R. E. LEONARD.

PROCESS OF AND APPARATUS FOR DRILLING OIL WELLS.

APPLICATION FILED MAR. 9, 1920.

1,400,962. Patented Dec. 20, 1921.

Fig. 1.

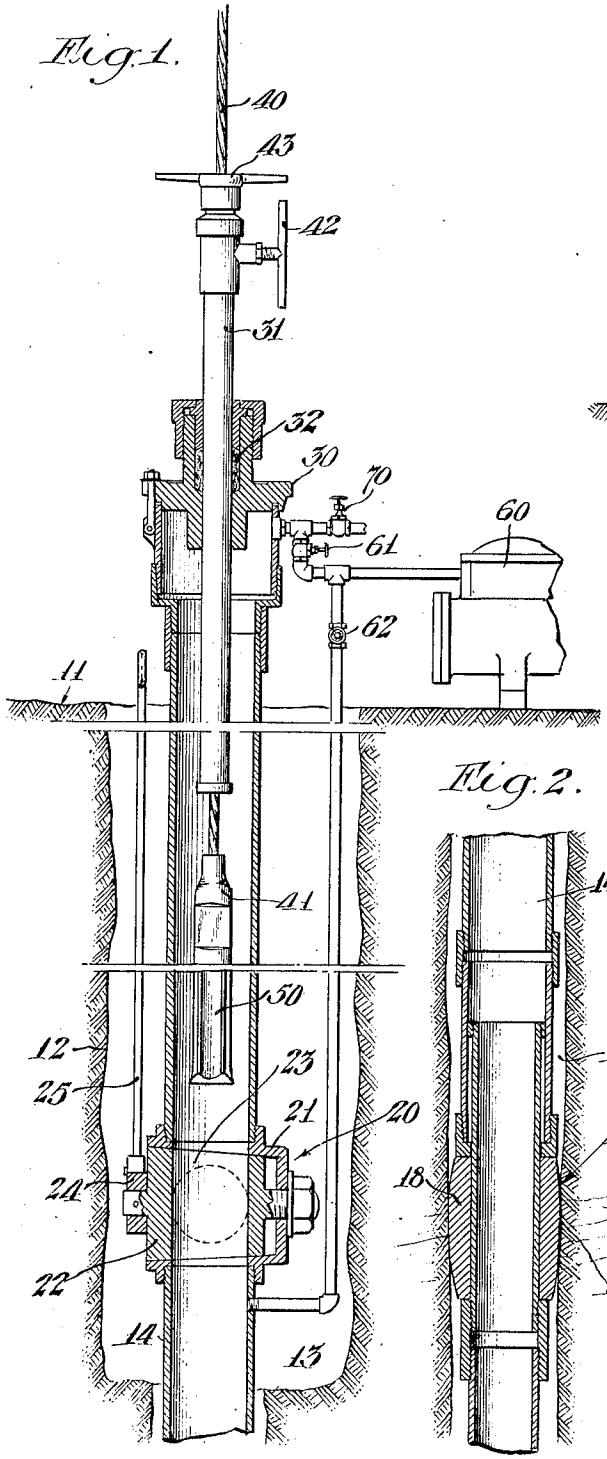
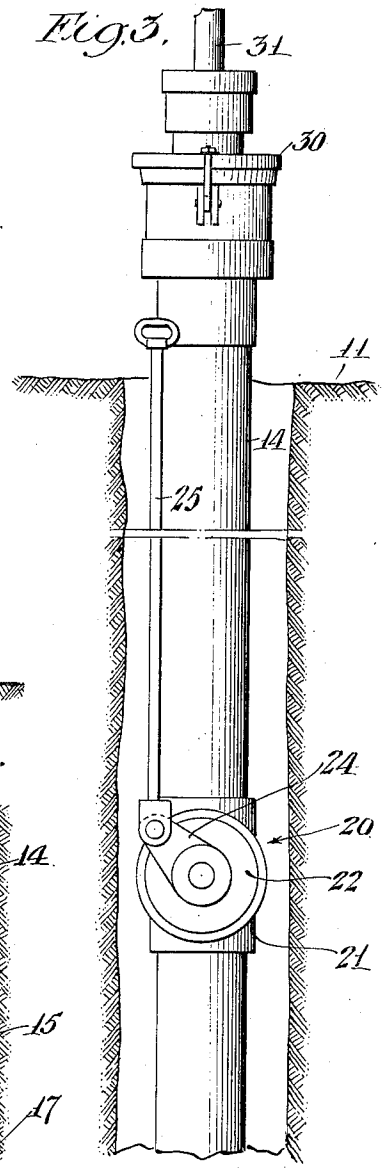


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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PROCESS OF AND APPARATUS FOR DRILLING OIL-WELLS.

