Dec. 24, 1929. J. OLIPHANT 1,741,069

PUMPING SYSTEM

Filed Aug. 31, 1927

Fig. 1.

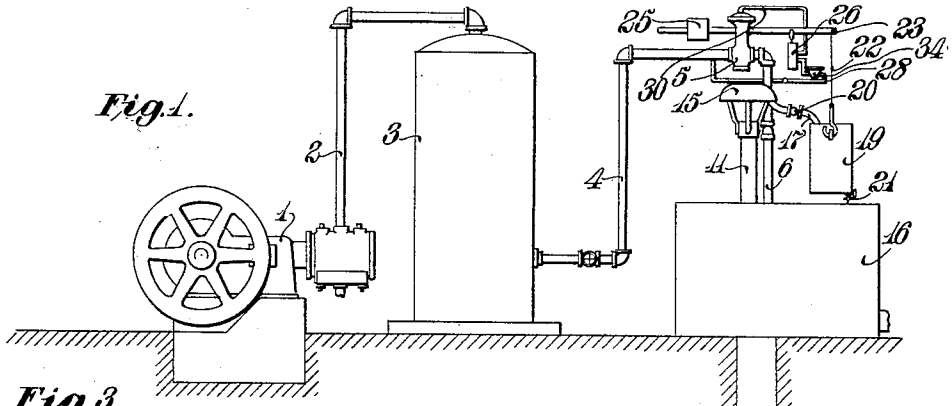


Fig. 3.

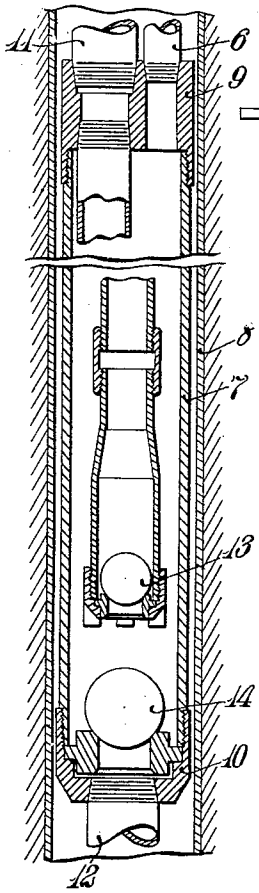


Fig. 2.

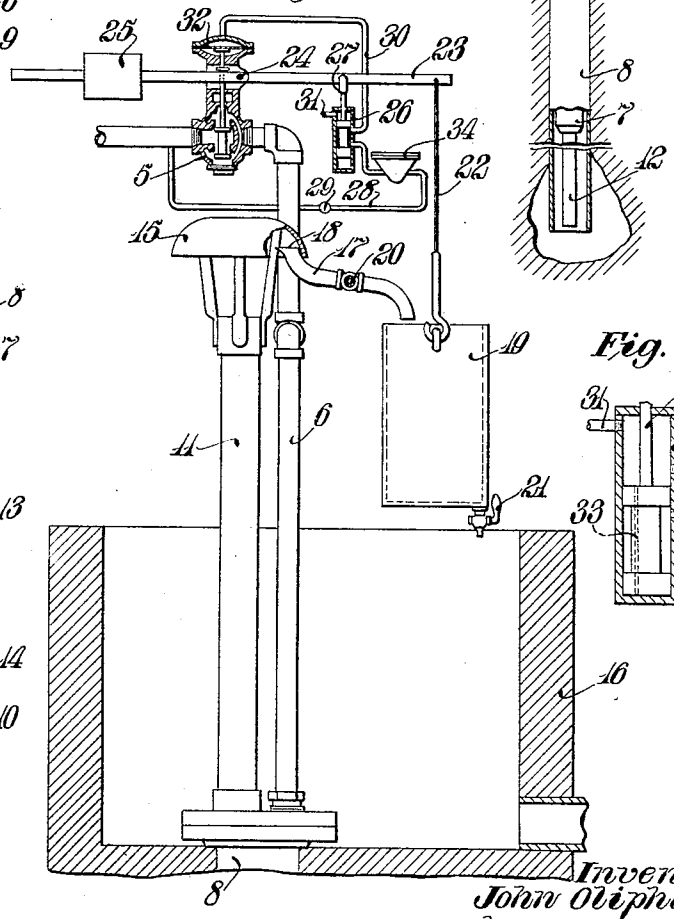
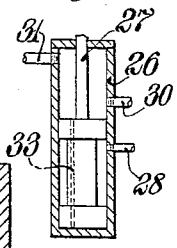


Fig. 4.



