Jan. 25, 1944. W. N. EDDINS 2,339,920

FLUID PRESSURE OPERATED PUMP

Filed Jan. 3, 1941 2 Sheets-Sheet 1

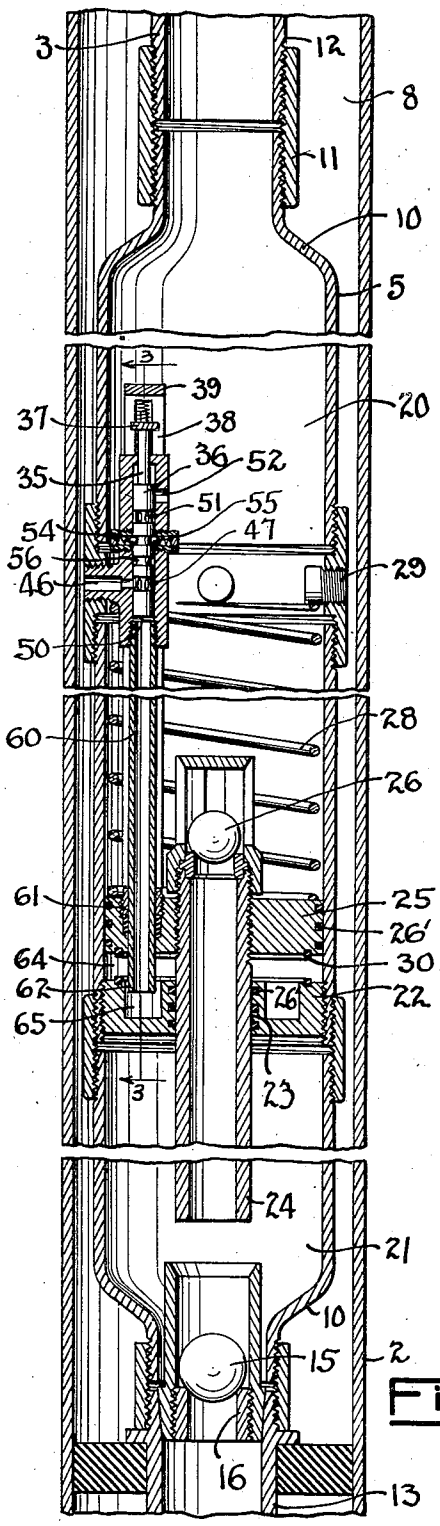


Fig. 1.

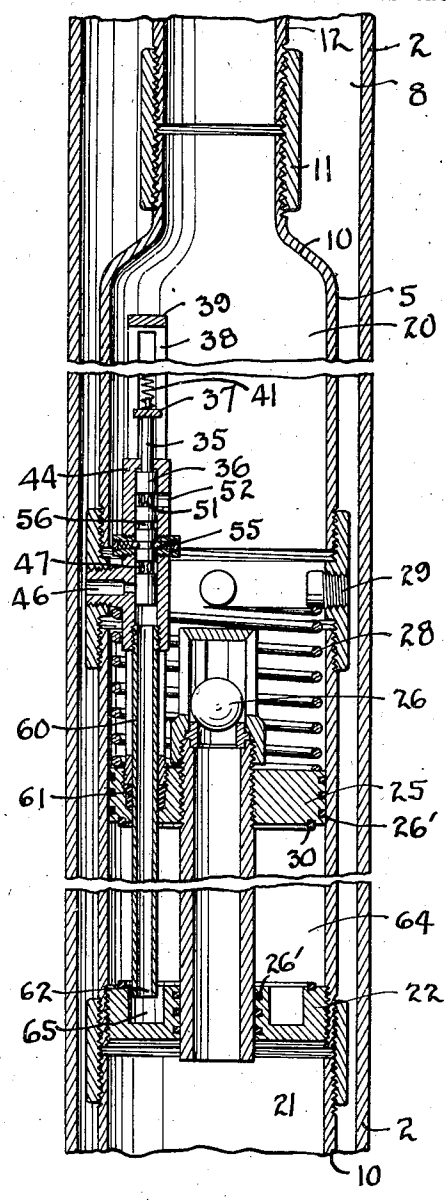


Fig. 2.