1,400,962. Specification of Letters Patent. Patented Dec. 20, 1921.

Application filed March 9, 1920. Serial No. 364,748.

To all whom it may concern:

Be it known that I, ROY E. LEONARD, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Process of and Apparatus for Drilling Oil-Wells, of which the following is a specification.

My invention relates to the drilling of oil wells, and the principal object of the invention is to provide a process and apparatus which will be superior in many particulars to the present methods of producing oil wells. There are in use in the United States two general methods of drilling which are commonly known as the standard and the rotary system.

In the standard system, a cutting bit is moved up and down in the well breaking away the bottom of the hole by impact.

In the rotary system a string of drill pipe is turned in the well carrying a bit at its lower end which cuts or abrades the bottom of the hole.

The standard system of drilling is particularly adapted to operations in hard rock which will stand up without casing and which offers a great resistance to the bit.

The rotary system is particularly adapted to soft formations. These formations, however, have a great tendency to cave and fill the hole and it is the regular practice in rotary drilling to maintain a supply of mud laden fluid in the well. This mud is forced by hydrostatic pressure back into the softer sands, gravel and rocks encountered in drilling and serves to support and consolidate in a wall of the well. It is, however, circulated for the purpose of removing the cuttings of the bit; the mud laden fluid passing downwardly through the drill pipe and passing upwardly outside and around the drill pipe to the surface of the ground where the cuttings or particles of rock are settled out and the heavy mud is re-circulated through the drill pipe to the bottom of the well.

The principal object of my invention is to provide a method of drilling which will combine the advantages of both systems, a reciprocating bit being used in connection with mud laden fluid. In my system, however, the mud laden fluid is not circulated and it is not depended on to remove the cuttings.

My system has the further great advantage that pressures may be used inside the well which are greatly in excess of the natural pressures produced by the hydrostatic head of the mud laden fluid standing in the well as when the rotary system is employed.

Further objects and advantages will be made evident hereinafter.

Referring to the drawing which is for illustrative purposes only, Figure 1 is a view of the upper portion of the well equipped with my invention, a portion of the apparatus used being shown in section to better illustrate the invention.

Fig. 2 is a view of the lower portion of the well.

Fig. 3 is a side elevation at right angles to Fig. 1.

In the embodiment of my invention shown, 11 is the surface of the ground and 12 is a pit or enlarged opening extending down to a point 13. Situated in the pit 12 is a casing 14, this casing extending downwardly from the pit 12 into the well 15 which forms an extension thereof. At some convenient point well below the surface of the ground, the driller selects a "shell" or a hard formation 16 and sets a packer 17 therein. This packer is standard in the art and consists of a body of soft rubber fibrous or plastic matter or metal 18 which is expanded and forced outwardly to make a gas tight joint between the casing 14, and the walls of the well 15. Many devices capable of producing this result are standard in the art and can be readily purchased and the particular construction employed will therefore not be described herein. In some cases the casing 14 may be secured by cement in the formation 16.

Secured in the casing 14, near the bottom of the pit 12 is a cock 20 which consists of a body 21 having a tapered plug 22 turned therein. This plug fits tightly in the body 21 and has a cylindrical opening 23 which is the same diameter as the inside of the casing 14. Fastened to the plug 22 is a lever 24 which may be operated through a rod 25 from a point above the surface 11 of the ground. By pushing downwardly on the rod 25 as shown in Fig. 3, the plug 22 may be rotated through an angle of ninety degrees, which will cause the opening in the plug 22 to extend crosswise of the casing 14 and completely shut off communication above and below the same. Secured on the top of the casing 14 is a head 30, this head being re-

movable for purposes which will hereinafter be described. Sliding in the head 30 is a plunger 31, a stuffing box 32 being provided in the head 30 around the plunger 31, to make a gas tight joint therewith. Passing through the center of the plunger 31 is a wire line 40 which is secured at its lower end in a rope socket 41. The wire line 40 is clamped solidly in the plunger 31 by a screw 42 and a gas tight joint is made there around by means of a suitable gland compressed by a gland cap 43. The standard drilling tools are secured to the rope socket 41. These tools consist of jars and auger stem not shown and a cutting bit 50. A mud pump 60 is provided, this pump communicating through a valve 61 with the casing 14 above the cock 20 and through a valve 62 with the casing below that cock. A valve 70 allows the pressure in the casing 14 to be relieved.

