June 21, 1932. H. F. WATKINS 1,863,643

OIL WELL PUMP

Filed May 15. 1928

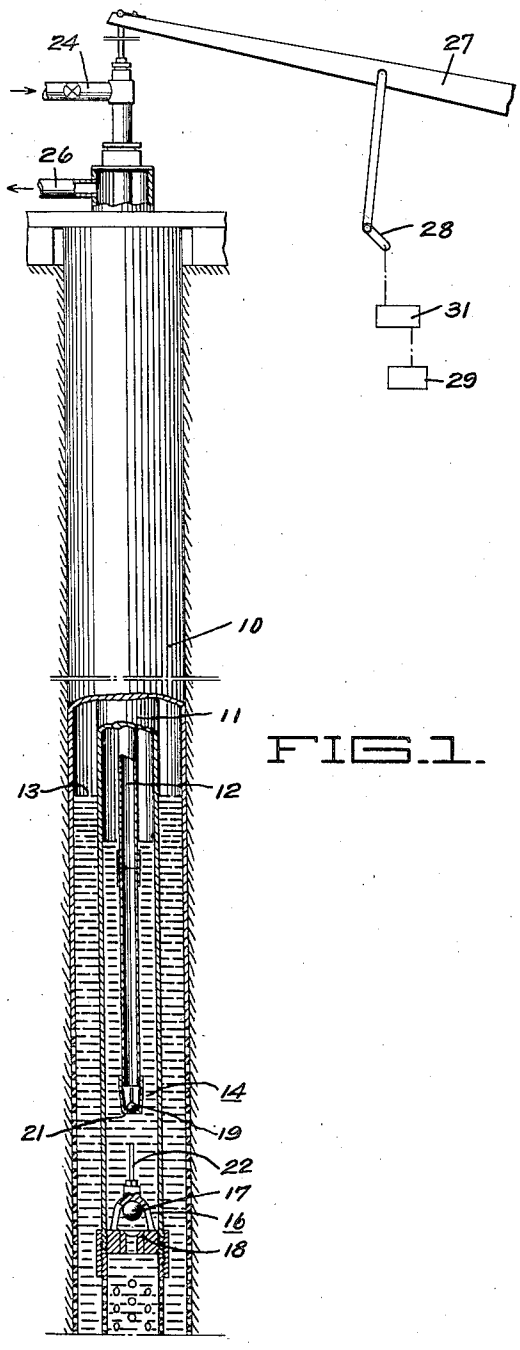


FIG. 1.

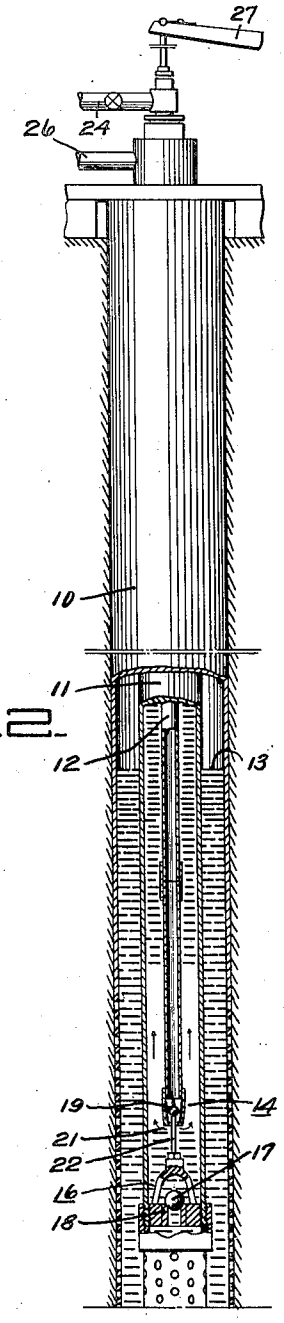


FIG. 2.

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Patented June 21, 1932

1,863,643

UNITED STATES PATENT OFFICE

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OIL WELL PUMP

Application filed May 15, 1928. Serial No. 278,015.

This invention relates generally to the construction of oil well pumping equipment, and to methods of utilizing such apparatus.

It is an object of this invention to devise a simple and reliable pumping apparatus utilizing compressed gas for the formation of pneumatic lifting pistons.

It is a further object of this invention to devise a novel apparatus and method of effecting pumping of oil from an oil well by the use of pneumatic pistons, which will prevent formation of oil emulsions to a practical degree.

Referring to the drawing:

Figure 1 is a side elevational view, partly in cross section illustrating the apparatus of this invention.

Fig. 2 is a view similar to Fig. 1 showing the apparatus in a different operating condition.

