Aug. 20, 1940. W. N. EDDINS 2,212,416

FLUID OPERATED PUMP

Filed Feb. 21, 1938

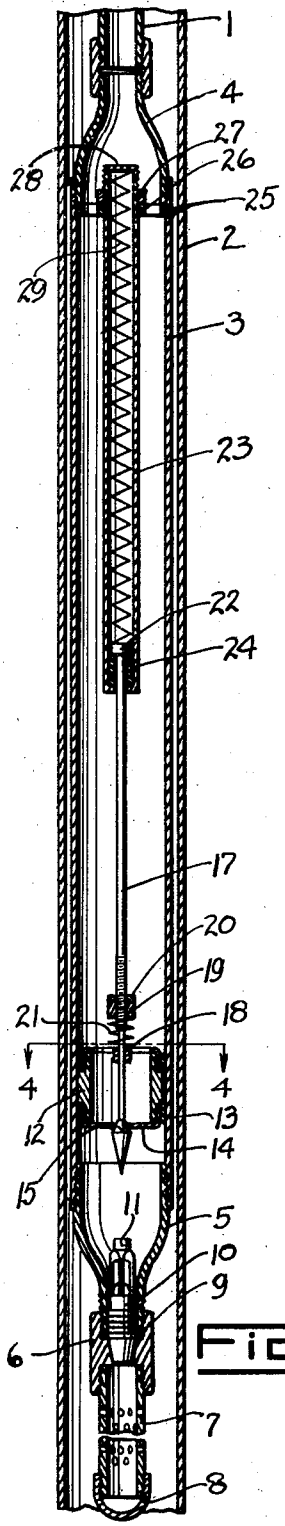


Fig. 1.

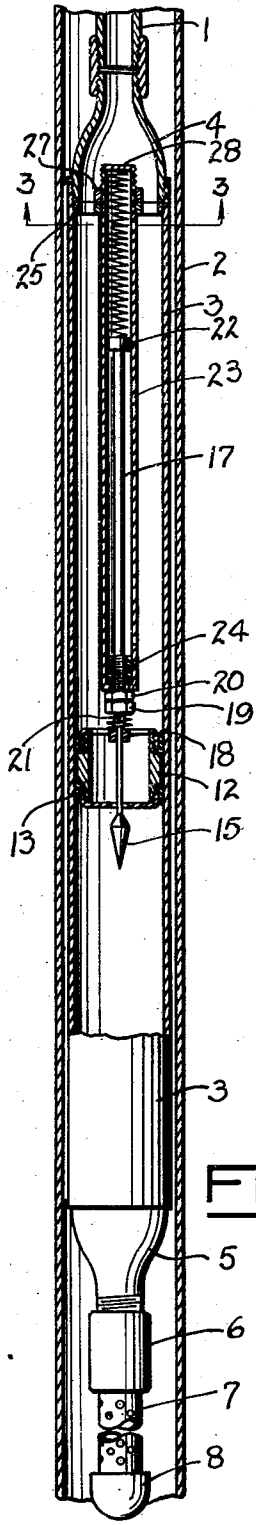


Fig. 2.

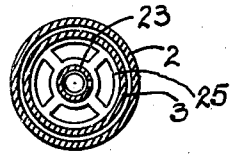


Fig. 3.

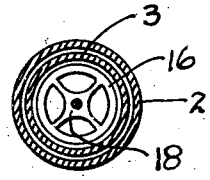


Fig. 4.

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FLUID OPERATED PUMP

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10 Claims. (Cl. 103—5)

My invention relates to pumps in which the pressure of air or gas in the well is employed as the lifting force.

It is an object of the invention to provide a pump to be operated by air or gas in which the gaseous fluid is forced to operate by heads.

I desire to provide a pump barrel having a piston therein which will normally close against the passage of fluid in the barrel but which after having been given a positive lift by the gas will open under the pressure of gas to discharge the said gas abruptly and in comparatively large volume.

I desire to so arrange the pumping mechanism that the most effective use of the lifting fluid may be obtained and the invention includes mechanism whereby the gas will be used as a lifting agent on the piston and then liberated to again raise the fluid in the pump tubing in heads.

With reference to the drawing herewith, Fig. 1 is a central longitudinal section through a pump employing my invention, said pump being employed in position within the well casing.

Fig. 2 is a view similar to Fig. 1 but showing the parts in a different operative position.

Fig. 3 is a transverse section on the plane 3—3 of Fig. 2; and

Fig. 4 is a similar transverse section on the plane 4—4 of Fig. 1.

My device is intended to control the flow of gas or other fluid under pressure from the lower end of the pump tubing upwardly beneath the oil or other liquid to be lifted so that it will first furnish a positive lift on the piston and then be released in large quantities so as to have a superior lifting power directly on the liquid in the tubing.