The method of operation is as follows:

The well having been drilled by standard methods to a point below the formation 16, the packer is set in that formation making a gas tight joint between the formation 16 and the casing 14, the parts then being assembled as shown on Fig. 1. The pump 60 is then started pumping water, oil or preferably mud laden fluid into the well. This mud laden fluid preferably consists of a heavy clay mixed to a creamy consistency with water. This fluid is forced downwardly into the well by the pump 60 which is capable of exerting a pressure of from 500 to 1000 pounds to the square inch and is allowed to pump until it builds up to a predetermined pressure. This pressure is, of course, greatly in excess of the pressure which would be produced by merely allowing the mud to stand in the well. As a result the mud is forced out into the formation tending to cement it up and to compact and to consolidate it. This pressure also prevents oil, water or gas from blowing into the well unless the pressures of such oil, water or gas are in excess of the pressure which can be pumped up by the pump 60. Pressure having been built up on the well, the bit is reciprocated by means of the cable 40 which is attached through a temper screw, not shown, to the walking beam of the well in accordance with standard practice. The bit strikes the bottom of the hole cutting it away. The purpose of the plunger 31 is to provide means by which the bit may be reciprocated without releasing the pressure on the well. The plunger slides up and down in the stuffing box 32 which prevents pressure from relieving itself around the plunger 31, the rope 40 and the plunger 31 being made tight by means of the gland cap 43.

If it is desired to withdraw the tools from the well, the clamp 42 and the gland 43 are slightly released so that the tools can be drawn upwardly, the wire line 40 sliding inside the plunger 31 which is stationary. The cock 20 is placed sufficiently low in the well so that the string of tools attached to the rope socket 41 may be pulled up into the space above this cock, which is then closed. The closing of this cock holds the pressure below this point, the valve 62 being opened the valve 61 may then be closed and the pressure allowed to relieve itself through the valve 70 which is then opened. When the space inside the casing 14 and above the cock 20 is at atmospheric pressure, the head 30 may be released from the top of the casing and the rope socket 41 and its attached tools may be withdrawn from the well. During this time, however, pressure is maintained on the well and the formations surrounding it so that there is no tendency for gas, oil or water to rush into the well.

If desired, a standard type of bailer may be secured to the socket 41 which is replaced in the well, the head 30 being again secured. Pressure can then be built up in the upper part of the casing by closing the valve 70 and opening the valve 61. As soon as this is accomplished, the cock 20 may be opened through the rod 25 and the bailer can be dropped to the bottom of the well for the purpose of removing the cuttings.

It will be noted that my invention provides means by which pressures may be maintained inside an oil well during the entire time that the drilling operation is being carried on, these pressures being very considerable in excess of the pressures which would be due to the hydrostatic head of fluid standing in the well.

I claim as my invention:

1. A process of drilling oil wells which comprises continuously maintaining a pressure in excess of the hydrostatic pressure produced by a body of fluid filling the well without circulation on the well and reciprocating a cutting bit in the well.

2. A process of drilling oil wells which comprises continuously maintaining a pressure in excess of the hydrostatic pressure produced by a body of fluid filling the well without circulation on the well and operating a cutting bit in the well.

3. An apparatus for drilling oil wells comprising a casing passing through formation above the oil sands; means for making a gas tight joint between said casing and said formation; means for closing the top of said casing; and means for continuously maintaining a fluid pressure in excess of the hydrostatic pressure produced by a body of fluid filling the well inside said casing.

4. An apparatus for drilling oil wells comprising a casing passing through formation above the oil sands; means for making a gas tight joint between said casing and said formation; a wire line extending down-

wardly into said casing; means for making a gas tight sliding joint between said wire line and the top of said casing; and means for continuously maintaining a fluid pressure in excess of the hydrostatic pressure produced by a body of fluid filling the well inside said casing.

5. An apparatus for drilling oil wells comprising a casing passing through formation above the oil sands; means for making a gas tight joint between said casing and said formation; a wire line extending downwardly into said casing; means for making a gas tight sliding joint between said wire line and the top of said casing; tools attached to said wire line; a cock in said casing through which said tools may pass; means for closing said cock after said tools are withdrawn therethrough; and means for continuously maintaining a fluid pressure in excess of the hydrostatic pressure produced by a body of fluid filling the well on said casing below said cock.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 4th day of March 1920.

ROY E. LEONARD.