The apparatus of this invention is somewhat similar to the device shown in my copending application No. 207,099 filed July 20, 1927. In that application I disclosed an oil well pump utilizing oil and gas pipe strings extending down into the well below the normal oil level. Associated with the lower portion of these pipes there is a pair of valves which are both positively mechanically actuated from the surface of the well. One valve serves to permit inflow of oil from the well while the other valve is in closed position, and the other valve when opened causes the admission of a charge of compressed air when the oil control valve is closed. By introducing gas under sufficient pressure and of a sufficient quantity, I can form substantially intact pneumatic pistons which expand upwardly and discharge a practically solid column of oil. By the use of the apparatus disclosed in said copending application, I have been able to pump oil from a well containing a substantial quantity of water, with practically no emulsification. I believe that this result is due to the fact that the valves are positively operated and are properly timed to secure optimum pumping conditions. While the apparatus disclosed in said copending application is to be preferred for best results, I have found that under certain operating conditions it is possible to secure good results by the use of a positively operated gas control valve in combination with a check valve for controlling inflow of oil. Such an apparatus is disclosed in this application and may be described in detail as follows:

Referring to the drawing, my apparatus has been shown as applied to an oil well 10 and consists of a pair of pipe strings 11 and 12 extended down into the well a substantial distance below the normal oil level, which has been indicated at 13. For reasons which will be presently apparent, I prefer to extend one of the pipes within the other and for this reason pipe 12 has been shown as extended concentric with pipe 11. For controlling communication between pipes 11 and 12, I have shown a positively actuated valve mechanism indicated generally at 14, and for controlling flow of oil from the well into the pipes 11, I have shown a valve 16.

Valve 16 is preferably of the check type and permits flow of the oil from the well into pipe 11, but prevents flow in the opposite direction. A convenient and reliable form of check valve consists of a ball 17 cooperatively associated with a suitable ball seat 18. To form a positively actuated valve 14, I prefer to employ a ball 19 cooperatively associated with a seat 21 secured to the lower end of pipe 12. In order to mechanically open and close valve 14, I have shown an upwardly projecting rod 22 carried by the structure of valve 16 and adapted to engage and unseat the ball 19 when pipe 12 is lowered.

Since I utilize pipe 12 for the admission of compressed gas into the well, the upper portion of this pipe at the surface of the well is connected with a suitable source of gas under pressure, as by means of pipe 24. Likewise the upper portion of pipe 11 is connected to an oil discharge pipe 26. Pipe 12 is vertically reciprocated within the well in order to effect opening and closing movements of valve 14, and for this purpose I have shown suitable mechanism such as a walking beam 27 which is connected to the upper end of pipe 12. Walking beam 27 is oscillated by suitable means such as diagrammatically represented by a crank connection 28, this crank

being driven by a variable speed motor 29 thru suitable speed reduction gearing 31.

When the device is in operation, the relative positions of pipes 11 and 12 is such that during the lower portion of the movement of pipe 12, valve 14 is held open, while for the upper portion of the movement of pipe 12, valve 14 remains closed. Assuming that the apparatus is initially in the position shown in Fig. 1, gas control valve 14 is closed and oil from the well is free to flow into pipe 11 thru check 16 to meet its normal level. When pipe 12 descends during the first half of the stroke, valve 14 remains closed until ball 19 engages rod 22, after which valve 14 is positively opened to cause gas under pressure to flow into the lower portion of pipe 11. The pressure exerted by gas being introduced in the lower portion of pipe 11 immediately causes a back pressure upon the oil sufficient to close the check 16 so that the pneumatic piston formed within the pipe 11 must expand upwardly and force out the oil column above it. When a sufficient amount of gas has been blown into pipe 11, as can be determined by experimentation for any one set of operating conditions, valve 14 is permitted to close by upward movement of pipe 12 and oil from the well can again flow into pipe 11 thru the check valve 16. The timing of the valves 14 and 16 can be varied by changing the speed of motor 29 and the extent of time that valve 14 is open compared to the time valve 16 is closed, can be varied by varying the position of pipe 12. Thus the apparatus may be adjusted to secure optimum pumping operation for any one set of conditions.

I claim:

1. In an oil well pump, an oil pipe string extending into the well below the normal oil level, a gas pipe string extending into the well within the oil pipe, a valve associated with the lower portion of the gas pipe, said valve being normally biased toward closed position, means for effecting opening of said valve upon lowering of said gas pipe, a source of gas under pressure located at the surface of the well and connected to said gas pipe, and means located at the surface of the well for cyclically moving said gas pipe at a rate independent of the gas pressure to effect recurrent opening and closing of said valve, opening of said valve serving to form an upwardly expanding pneumatic piston within the oil pipe.

2. In an oil well pump, concentric oil and gas pipe strings extending into the well, a source of gas under pressure connected with the gas pipe at the surface of the well, a check valve associated with the lower portion of the oil pipe for permitting flow of oil from the well into the oil pipe but to prevent flow in the opposite direction, a valve associated with the gas pipe, said last named valve being normally biased toward closed position, means for effecting opening of said last named valve upon lowering of said gas pipe, and mechanical means located at the surface of the well for vertically reciprocating said gas pipe with cyclic movements independent of the pressure of gas introduced into the well.

3. In an oil well pump, an oil pipe string extending to the well below the normal oil level, a gas pipe string likewise extending into the well and communicating with the oil pipe at its lower end, a valve located at the lower end of the gas pipe, a source of gas under pressure located at the surface of the well and connected with the upper portion of the gas pipe, actuating mechanism located at the surface of the well for cyclically reciprocating said pipe in a vertical direction, means for effecting opening of said valve upon movement of said gas pipe in one direction to permit gas to form an upwardly expanding pneumatic piston and closing of said valve upon movement of said gas pipe in the opposite direction, and a check valve for controlling flow of oil from the well into the oil pipe.

In testimony whereof, I have hereunto set my hand.

HAROLD F. WATKINS.