I desire to avoid the slow bubbling of the gas or air through the oil and thus prevent the slipping of the gas past the oil without material lifting effort. To accomplish this I place at the lower end of a pump tubing extending downwardly from the surface within the casing 2 a pump barrel 3. Said pump barrel is connected to the lower end of the tubing through a swage nipple 4 so as to materially enlarge the capacity of the tubing at that point.

The pump barrel 3 is connected to a swaged nipple 5 at its lower end and to a valve supporting member 6. Said member 6 serves also as a coupling to connect the nipple 5 with a length of perforated pipe 7 which may be closed at its lower end by a bull plug 8.

Within the upper end of the coupling 6 is a tapered seat 9 to receive the usual standing valve 10, the cage 11 of the valve extending upwardly into the nipple 5.

Mounted within the working barrel 3 is a plunger 12, which fits closely within the barrel and has packing cups 13 at its upper and lower ends so as to form a seal with the interior of the barrel. Said plunger is tubular and has a cap 14 closing the lower end thereof, said cap having an axial opening normally closed by the valve 15. On the upper end of the plunger is a supporting spider 16 shown best in Fig. 4.

The valve has an upwardly extending stem or rod 17 thereon which has a bearing within a central bushing 18 in the spider 16. Above the plunger the stem is increased in diameter and has screwed thereon an adjusting nut 19 and a lock nut 20. Between the nut 19 and the bushing 18 upon the plunger is a compression spring 21 which tends to hold the plunger spaced away from the nut 19 and against the valve 15.

The upper end of the valve stem or rod 17 has thereon a cylindrical head 22 which fits slidably within a guide cylinder 23. Between the head 22 of the valve stem and the lower end of the guide cylinder is a cushion 24 of rubber or similar material. The upper end of the guide sleeve 23 is supported within a spider 25 screwed within the upper end of the barrel and having a central bushing 26 thereon threaded to engage with the outer surface of the guide sleeve. A nut 27 on the sleeve tends to secure the sleeve in adjusted position supported axially of the pump barrel.

The upper end of the guide sleeve is closed by a plate 28 which serves as a stop for the upper end of a coil spring 29, the lower end of which bears against the head 22 of the valve stem thus tending to resist the upward movement of the stem relative to the pump barrel.

In the operation of my device the pump barrel is positioned below the liquid level in the well and fluid from the well will enter through the perforated pipe 7 and past the standing valve 11 into the space below the plunger. Both liquid and gas will thus pass into the pump barrel. The gas will accumulate below the piston and when sufficient pressure is produced to raise the piston with such liquid as may be above the same, the piston will rise carrying with it the valve 15 and valve stem 17, the valve remaining closed. As the valve stem 17 moves upwardly within the guide sleeve 23 it will reach a point where the resistance to the further movement of the valve stem will be great enough to retard

further upward movement. As pressure increases underneath the plunger, causing it to rise still further, valve 15 will be unseated at the lower end of the plunger and allow the passage of the gas upwardly through the piston and into the tubing 1 lifting above it the charge of liquid which is in the pump barrel and tubing. While the load of liquid above the piston is gradually decreased in this manner the spring 29 will force the valve stem and the piston back toward its original position at the lower end of the pump barrel. The action of the spring 21 on the plunger will tend to move the plunger toward the valve head but in the passage of the plunger downwardly through the liquid which has followed the piston upwardly the valve will remain open. As it reaches the lower end of its movement, however, the valve stem will stop and the action of the spring 21 together with the pressure of the liquid above will seat the plunger upon the valve, thus closing off the further passage of fluid until sufficient gas pressure has again accumulated below the piston to start it again on its upward movement.

It is to be understood that a unit such as just described will be employed in the tubing at a plurality of stages therein. Thus when the fluid has been lifted from one stage to the next the gas will accumulate below the piston at each succeeding stage and will operate in the same manner as is described to raise the liquid the distance between that stage and the next upper stage.

The advantages of this method of controlling the discharge of gaseous fluid upwardly with the liquid above the same lie in the superior lifting effect of the gas when it is kept separated during an initial lift then discharged in large quantities into the liquid itself. Each quantity of gas thus released acts as an air piston below the liquid above and acting particularly within the tubing 1, which is of reduced diameter, it will increase the lifting effect of the gas so that the waste of gas is largely eliminated. Another advantage is the definite lift before the piston opens. The gas will not slip by the liquid which is to be lifted and thus lose the lifting effect of the gas. In my device I arrange the piston to operate in a pumping barrel of larger diameter than the tubing so that the amount of gas accumulated below the piston can be increased and thus provide a superior lifting effect against the liquid above. In succeeding stages in the tubing this same advantage may be gained and an effective use of the gas produced by the well will thus be obtained. It will, therefore, be understood that the amount of gas in the well will be conserved and a smaller amount of gas per barrel lifted will be used in carrying out the invention.