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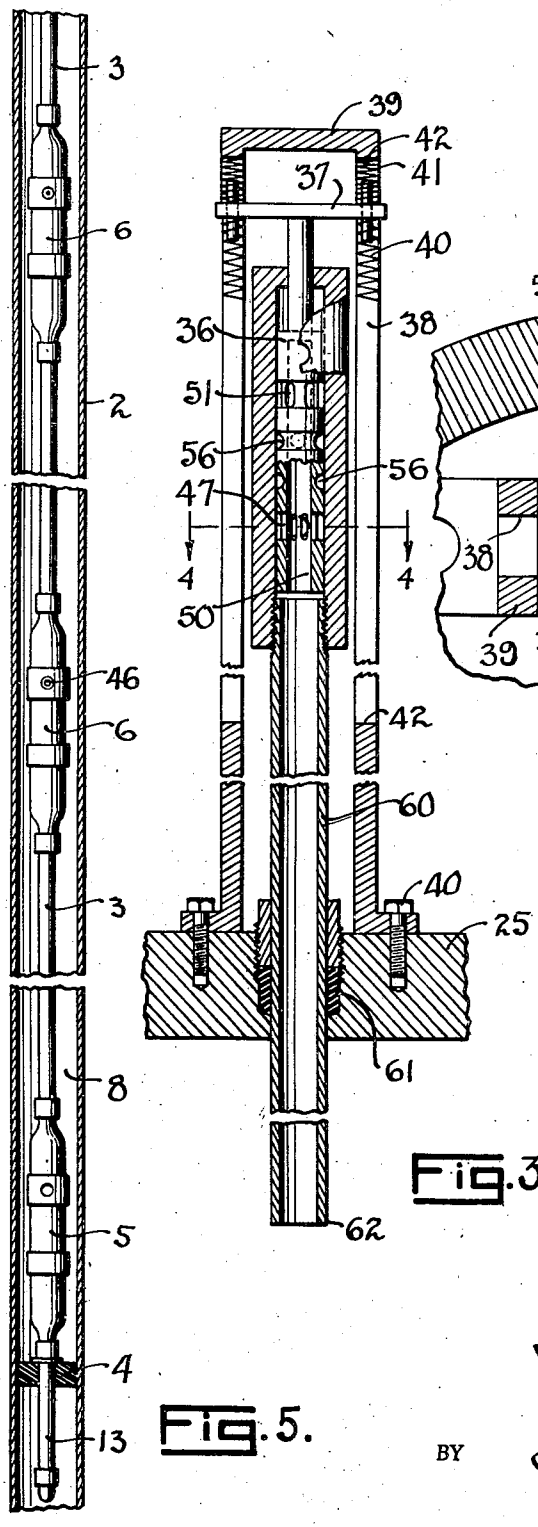


Fig. 5.

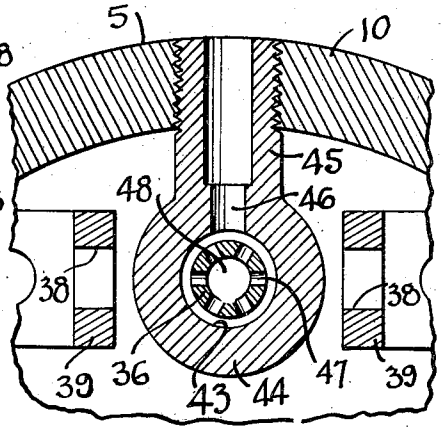


Fig. 4.

Fig. 3.

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FLUID PRESSURE OPERATED PUMP

William Nelson Eddins, San Antonio, Tex.

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7 Claims. (Cl. 103—5)

The invention relates to a fluid pressure operated pump of the type which will be positioned down in a well bore and it is intended that the pressure fluid will be utilized to periodically actuate the pump so as to control the direction of flow of the pressure fluid for the purpose of actuating the control valve and for elevating the liquid from the well.

It is one of the objects of the invention to provide a fluid pressure operated pump which can be disposed at any elevation in the well bore or, if desired, at the surface so as to utilize the pressure of the fluid being used to elevate the liquid from the well to control the action of the pump.

Another object of the invention is to provide an intermitter pressure operated pump in a well bore wherein the pressure fluid is utilized to control the valve for directing the pressure fluid into the liquid to be pumped.