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Patented Dec. 24, 1929 1,741,069

UNITED STATES PATENT OFFICE

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PUMPING SYSTEM

Application filed August 31, 1927. Serial No. 216,662.

My invention relates to pumping systems and more particularly to displacement pumps.

An object of my invention is to provide an improved pumping apparatus. Another object is to provide an improved pumping apparatus particularly adapted for use in wells where the available static head is at times insufficient for efficient air lift pump performance. Another object is to provide pumping mechanism which may be operated either as a displacement pump or as an air lift pump. Still another object is to provide improved adjustable automatic controlling mechanism which may be varied to suit different operating conditions. These and other objects and advantages of my invention will, however, subsequently more fully appear.

In the accompanying drawings I have shown for purposes of illustration one form which my invention may assume in practice.

In these drawings,—

Fig. 1 is a diagrammatic view of my improved pumping system.

Fig. 2 is a view, more or less diagrammatic, partly in section and partly in elevation showing my improved control mechanism.

Fig. 3 is a central vertical section through the displacement barrel and associated parts in the well.

Fig. 4 is an enlarged sectional view of the pilot valve in the opposite position from that shown in Fig. 2.

In the illustrative embodiment of my improved pumping system a compressor 1 is shown discharging air or other gas by way of a pipe 2 to a receiver tank 3. A pipe 4 leads off from the receiver tank 3 for conducting compressed fluid past the main valve 5 to a down pipe 6. The valve 5 is actuated to open or closed position by automatic mechanism to be later described. Referring now to Fig. 3 a displacement barrel 7 is shown disposed within a well casing 8, said displacement barrel having top and bottom members 9 and 10 which may be connected thereto by screw threads as shown. In the top member 9 is fitted the air line 6 and the liquid discharging or riser pipe 11, and the bottom member 10 has connected thereto a tail pipe 12. Suitable check valves 13 and 14 herein of the ball and metal seat type permit the liquid to flow into the displacement barrel and to be discharged through the riser pipe. It will be understood that the specific construction of the displacement barrel forms no part of the present invention and any well known form may be substituted for the one illustrated. The discharge pipe 11 terminates in the usual umbrella top 15, above a receiving basin 16.

The mechanism for periodically actuating the valve 5 to open and closed position will now be described. As shown in Fig. 2 a deflector pipe 17 terminates at its upper end in an enlarged receiving opening 18 under the umbrella top and discharges at its lower end into a bucket 19, and this pipe is provided with any suitable regulating valve 20. The bucket 19 is provided with an outlet controlled by a second regulating valve 21 and is suspended by any suitable means 22 from one end of a lever 23 pivoted as at 24 to any suitable support. This lever 23 carries an adjustable counter-weight 25 on the opposite side of the pivot from the bucket 19, and has connected thereto a pilot valve 26 by means of a suitable link connection 27, said pilot valve in turn being operatively connected to the main valve. The pilot valve has three openings, the first of which is connected by a suitable pipe 28 controlled by a regulating valve 29 to the supply line pressure. The second opening of the pilot valve leads to the main valve by way of a pipe 30 while the third opening is connected to the atmosphere at 31. The main valve is of the well known diaphragm type adapted to be held open by air pressure acting on the diaphragm 32 and held closed by any suitable mechanism (as by a weight or spring not shown). A passage 33 is provided in the pilot valve for venting the lower end of the valve casing to atmosphere. If desired a pressure reducing valve 34 may be employed in the line 28 to reduce the pressure for operating the control system.

The operation of my pumping system and controlling mechanism will now be de-

scribed. The system is shown in operation in Fig. 2. When it was desired to start the pump, the valve 29 was opened and pressure fluid transmitted through the pipe 28 through pilot valve 26 to act on the diaphragm 32 and move and hold the main valve 5 in open position. The bucket is not initially filled with liquid and the counter-weight 25 therefore holds the pilot valve in its top position.

