening in the drilling floor for the passage through the drilling floor of the fast line from the crown block to the draw works, the opening being located in a region beneath the window, and elongated guard means for the fast line secured to the drilling rig adjacent to the opening in the drilling floor and extending upwardly from the drilling floor in the region of the window to prevent contact between the fast line and strings of pipe which may be pulled through the window.

5. In a subterranean drilling apparatus, a structure including a platform having an open-ended drilling slot and a pipe rack located adjacent the closed end of the drilling slot, a drilling rig having a crown block provided with a fast line and a window in one of its sides through which strings of pipe may be pulled to within

7

the drilling rig, a supporting structure for mounting the drilling rig on the platform above the drilling slot with the window side of the drilling rig being positioned adjacent the pipe rack, the supporting structure including a subfloor and a drilling floor mounted above the subfloor, draw works mounted on the subfloor on the window side of the drilling rig with the longitudinal axis of the draw works drum substantially parallel to the plane of the window side of the drilling rig, means providing an elongated opening in the drilling floor substantially parallel to the longitudinal axis of the draw works drum for passage through the drilling floor of the fast line from the crown block to the draw works, the opening being located in a region beneath the window, and elongated guard means for the fast line secured to the drilling rig adjacent to the opening in the drilling floor and extending upwardly from the drilling floor in the region of the window to prevent contact between the fast line and strings of pipe which may be pulled through the window.

6. In a subterranean drilling apparatus, a structure including a platform having an open-ended drilling slot and a pipe rack located adjacent the closed end of the drilling slot, a drilling rig having a crown block provided with a fast line and a window in one of its sides adjacent the pipe rack so that strings of pipe may be pulled through the window into the drilling rig, a supporting structure for mounting the drilling rig on the platform above the drilling slot with the window side of the drilling rig being positioned adjacent the pipe rack, the supporting structure including a subfloor and a drilling floor mounted above the subfloor, draw works

8

mounted on the subfloor on the window side of the drilling rig with the longitudinal axis of the draw works drum parallel to the plane of the window side of the drilling rig, means providing an elongated opening in the drilling floor parallel to the longitudinal axis of the draw works drum for passage through the drilling floor of the fast line from the crown block to the draw works, the opening being located in a region beneath the window, elongated guard means for the fast line secured to the drilling rig adjacent to the opening in the drilling floor and extending upwardly from the drilling floor in the region of the window to prevent contact between the fast line and strings of pipe which may be pulled through the window.

References Cited in the file of this patent

UNITED STATES PATENTS

1,647,065	Vaughan et al.	Oct. 25, 1927
2,512,022	Hurt	June 20, 1950
2,531,930	Woolslayer et al.	Nov. 28, 1950
2,627,391	Crookston et al.	Feb. 3, 1953
2,628,818	Graham	Feb. 17, 1953
2,653,796	McGee et al.	Sept. 29, 1953

FOREIGN PATENTS

764,345	Great Britain	Dec. 28, 1956
---------	---------------------	---------------

OTHER REFERENCES

30	New Remote Control Rig, Oil and Gas Journal, June 29, 1950, pages 74, 75, 76.
----	---