Another object of the invention is to provide a series of valves to be operated by the pressure fluid which elevates the liquid from the well.

Another object of the invention is to provide a series of kick-off valves wherein each valve will operate to admit the desired amount of pressure fluid to effect the elevation of the liquid from the well.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view thru the device illustrating the arangement of the parts as it is positioned in a well bore.

Fig. 2 is a section similar to Fig. 1 but showing the pump as having been elevated by directing the pressure fluid beneath the plunger of the pump.

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is a section taken on the line 4—4 of Fig. 3.

Fig. 5 is a side elevation of a well equipped with the devices and illustrating the different units as spaced along the tubing in the well.

It is to be understood that the invention may be applied at any elevation in the well bore or at the well head as desired.

Fig. 5 shows a casing 2 which is positioned in a well bore and in which the tubing 3 has been run. This tubing carries a packer 4 which is illustrated in Fig. 5 as being directly below the lowermost pumping unit 5. This packer 4, however, may be positioned at any desired elevation, either below or above the unit 5.

If the packer is positioned above the unit 5, then, of course, a macaroni pipe will be used to conduct pressure fluid from the reservoir 8 between the tubing and the casing down to the elevation of the unit 5. Any desired number of units, such as 6 may be positioned along the tubing in the well so as to act as stage lift pumps to accelerate the flow of liquid from the well. Fluid under pressure may be introduced into the reservoir 8 in any desired manner.

Figs. 1 and 2 illustrate the detailed arrangement of the pumping unit 5, wherein a housing 10 is connected by the coupling 11 to a section 12 of the tubing 3. This housing 10 may be of any desired length or size and is in turn connected to the pipe 13 extending below the unit 5. As seen in Fig. 5 this pipe 13 is in the form of a footpiece or tail pipe which may be of any desired length to extend down into the liquid being pumped.

To avoid any back pressure being placed upon the formation from which the flow is occurring, a standing valve 15 is positioned in the lower end of the unit 5 and is arranged to engage a seat 16 to prevent any downflow of pressure. An ordinary type of ball check valve has been shown which will lift upon the upflow of a predetermined pressure.

The housing 10 is of particular construction in that it is divided into an upper chamber 20 and a lower chamber 21 by means of a fixed barrier 22. This barrier may be anchored in the housing at the desired elevation and has an opening 23 therein which is arranged to slidably receive the stem 24 carried by a plunger 25. Suitable seal rings 26' are positioned on each the plunger and the barrier so as to provide a seal with the housing 10 and the stem 24 respectively.

The plunger 25 is arranged for reciprocating movement in the upper chamber 20 and is arranged to carry the stem 24 with it in its reciprocating movement. A ball or check valve 26 which is in the form of a traveling valve is carried by the plunger 25 and this valve is also an upwardly opening valve which will allow an upflow of fluid but will cut off any down flow thru the stem 24. A spring 28 is mounted in the chamber 20 and is arranged to abut against the insert plugs 29 at its upper end and to seat on the upper side of the plunger 25 at its lower end. In this manner the plunger will be normally forced downward to a position closely ad-

jacent the barrier 22, as seen in Fig. 1. A pair of bumper rings 30 are positioned on the barrier and the plunger, respectively, to cushion the shock of the downward movement of the plunger.

In operation as the plunger moves up the check valve 26 will close so that the continued upward movement of the plunger will create a suction in the chamber 21 to draw in a charge of gas and liquid thru the tail pipe 13 by raising the valve 15. As the upward movement of the plunger ceases the spring 28 will urge it downwardly, forcing the stem 24 back into the chamber 21 to remove the suction from the chamber 21 and create a pressure therein. This permits the valve 15 to instantly close and as the pressure builds up in the chamber 21, the valve 26 will lift from its seat to cause displacement of liquid from the chamber 21 into the chamber 20. It seems obvious that as the plunger reciprocates in this manner, that a pumping action is developed which transfers gas and liquid from the chamber 21 into the chamber 20.

