

United States Patent [19]**Swenson**[11] **3,811,322**[45] **May 21, 1974****[54] METHOD AND APPARATUS FOR
MONITORING RETURN MUD FLOW**[75] Inventor: **William J. Swenson**, Houston, Tex.[73] Assignee: **The Offshore Company**, Houston,
Tex.[22] Filed: **Sept. 25, 1972**[21] Appl. No.: **291,907**[52] **U.S. Cl.**..... **73/155, 175/48**[51] **Int. Cl.**..... **E21b 47/10**[58] **Field of Search** 73/151, 152, 155, 202;
175/5, 7, 40, 48

[56]

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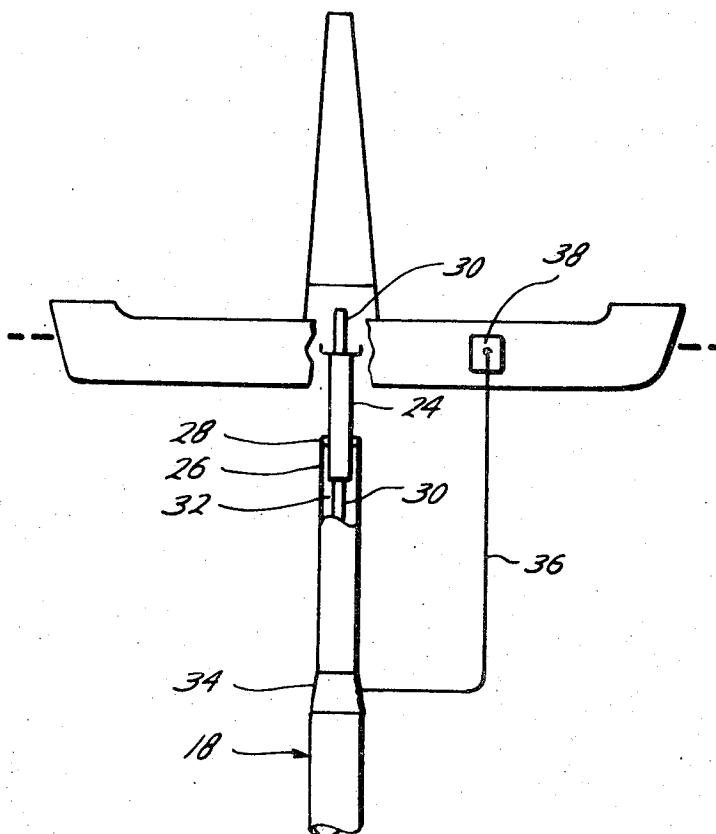
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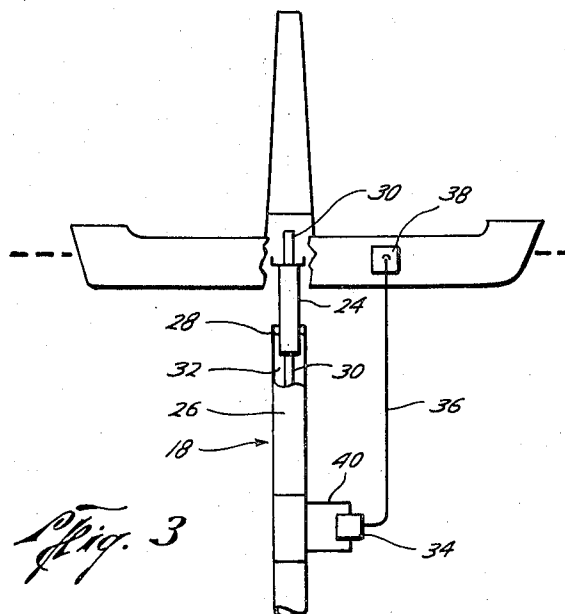