What is claimed is:

1. A deep well pump including a well tubing, a pump barrel thereon of larger transverse diameter than said tubing, a standing valve at the lower end of said barrel, a piston in said pump barrel, a fluid passage through said piston, a valve stem slidable axially through said piston, a valve thereon, a seat for said valve in said passage at the lower side of said piston, a guide for said valve stem above said piston, means to urge said valve stem resiliently downwardly in said guide, and means to limit the downward movement of said valve stem in said guide.

2. A deep well pump including a well tubing, a pump barrel thereon of larger transverse diameter than said tubing, a standing valve at the lower end of said barrel, a piston in said pump barrel, a valve stem slidable axially through said piston, a stationary guide for said stem acting to limit its movement, a valve on said stem below said piston, a valve seat in the lower side of said piston through which fluid may flow through said piston, means tending to hold said valve normally closed and means responsive to the upward movement of said piston a predetermined distance to unseat said valve and open the flow of fluid through said seat.

3. A deep well pump including a well tubing, a pump barrel thereon below the fluid level in the well of larger transverse diameter than said tubing, a standing valve at the lower end of said barrel, a piston in said pump barrel, a fluid passage through said piston, a valve stem mounted in said pump barrel slidable axially through said piston, a downwardly opening valve, a valve seat therefor in said passage at the lower side of said piston, means to hold said valve resiliently in its seat, and means acting on said valve when said piston is moved upwardly a predetermined distance by fluid pressure to open said valve and allow said fluid to pass.

4. A fluid operated pump including a pump tubing, a pump barrel of comparatively larger diameter positioned on said tubing adjacent the lower end of the same, a piston in said barrel, a standing valve at the lower end of said barrel, a passage through said piston, a downwardly opening valve in said passage, means mounted in said barrel to hold said valve normally closed, said piston being moved upwardly by fluid pressure, and means acting when said piston is moved upwardly a predetermined distance in said barrel to open said valve and allow the pressure fluid to pass.

5. A fluid operated pump including a pump tubing, a pump barrel of comparatively larger diameter thereon, a piston in said barrel, a standing valve at the lower end of said barrel, a passage through said piston, a downwardly opening valve in said passage, means to hold said valve normally closed, said piston being moved upwardly by fluid pressure, a stem on said valve, and a spring above said piston to resiliently oppose the upward movement of said stem and acting to open said valve when said spring has been compressed a predetermined amount.

6. A fluid operated pump including a pump tubing, a pump barrel of comparatively larger diameter thereon adjacent the lower end of said tubing, a piston in said barrel, a standing valve at the lower end of said barrel, a passage through said piston, a downwardly opening valve in said passage, means to hold said valve normally closed, said piston being moved upwardly by fluid pressure, an upwardly extending stem on said valve, a guide for said stem mounted on said barrel, means to limit the downward movement of said stem in said guide, and means including said guide to force said valve from its seat when said stem reaches a predetermined height.

7. A method of raising liquid from wells having a pump barrel therein comprising placing a barrier in said barrel below the liquid level therein, acting upon said barrier by the pressure of gaseous fluid to raise said barrier and the liquid above the same, closing off the passage of said liquid backwardly into the well, opening a passage for fluid through said barrier for said gaseous fluid, and moving the liquid above said barrier into a restricted passage where said gaseous fluid will raise the liquid above the same to a higher level in said passage.

8. A method of raising liquid from wells having a pump barrel therein including trapping a volume of gaseous fluid under pressure below a column of liquid in said barrel and raising said column a certain distance, releasing said gaseous fluid into said column of fluid, constricting the diameter of the fluid column above the point of release of said gaseous fluid, shutting off the return of said liquid backwardly into the well, and repeating the process.

9. A pump including a tubing, a pump barrel of larger diameter than said tubing adjacent the lower end of said tubing, a standing valve at the lower end of said barrel, a freely movable piston in said pump barrel, a valve stem axially of said piston, a valve on said stem, means normally holding said valve upwardly to close a passage through said piston, a guide in said barrel above said piston for said valve stem, and means associated with said guide to limit the upward movement of said piston.

10. A pump tubing, a pump barrel thereon at the lower end of said tubing, a standing valve in said barrel, a piston in said barrel having a longitudinal passage, a valve in said passage, said piston being movable upwardly in said barrel by gas pressure, means associated with said valve to oppose the upward movement of said piston and adapted to open said valve at the upward limit of the movement of said piston in said barrel.

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