In order to control the reciprocation of this plunger 25 a control valve 35 has been arranged in the chamber 20 but it is to be understood that this valve may be otherwise disposed if desired. In the particular construction shown the valve member 36 as best seen in Fig. 3 is provided with a cross head 37. This cross head extends laterally from the valve and projects into the slots 38 in a bridge or bracket 39 which is rigidly connected by the bolts 40 on the plunger 25. Cushion springs 40 and 41 may be carried by the cross head so as to cushion the shock imparted to the cross head 37 by the movement of the bridge 39 and the plunger 25. The ends 42 of the slots at the top and bottom are arranged to abut the springs 40 and 41 as the plunger moves to the end of its stroke. These springs may be set so as to control the mechanism. Movement of the plunger is limited by the movement of the valve member 36.

This control valve is of peculiar construction in that it has a cylindrical sleeve type of valve which is arranged to be moved inside of the valve housing 44 which is fixed by the side inlet plug 45 in the housing 10, as is best seen in Fig. 4.

The valve housing 44, as seen in Fig. 1, is supported on this inlet 45 so that it is rigidly fixed in position. An inlet passage or port 46 leads inwardly from the inlet 45 into a central recess 43 in which the valve member 36 is arranged to travel. The valve has inlet ports 47 therein which are disposed so that they are in alignment with the port 46 when the plunger is in its lowermost position, as seen in Fig. 1. The downward movement of the plunger may be limited in any desired manner so as to cause the ports 46 and 47 to be aligned.

The valve 36 has an opening 48 therein which leads from the ports 47 thru the lower open end 50 of the valve member. This opening 48 is of sufficient length as seen in Fig. 3 to extend above the elevation of the outlet ports 51 adjacent the upper end of the valve member. These ports are arranged to move into and out of alignment with the discharge port 52 so that pressure fluid may pass into the upper chamber 20. In order to hold the valve in either open position to admit pressure fluid thru the ports 47 or in closed position to cut off such pressure, a latch 54 has been disposed in the valve housing 44 and is in the form of the latch balls 55 which will snap into the space or groove 56 in the periphery of the valve member 36.

A feeder pipe 60 is connected to the lower end of the housing 44 and passes thru a stuffing gland 61 in the plunger 25 and has its lower end 62 projecting into a space 65 in the barrier 22. This pipe is provided so that pressure fluid entering the ports 46 and 47 may flow downwardly into the space 64 between the plunger 25 and the barrier 22. Thus, when the plunger moves to its lowermost position due to the force of the spring 28, the ports 47 will move into alignment with the port 46 and direct pressure fluid in the reservoir 8 into the pipe 60. This fluid pressure accumulates in the space 64 under the plunger, causing the plunger and the bridge 39 to gradually move upward. As the plunger moves upwardly a sufficient distance to cause the lower end 42 of the slot 38 to abut the springs 40, it will then cause the valve 36 to be moved from the position in Fig. 1 to the position of Fig. 2. In Fig. 2 the valve has been snapped upwardly so as to close the inlet port 46 by moving the ports 47 out of alignment therewith. This movement of the valve shuts off the flow of pressure fluid in the space 64 and opens the space 64 into the chamber 20 whereby the pressure fluid can now reverse its path of flow and move upwardly thru the pipe 60, on thru the valve 36, the ports 51 and the outlet port 52 to discharge into the chamber 20. The spring 28 urging the plunger 25 downwardly initiates this reverse flow of pressure fluid. The pressure fluid is thus discharged into the chamber 20 and assists in aerating the column of liquid in the tubing 12 so as to assist in its elevation from the well.

As the plunger 25 moves downwardly the upper end of the slot 38 will contact the top spring 41 of the valve member and cause the valve to be again returned to the position of Fig. 1 as the plunger reaches its lowermost position. As the valve is snapped downwardly the port 52 is closed and the port 46 opened so that pressure fluid is again directed into the space 64 where it will again build up a sufficient pressure to again elevate the plunger. The plunger performs a pumping operation and additionally the pressure fluid is discharged to aerate the column of liquid. Thus it may be said that the pressure fluid performs a dual function of effecting the pumping action and then assisting in the elevation of the liquid.

Fig. 5 shows a plurality of the pumping units which are duplicates of the units 5 which are disposed at spaced elevations in the tubing and each may be operated by the same source of pressure in the reservoir 8. The size of the ports 46 and 52 may be varied as desired to admit a greater or lesser amount of pressure fluid, depending upon the elevation of the unit in the well bore. The total capacity of all inlet devices above the lowermost will be less than the capacity of the reservoir so that the lowermost device will always receive pressure fluid.