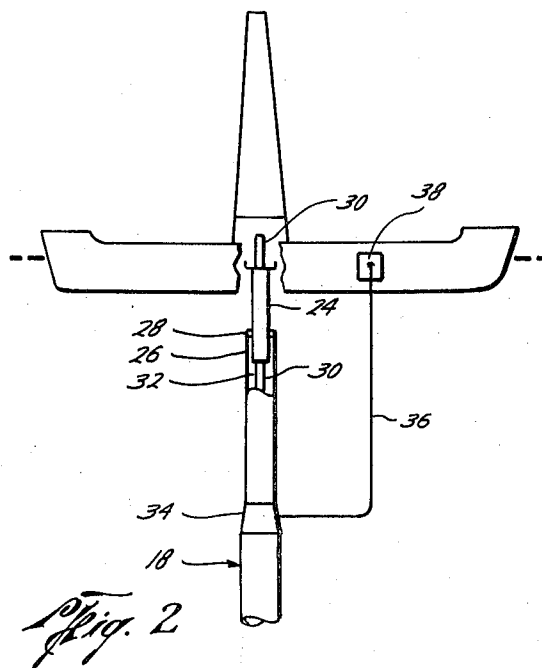
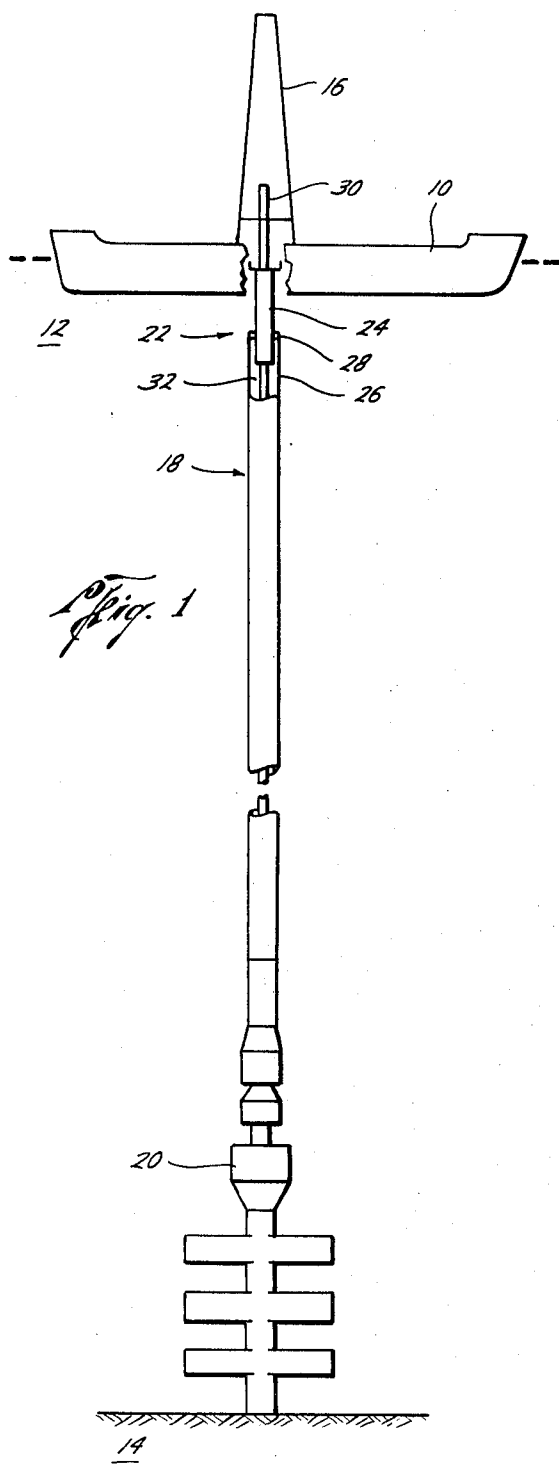
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ABSTRACT

A method and apparatus for monitoring steady state mud flow return rate through a marine riser extending between a floating drill ship and the ocean floor, and including a telescopic joint wherein the mud flow return rate is measured at a point below the telescoping joint where the flow rate is essentially unaffected by the pumping action of the telescoping joint and the measurements are then transmitted to the drill ship.

