April 8, 1930. C. JACOBSEN 1,753,930

APPARATUS FOR PUMPING DEEP WELLS

Filed July 5, 1928

Fig. 1.

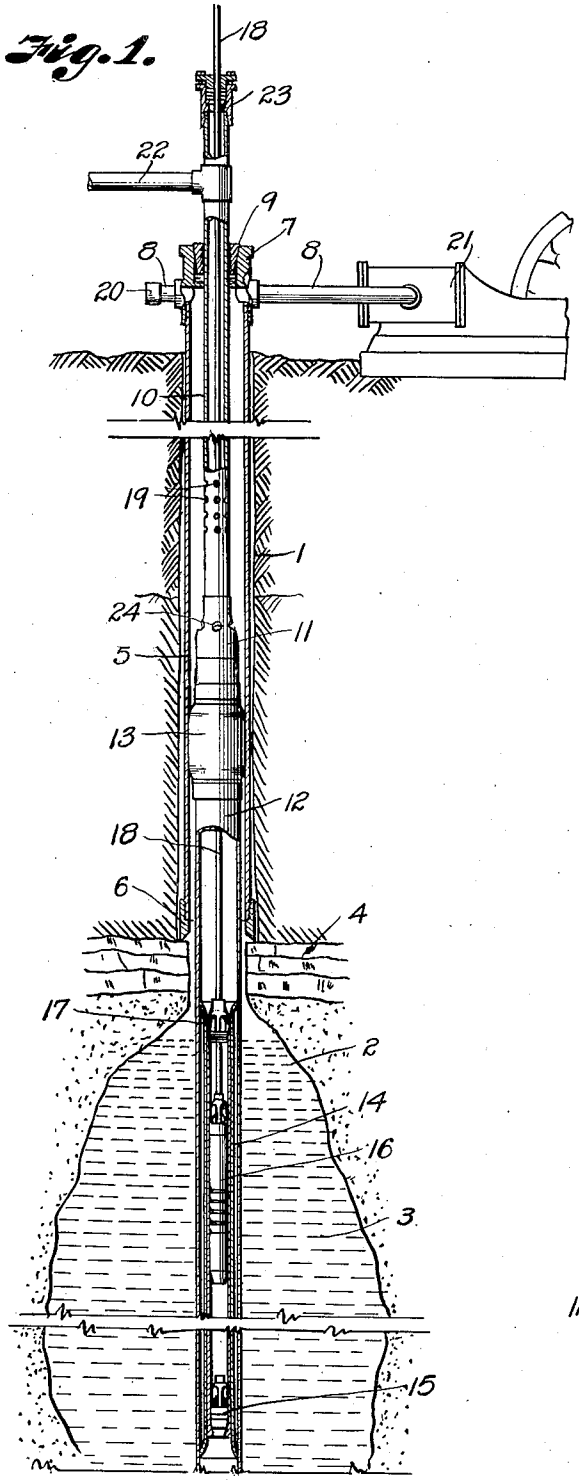
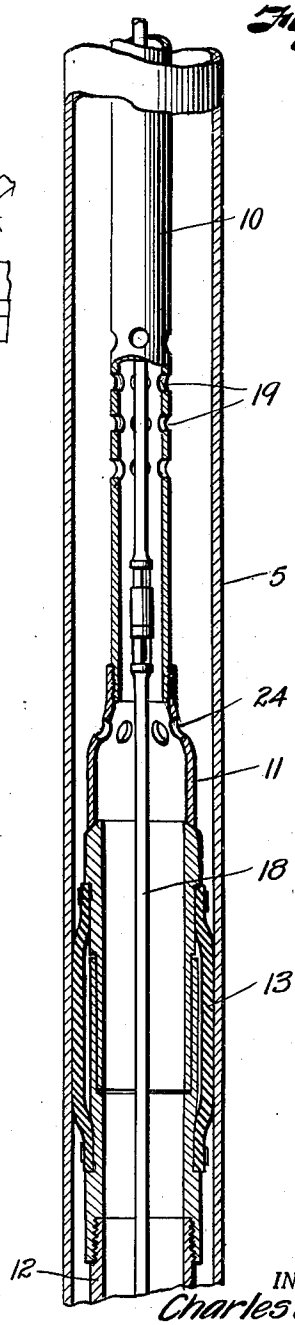


Fig. 2.



INVENTOR.
Charles Jacobsen
BY Arthur C. Brown
ATTORNEY

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UNITED STATES PATENT OFFICE

CHARLES JACOBSEN, OF TULSA, OKLAHOMA

APPARATUS FOR PUMPING DEEP WELLS

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My invention relates to an apparatus for pumping wells and more particularly deep oil wells.