While a sleeve type valve member 36 has been shown, it seems obvious that a rotatable valve or any other type of control valve may be utilized instead of the form illustrated, the principal feature being a valve which will open or close as the plunger 25 moves to the end of its stroke in each direction.

Broadly, the invention contemplates a fluid pressure operated pump for wells which may be disposed at any desired elevation and wherein the pressure fluid for actuating the pump is discharged into the column of liquid being elevated to assist in the flow of such liquid.

What is claimed is:

1. A fluid lift intermitter pump for wells comprising a casing, a tubing therein, an intermitter chamber having an inlet thereto and an outlet to said tubing, a plunger in said chamber, a fluid pressure control valve operated by said plunger, an inlet from said valve to below said plunger so that fluid pressure from without said chamber may be directed below said plunger to elevate said plunger, and means to thereafter direct such fluid above said plunger to elevate the liquid in the well, and means to urge said plunger downwardly when the applied fluid pressure falls below a predetermined value.

2. In an intermitter pump device for wells, an intermitter chamber having an inlet and an outlet, a barrier therein, a plunger above said barrier, a traveling valve carried by said plunger, a control valve operated by the plunger, a fluid pressure inlet controlled by said control valve to discharge below said plunger so that the plunger is raised by the discharge and the discharge thereupon cut off from below the plunger and means whereby the pressure below said plunger is thereafter shifted to discharge above the plunger to further elevate the well liquid.

3. In an intermitter pump device for wells, a compression chamber, a barrier therein, a plunger above said barrier, a traveling valve carried by said plunger, a control valve linked to the plunger, a fluid pressure inlet controlled by said control valve to discharge below said plunger so that the plunger is raised by the discharge and the discharge thereupon cut off from below the plunger and means whereby the pressure below said plunger is thereafter shifted to discharge above the plunger to further elevate the well liquid, said valve thereupon permitting escape of the pressure fluid from below the plunger so that said plunger reverses its movement to reverse said valve.

4. In an intermitter pump device for wells, an expansion chamber, a barrier therein, a plunger above said barrier, a traveling valve carried by said plunger, a control valve stationed above and linked to the plunger, a fluid pressure inlet controlled by said control valve, said control valve to discharge below said plunger so that the plunger is raised by the discharge and the discharge thereupon cut off from below the plunger and means whereby the pressure below said plunger is thereafter shifted to discharge above the plunger to further elevate the well liquid, said valve thereupon permitting escape of the pressure fluid from below the plunger so that said plunger reverses its movement to reverse said valve, and means to urge said plunger down.

5. In an intermitter pump device for wells, an intermitter chamber, a barrier therein, a plunger above said barrier, a traveling valve carried by said plunger, a control valve linked to the plunger, a fluid pressure inlet controlled by said control valve, said control valve to discharge below said plunger so that the plunger is raised by the discharge and the discharge thereupon cut off from below the plunger and means whereby the pressure below said plunger is thereafter shifted to discharge above the plunger to further elevate the well liquid, and a stem extending from said plunger through said barrier to conduct well fluid through said barrier and plunger.

6. A mechanism for flowing wells by the application of pressure fluid to the well tubing including, movable fluid pressure operated means operable intermittently for drawing in a charge of well fluid into the well tubing, means for admitting pressure fluid to operate said first means, and additional means to discharge such admitted pressure fluid into the tubing above said first means to assist in the elevation of the well fluid while simultaneously again moving said first means to displace a charge of the well fluid just entering the tubing to a position to be elevated by such discharge.

7. A fluid operated pump for wells comprising a casing, a tubing therein, a working barrel on said tubing, a plunger in said barrel, a barrier in said barrel, a member extending from said plunger downwardly through said barrier, a traveling valve on said member, a fluid pressure control valve connected to said plunger, inlets from space formed by the casing and tubing through said valve to the compression chamber formed by said piston, a tubular member and barrier in said barrel, so that fluid pressure from outside the tubing and chamber may be directed into said chamber thereby causing said plunger to elevate the liquid in the well, means to urge said plunger and tubular member downwardly, said control valve acting to alternately open and close said inlets to effect a reciprocation of said piston and pumping of the liquid, and means to release the pressure fluid from below said plunger.

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