8 Claims, 3 Drawing Figures

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METHOD AND APPARATUS FOR MONITORING RETURN MUD FLOW

The present invention is directed to an improved method and apparatus for monitoring the mud flow return rate through a marine riser used with a floating drill ship.

The problems created by the ship's motion when drilling from a floating vessel have plagued the drilling industry from the advent of the floating drill ship. One such problem engendered by the ship's motion is the detection of blowouts by monitoring the return mud flow. On land rigs and on fixed and movable drilling platforms, return mud flow is monitored at the ground or deck level to detect sudden surges or drops in the flow rate which may signal an impending blowout. When such a sudden increase or decrease in flow rate is observed, proper measures are taken to prevent or minimize the blowout.

However, when drilling from a floating vessel, the well casing is connected to the drill ship by marine conductor or marine riser which extends between the ocean floor and the drill ship. To accommodate the ship's motion, the marine riser is provided with a telescoping joint, usually near its upper end. The ship's heave strokes the telescoping joint up and down, creating a pumping action on the returning mud flow, which results in pulsations of the mud flow as received by the shipboard mud system. Under these conditions, the instantaneous maximum mud flow rate induced by the ship's heave may be several times the steady state or real flow rate. Thus, the real flow rate is masked by the pumping action of the telescoping joint making it difficult or impossible to detect quickly any changes in the real flow rate.

It is, accordingly, the primary object of the present invention to provide a method and apparatus for monitoring steady state or real mud flow return rate in a marine riser.

Another object is to provide such a method and apparatus wherein the mud flow is measured at a point below the telescoping joint in the marine riser where the flow rate is essentially unaffected by the pumping action of the telescoping joint.

Another object is to provide such a method and apparatus wherein only a small representative portion of the mud flow is measured externally of the marine riser so as to not obstruct the mud flow.

These and other objects and advantages of the present invention will be apparent from the following drawings, specifications and claims. In the accompanying drawings in which like numerals indicate like parts:

FIG. 1 is a somewhat diagrammatic representation in elevation and partly in section of a floating drill ship engaging in offshore drilling operations with the typical marine riser including a telescoping joint extending from the drill ship to the ocean floor;

FIG. 2 is a view similar to FIG. 1, showing the desired placement of mud flow measuring apparatus according to the present invention; and

FIG. 3 is a view similar to FIG. 1, and showing an alternative placement of the mud flow measuring apparatus externally to the marine riser.

Referring now to FIG. 1, there is shown a floating drill ship 10 on a body of water 12 engaged in drilling a well bore in the ocean floor 14. The ship 10 mounts on its deck a derrick 16 which includes a drawworks and other usual apparatus for conducting drilling oper-

ations. Extending between the ship and ocean floor is a marine riser indicated generally at 18 which includes at its lower end the usual blowout preventer apparatus 20, and at its upper end telescoping joint 22. Telescoping joint 22 includes an upper cylindrical portion 24 of reduced diameter which is mounted from and movable with the ship 10, and a lower cylindrical portion 26 which remains stationary with respect to the ocean floor. Upper section 24 telescopes into the bore of lower section 26, and seal 28 seals between the outer diameter of section 24 and the inside diameter of section 26.

Drilling operations are conducted through the bore of the marine riser 18 with drill stem 30 extending from the drawworks of derrick 16, down through the riser 18, and terminating in the usual drill collars and drill bit (not shown). In the customary fashion, drilling mud for flushing out dirt and rock chips as the well is drilled is circulated down through the drill stem 30 and returns to the ship through the annulus 32 between the outer diameter of drill stem 30 and the inside diameter of marine riser 18.

