Oct. 25, 1932. E. WHINNEN 1,884,940

DRILL ROD VALVE MECHANISM

Filed Jan. 17, 1931

Fig. 1.

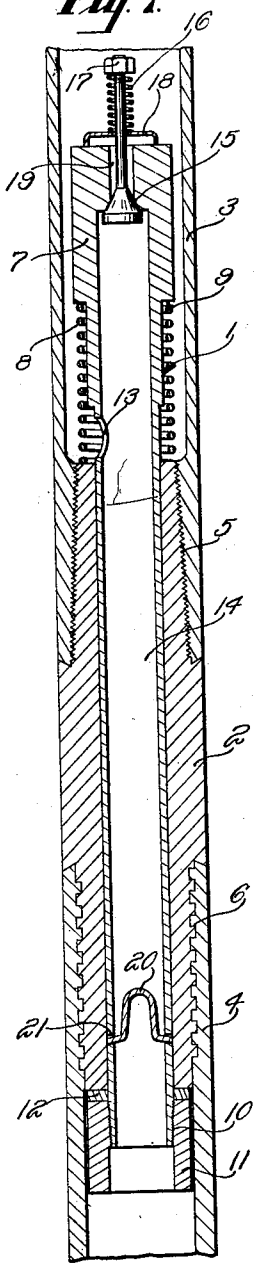


Fig. 2.

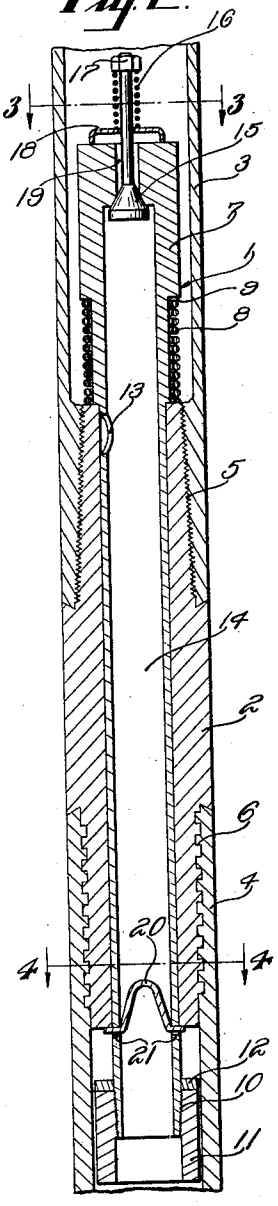


Fig. 3.

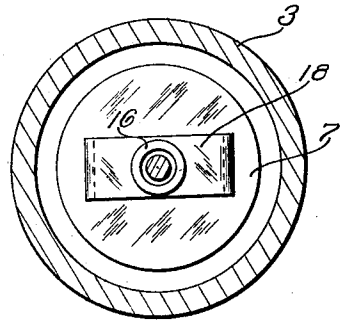
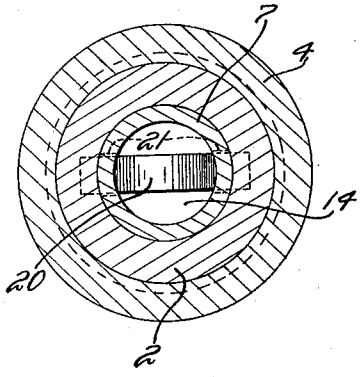


Fig. 4.



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UNITED STATES PATENT OFFICE

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DRILL ROD VALVE MECHANISM

Application filed January 17, 1931. Serial No. 509,412.

This invention relates to drilling apparatus, and more particularly to improvements in a valve mechanism for the drill rods of a drilling apparatus of the oil and gas well type.

An object of this invention is to provide an improved valve mechanism for a drill rod. Another object is to provide an improved check valve for a drill rod whereby fluid flow through the rod is controlled. A further object is to provide an improved valve mechanism that can be set, before it is run into the hole, so that fluid may pass in either direction, and which may, at will, be repositioned irrespective of its position in the hole to preclude passage of fluid except in the downward direction. Still another object is to provide an improved check valve for a drill rod whereby the valve parts may be locked in position against the pressure of the gas in the hole when the rod is raised from the hole, thereby preventing the flow of oil or gas upwardly through the drill rod during hoisting of the rod. Yet another object is to provide an improved valve mechanism for a drill rod wherein the valve may remain open during the lowering of the rod in the hole and may be closed when the rod is positioned at the bottom of the hole. These and other objects and advantages of the invention will, however, subsequently more fully appear.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In this drawing,—

Fig. 1 is a longitudinal section through the illustrative form of the improved valve mechanism;

Fig. 2 is a view similar to Fig. 1 showing the parts in a different position;

Fig. 3 is a transverse section taken on line 3—3 of Fig. 2; and

Fig. 4 is a transverse section taken on line 4—4 of Fig. 2.