In pumping wells of this type according to common practice a plunger barrel is located at the bottom of the well and operated by sucker rods running from the power at the top of the well to the plunger in the barrel to lift the oil through the well. The great weight of the sucker rods combined with static load of the fluid causes breakage of the rods, resulting in loss of production due to the time required for repairs and replacement of rods. Air and gas have been employed for lifting the fluid from the wells, but in many instances high pressure of the lifting medium causes a back pressure in the sands, interfering with flow of oil to the well.

It is the object of my invention to overcome the disadvantages of both methods of producing the oil, by combining a mechanical pump with a gas or air lift, and in accomplishing this object I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a vertical section of an oil well equipped with my improved pumping apparatus and adapted for employing my method.

Fig. 2 is an enlarged longitudinal section of a portion of the apparatus, particularly illustrating the connection between the tubing and liner and the tubing intake ports.

Referring in detail to the drawings:

1 designates a well hole terminating in the usual shot hole 2 which may be extended into a pocket 3 and is overlaid by cap rock 4. Extending through the well hole, or part thereof, is the usual casing 5 resting on a shoe 6 supported by the cap rock. Supported on the casing at the top of the well is the usual casing-head 7 having flow lines 8. Extending through the casing-head 7 and a combination stuffing box and spider 9 therein and through the casing 5 to near the bottom of the well is tubing 10, terminating preferably in an outwardly swedged lower end 11.

Located in the casing immediately below the tubing and extending beyond the casing to the bottom of the well is a liner 12, and interposed between the upper end of the liner and the casing is a packer 13 for separating the annular space between the casing and liner into upper and lower portions and adapted for preventing flow of fluid or pressure medium through said annular space at this point.

Located in the bottom of the liner and preferably swedged thereto at its upper and lower ends is a pump barrel 14 having a standing valve 15 at its lower end, and provided with a plunger 16 in accordance with common practice. Connected with the plunger and extended through a guide 17 at the top of the barrel is a sucker rod 18 which extends up through the liner and through the tubing to the top of the well, where it may be connected with any suitable operating mechanism for reciprocating the rod.

Located in the tubing at a sufficient height in the well to avoid submergence are ports 19 providing communication between the tubing and the annular space between the tubing and casing, for admitting air or gas delivered to said annular space into the tubing for lifting fluid through the tubing, as will presently be described. The air or gas is admitted to such annular space through one or both of the flow lines 8 in the casing-head 7, which, in the practice of my invention, become pressure lines as distinguished from flow lines. If but one of the flow lines is to be employed for supplying pressure medium, the other flow line may be plugged as indicated by the cap 20. The pressure medium may be supplied from a compressor or other source of supply indicated at 21.

Leading from the tubing above the casing-head is a flow line 22, and located on the top of the tubing is a high pressure stuffing box 23 through which the sucker rod is extended.

I prefer to provide the tubing near the liner with ports 24 through which fluid may pass into the annular space about the tubing upon initial operation of the apparatus, to provide a fluid seal in said space below the air or gas ports 19 and to initially relieve the pump of static load of the fluid.

In using the method and apparatus, as-

suming that the well is cased as described, the liner with its pumping barrel is let into the well and packed from the casing near the bottom of the well. The tubing is then let into the well to rest on the top of the liner, a part of the weight of the tubing being carried by the spider in the casing-head, but a sufficient part of the weight of the tubing being applied to the liner above the packer to anchor the liner and prevent its vertical movement, and preventing the packer from slipping during the pumping operation.

The pump plunger is then let through the tubing on the sucker rods. With the parts so assembled the pump is operated in the usual manner and simultaneously with the pump operation, air or gas is delivered through the annular space about the tubing with sufficient pressure to lift the head of oil in the tubing above the ports 19. Oil pumped by the plunger is lifted through the liner and lower portion of the tubing until it reaches the ports 19. At this point, pressure of the air or gas admitted through the ports is applied to the oil and lifts the same through the remaining height of the well and delivers it through the outlet 22 at the top of the well.

By combining the mechanical and pressure flows as described, I relieve the sucker rods of the static head of the fluid throughout the greater depth of the well and thereby avoid breakage of the rods which would necessarily occur if they were required to lift the entire load.

By employing the plunger pump in connection with the pressure medium, I also obviate back pressure of said medium in the well, as the liquid seal and back check valves in the pump, as well as the packer in the liner, prevent flow of the pressure medium into the well hole.

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

Apparatus for pumping deep wells including in combination with well casing, a liner in said casing and extending therefrom into the well hole, a packer between the liner and the casing, tubing in the casing resting on the liner and having ports above the packer, a standing valve in the liner, a plunger in the barrel above the standing valve, rods connected with the plunger and extended through the tubing, and means for delivering pressure medium to the tubing through the casing and said ports, the tubing having auxiliary ports below said first-named ports for admitting fluid from the barrel to the casing below said first-named ports.

In testimony whereof I affix my signature.

CHARLES JACOBSEN.