It is desirable to monitor the flow rate of drilling mud returned to the ship 10, since any sudden change in the flow rate may indicate an impending blowout or other problem which requires immediate closing of the blowout preventer 20, or other action to protect the well as well as the ship and its personnel. However, when drilling with the apparatus shown in FIG. 1, monitoring of the mud flow rate as it returns to the ship is made unreliable by the pumping action of telescoping joint 22. As the ship 10 heaves up and down with respect to the ocean floor responsive to wave action, the effective volume of annulus 32 through which the mud is flowing undergoes concomitant changes due to the extension and retraction of telescoping joint 22. This results in alternate surges and drops in the mud flow return rate as observed from the ship 10 which mask the true or steady state flow rate, and make it difficult or impossible to spot a change indicating an impending blowout in sufficient time to take necessary preventive action.

Referring now to FIG. 2, there is shown an apparatus according to the present invention which overcomes this problem. It is the discovery of the present invention that the steady state or true mud flow rate can be monitored by measuring the flow at a point below the telescoping joint 22 where the flow rate is essentially unaffected by the pumping action of the telescoping joint. Thus, suitable flow measuring means may be inserted in the marine riser at a point below the telescoping joint, as indicated diagrammatically by flow sensor 34. Virtually any type of suitable flow sensor may be utilized and may measure either volumetric flow through the annulus 32, or linear velocity of the mud.

Means are provided for transmitting the measurements made by the flow sensor to the drill ship. These transmitting means are indicated diagrammatically by wire 36 extending from the flow sensor 34 to suitable display means 38 on the drill ship. The display means 38 receive the transmitted measurements made by the flow sensor and display them in some intelligible form, such as print-out, a meter, gage, etc. While an electrical connection is shown between the flow sensor 34 and display means 38, other means of transmission may of course be employed, such as, for example, a flexible cable connection between the flow sensor 34 and dis-

play means 38, sonor transmission through the water or seismic vibrations transmitted through the marine riser itself to the ship.

It is preferable that the flow sensor 34 be of a type which presents little obstruction to the mud flow path. If it is desired to use a type of flow sensor which does obstruct flow, it is preferable that the flow sensor be mounted externally to the marine riser 18 as in a bypass line 40, illustrated in FIG. 3. With this arrangement, only a small but representative portion of the entire mud flow would be monitored as it flows through the bypass line 40 and flow sensor 34.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A method for monitoring the steady state mud flow return rate in a marine riser extending between the ocean floor and a drill ship and including a telescoping joint, said method comprising:
 - measuring the mud flow at a point below the telescoping joint where the mud flow rate is essentially unaffected by the pumping action of said telescopic joint, and
 - transmitting said measurements to said drill ship.
2. The method according to claim 1 wherein the mud flow rate is measured in the annulus of said marine riser.
3. The method according to claim 1 wherein a representative portion of said mud flow is measured externally of said marine riser.
4. An apparatus for monitoring mud flow return rate in a marine riser extending between the ocean floor and a floating drill ship and including a telescoping joint,

said apparatus comprising:

means for measuring the mud flow in said riser at a point below said telescoping joint where the mud flow rate is essentially unaffected by the pumping action of said telescoping joint,

means for transmitting the measurements made by said measuring means to said drill ship, and

means on said drill ship for receiving and displaying said transmitted measurements.

5. The apparatus according to claim 4 wherein said measuring means comprises a flow sensor placed in the annulus of said marine riser.

6. The apparatus according to claim 4 wherein said measuring means comprises a flow sensor placed in a bypass line connected to said marine riser for measuring only a representative portion of said mud flow in said marine riser.

7. An apparatus for monitoring mud flow return rate during offshore drilling operations comprising:

a floating drill ship;

a marine riser extending from said ship to the ocean floor and including,

a telescoping joint in said marine riser to accommodate vertical movements of said drill ship with respect to the ocean floor, and

mud flow measuring means positioned in said marine riser at a point below said telescoping joint;

means for transmitting the measurements made by said measuring means to said drill ship; and

means on said drill ship for receiving and displaying said transmitted measurements.

8. The apparatus according to claim 7 wherein said mud flow measuring means comprise flow sensor apparatus mounted in a bypass line externally of said marine riser for measuring only a portion of the mud flow.

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