In this illustrative construction the improved valve mechanism, generally designated 1, is shown supported by a coupling 2 connecting rod sections 3 and 4 of a drill rod. The rod section 3 is threadedly connected at 5 to the coupling 2, while the rod section 4 is threadedly connected to the coupling at 6. In the present form of construction the improved valve mechanism 1 is arranged adjacent the lower end of the rod line for purposes to be hereinafter mentioned.

Now referring to the improved valve mechanism 1 in detail, it will be observed that supported for sliding by the bore of the coupling 2 is a tubular plunger 7 normally held in its raised position by a coil spring 8 encircling the body of the plunger and interposed between the upper end of the coupling 2 and a shoulder 9 at the upper end of the plunger. Threadedly connected at 10 to the lower end of the plunger is a stop collar 11, while interposed between the lower end of the coupling and this stop collar and surrounding the plunger, is a washer 12. The walls of the plunger 7 are perforated adjacent the upper end of the coupling 2 by a port 13 as shown in Fig. 1. Extending centrally through the plunger is a longitudinal passage 14, and fluid flow through this passage is controlled, when port 13 is closed, by an automatic check valve 15 normally held in closed position by a coiled spring 16 herein acting between a nut 17 threaded at the upper end of the valve stem and a bridge member 18 spanning the upper relatively restricted end 19 of the passage 14. Carried within the plunger 7 adjacent the lower end thereof is a flat transversely flexed spring 20 having its ends guided in apertures 21 formed in the walls of the plunger as shown in Fig. 1. When the parts are in the position shown in Fig. 2, that is when the vent port 13 is closed, the ends of this spring 20 are adapted to spring outwardly to underlie the lower end of the coupling thereby locking the vent port 13 in its closed position. It will thus be seen that the check valve 15 is adapted to control the flow of fluid through the longitudinal passage 14 in the valve plunger 7 and that the vent port 13 controls the flow of fluid through the rod section 3 downwardly through the longitudinal passage in the plunger as hereinafter described.

The method of closing the vent port 13 consists of operating the fluid circulation

pump connected to the upper end of the drill rod and pumping oil under high pressure downwardly through the rod, at nearer than normally to its full capacity so as to force as great a volume of oil under as high a pressure as possible downwardly through the rod. This high oil pressure acts on the plunger 7 overcoming the pressure of the gas and forcing the plunger downwardly against the upper end of the coupling 2 thereby moving the vent port 13 to its closed position within the coupling, as shown in Fig. 2, cutting off the flow of fluid therethrough. The plunger 7 is locked automatically in its closed position, as shown in Fig. 2, by the spring 20 the ends of which, when the parts assume the position shown, move outwardly to underlie the bottom of the coupling 2 thereby forming a positive lock for the parts.

When the parts are in the position shown in Fig. 2, and the rod is full of oil, any attempt to pull the rod line out of the hole without first allowing the oil to escape from the rod would result in what is called a "wet pull", and the oil would be sprayed all over the derrick every time a rod joint is uncoupled at the ground surface of the well. To overcome this undersirable feature as far as possible, the check valve 15 is provided to permit the flow of oil from the drill rod downwardly past the valve mechanism 1. If the well is making high pressure gas the gas attempts to flow upwardly through the rod but is prevented from doing so by the automatic check valve 15, so it is possible to raise the rod from the hole without any oil or gas escaping upwardly through the rod.

The improved drill rod valve mechanism 1 is particularly useful in conjunction with mechanism for cleaning the débris from the bottom of the hole. During this hole cleaning operation the valve mechanism 1 is attached in the rod line immediately above a sediment trap or débris collecting device of a well known form. When the rod is lowered into the hole, the inlet opening of the sediment trap is closed by a frangible closure member, for instance a glass cap, so that gas is prevented from entering the sediment trap and blowing up through the rod and flowing out on the derrick floor or up in the derrick. During the lowering of the rod in the hole the valve mechanism 1 is held open by the spring 8. When reaching the bottom of the hole, the frangible closure member is broken by impact with the hole bottom thus opening the inlet of the sediment trap. It will be understood that when the frangible closure member above referred to is broken the sediment trap is at the bottom of the hole so that there is no danger of damage being done by gas flowing upwardly through the rod, for the gas then flows up through the sediment trap, past the valve mechanism 1, through the rod and out through the fluid circulation hose in the manner well understood in the art. This flow of gas is not sufficient to pick up the débris at the bottom of the hole and carry it into the sediment trap, so fluid under pressure, as for instance oil, is then pumped down the well outside the drill rod so that after a sufficient quantity of oil has been pumped down the hole to practically fill it, the oil begins to flow up through the sediment trap, rod valve and rod, and fluid circulation hose and is conducted back to the oil sump. This circulation of oil picks up the débris in the bottom of the hole and carries it into the sediment trap. The drill rod is now ready to be withdrawn from the hole so that the sediment trap may be detached from the rod and the débris may be removed therefrom, so it is now desired to prevent further flow of oil and gas upward through the sediment trap, rod valve, and rod. The vent port 13 of the valve mechanism is then closed by pumping circulation down through the rod, in the ordinary way, and the rod withdrawn from the hole in the manner above described. These and other uses and advantages of the improved drill rod valve mechanism will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A drill rod valve mechanism comprising a supporting body, a valve controlling fluid flow through the rod including a valve plunger movably mounted in said body and having a fluid passage therethrough, said valve being controlled by the pressure of the fluid controlled thereby, and an automatic check valve carried by said valve plunger for controlling the fluid flow through the passage in said plunger.

2. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism including a valve for controlling fluid flow through the rod and controlled by the pressure of the circulation fluid, and a supplemental valve for controlling fluid flow through the rod when said first mentioned valve is closed.

3. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism including a valve for controlling fluid flow through said rod and controlled by the pressure of the circulation fluid, and an automatic check valve for permitting fluid flow through the rod in one direction when said

first mentioned valve is closed and preventing automatically fluid flow in the opposite direction.

4. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism including a movable valve element for permitting upward fluid flow through said rod and controlled by the pressure of the circulation fluid, and a supplemental valve carried by said valve element for permitting downward fluid flow past said valve element when the latter is in its closed position.

5. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism including a movable valve element for controlling fluid flow through said rod and controlled by the pressure of the circulation fluid, and an automatic check valve carried by said valve element for permitting flow of fluid past said valve element in one direction when the latter is in its closed position and preventing automatically flow of fluid past said valve element in the opposite direction.

6. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism carried by said drill rod within the latter and including a closable valve element for controlling fluid flow through the rod and controlled by the pressure of the circulation fluid, and a supplemental valve for controlling fluid flow past said valve element when the latter is in its closed position.

7. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism carried by said drill rod within the latter and including a reciprocable valve element for controlling fluid flow through the rod and controlled by the pressure of the circulation fluid, and an automatic check valve for controlling fluid flow past said valve element in one direction when the latter is in its closed position and for preventing automatically fluid flow past said valve element in the opposite direction.

8. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism carried by said drill rod within the latter and including a reciprocable valve element for controlling fluid flow through the rod and controlled by the pressure of the circulation fluid, and a supplemental valve carried by said reciprocable valve element for controlling fluid flow past said valve element when the latter is in its closed position.

9. The combination with a drill rod through which fluid is adapted to be circulated under pressure, of a valve mechanism carried by said drill rod within the latter and including a reciprocable valve element for controlling fluid flow through the rod and controlled by the pressure of the circulation fluid, and an automatic check valve carried by said reciprocable valve element for controlling fluid flow past said valve element in one direction when the latter is in its closed position and for preventing automatically fluid flow past said valve element in the opposite direction.

10. The combination with a drill rod comprising rod sections and a coupling member connecting said rod sections, of a valve mechanism including a hollow sleeve valve mounted in said coupling member for controlling fluid flow through the rod and closable to prevent fluid flow upwardly through the rod, said valve having passage means for conducting fluid therethrough.

11. The combination with a drill rod comprising rod sections and a coupling connecting said rod sections, of a valve mechanism mounted within the said coupling and including a valve element for controlling fluid flow through the rod and an automatic check valve for permitting flow through the rod in one direction when said first mentioned valve is closed and preventing automatically fluid flow through the rod in the opposite direction.

12. The combination with a drill rod through which fluid under pressure is adapted to be circulated, and comprising rod sections and a coupling connecting said rod sections, of a valve mechanism slidably mounted within said coupling for controlling fluid flow through the rod and controlled by the pressure of the circulation fluid and automatically closable to prevent fluid flow upwardly through the rod, said valve mechanism including a tubular valve element through which the fluid may flow.

13. A drill rod valve mechanism for controlling fluid flow through a drill rod and openable to permit fluid flow in either direction through the rod and closable at will irrespective of the position of the valve mechanism in the drill hole, and means for automatically locking said valve mechanism in its closed position.

14. In a drill rod valve mechanism, a valve openable to permit fluid flow in either direction through a drill rod and closable at will irrespective of the position of the valve mechanism in the drill hole, means for automatically locking said valve in its closed position, and an automatic check valve for permitting flow of fluid in a downward direction through the rod but preventing automatically fluid flow in an upward direction through the rod.

15. In a drill rod valve mechanism, a valve for permitting fluid flow through a drill rod in either direction and closable by the pressure of the fluid in the rod, means for automatically locking said valve in its closed position,

and a valve for permitting flow of fluid through the rod in only the downward direction when said first mentioned valve is closed.

16. In a drill rod valve mechanism, a valve for permitting fluid flow through a drill rod in either direction and closable by the pressure of the fluid in the rod, means for automatically locking said valve in its closed position, and a valve for permitting flow of fluid through the rod in only the downward direction when said first mentioned valve is closed and automatically closable by the pressure of the fluid in the rod to prevent fluid flow upwardly through the rod.

In testimony whereof I affix my signature.

EUGENE WHINNEN.