Pressure fluid being conducted through the down pipe 6, the check valve 14 is seated by pressure, and the charge of liquid in the displacement barrel is forced upwardly past the check valve 13 through the discharge pipe 11 and against umbrella top 15. Assuming that the regulating valve 20 is open, a portion of the liquid being discharged and received by the enlarged upper end of the pipe 17 is transferred to the bucket 19. When the level of the liquid in the bucket 19 reaches a certain point its weight will overcome the effect of the counter-balance weight 25 and move the pilot valve to its lower position as shown in Fig. 4, thus closing communication between the pipes 28 and 30 and opening the space above the diaphragm 32 to the exhaust. The valve 5 is then closed, cutting off the pressure fluid, but the liquid continues to discharge for a certain interval of time, thereby using the power medium expansively. After the discharge of liquid has ceased the liquid in the bucket 19 will leak out past the valve 21 and the counter-weight 25 will again actuate the pilot valve to its top position and therefore open the main supply valve. During the interval of time that is required for the liquid to drain out of the bucket another charge has accumulated in the displacement barrel 7 and the pump is ready to complete another cycle of operations as described.

It will be obvious that by regulating the valve 20 the time of cutting off the air supply may be varied so that the pressure fluid may be used expansively to the extent desired and at the same time the interval required for filling the displacement barrel may be also varied to comply with the characteristics of the well by the proper adjustment of valve 21. It will also be noted that by completely closing the regulating valve 20 the valve 5 is held in its open position and pressure fluid is continuously discharged through the down pipe 6 and the pump would operate as an ordinary air lift pump. This feature is particularly advantageous in wells where the available static head is at times sufficient for efficient air lift pump performance, while at other times the head and therefore the submergence of the foot piece or displacement barrel is so reduced that displacement pump operation is more efficient.

While I have in this application specifically described one form which my 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. In a displacement pumping apparatus, a displacement barrel, means for discharging liquid therefrom, means for intermittently supplying actuating fluid thereto comprising a supply line, a valve therein, means for normally maintaining said valve in open position, a deflector pipe arranged to receive a portion of the liquid discharged, a regulating valve therein, a bucket for receiving the liquid from said deflector pipe, and means for moving said supply line valve to closed position controlled by the quantity of liquid in said bucket, said bucket having a continuously open outlet therein for gradually discharging liquid therefrom, an adjustable continuously open regulating valve in said outlet, said regulating valves constituting means for timing the operation of the main valve.

2. In a displacement pumping apparatus, a displacement barrel, means for discharging liquid therefrom including an umbrella discharge member, means for intermittently supplying actuating fluid to said barrel comprising a supply line, a valve therein, means for normally maintaining said valve in open position, and means for automatically moving the same to closed position, said last named means including a pipe having one end received under the umbrella top for removing a definite portion of the liquid discharged for the purpose of actuating the valve.

3. In a pumping system, a displacement barrel, means for discharging liquid therefrom, means for intermittently supplying actuating fluid to said barrel, comprising a supply line, a valve therein, means for normally maintaining said valve in open position, a deflector member arranged to receive a portion of the liquid discharged, a regulating valve therein, a bucket for receiving the liquid from said deflector member, and means for moving said supply line valve to closed position controlled by the quantity of liquid in said bucket, said bucket having an outlet therein for gradually discharging liquid therefrom, a second regulating valve in said outlet, said regulating valves constituting means for timing the operation of the main valve, said first mentioned regulating valve adapted to be closed whereby the supply valve is continuously held open for operating the system as an air lift pump.

4. In a liquid pumping apparatus of the single unit displacement type, a displacement barrel, means for conducting pressure fluid thereto and means for conducting liquid therefrom, means controlled by the liquid pumped for automatically cutting off the

pressure fluid supply when liquid has been discharged for a certain time interval, means for automatically reopening the supply means a certain time interval after the discharge of liquid has ceased, and a plurality of adjustable means whereby said time intervals may be separately varied to suit different operating conditions.

In testimony whereof I affix my signature.

JOHN OLIPHANT.