July 16, 1935. R. B. BRYANT 2,008,172

MEANS FOR FLOWING WELLS

Filed July 31, 1933 2 Sheets-Sheet 1

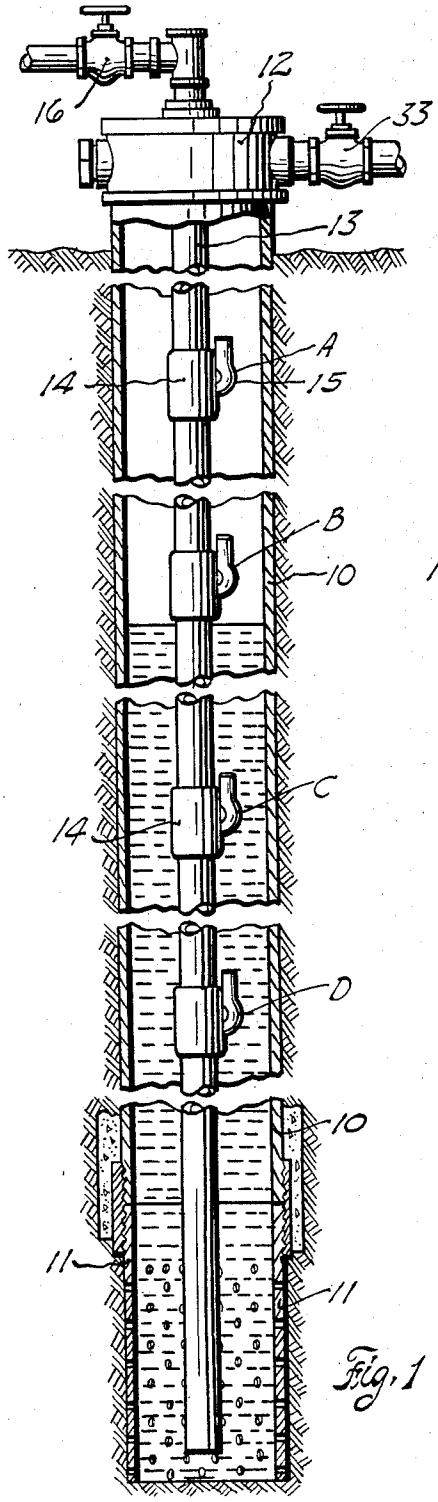


Fig. 1

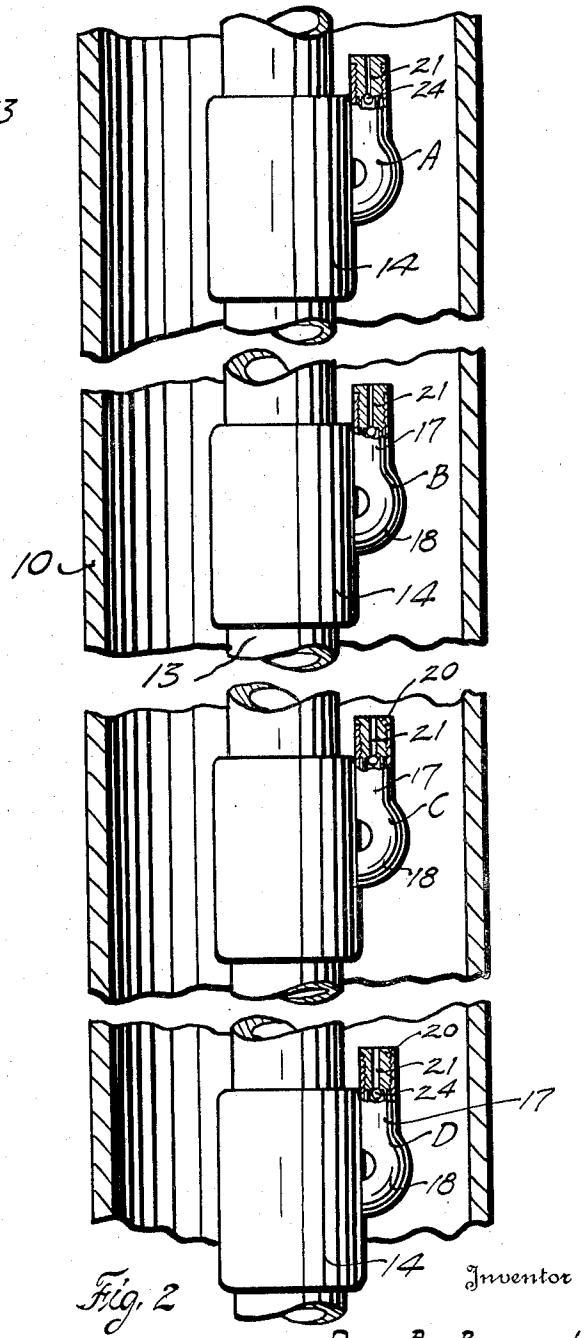


Fig. 2

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MEANS FOR FLOWING WELLS

Filed July 31, 1933 2 Sheets-Sheet 2

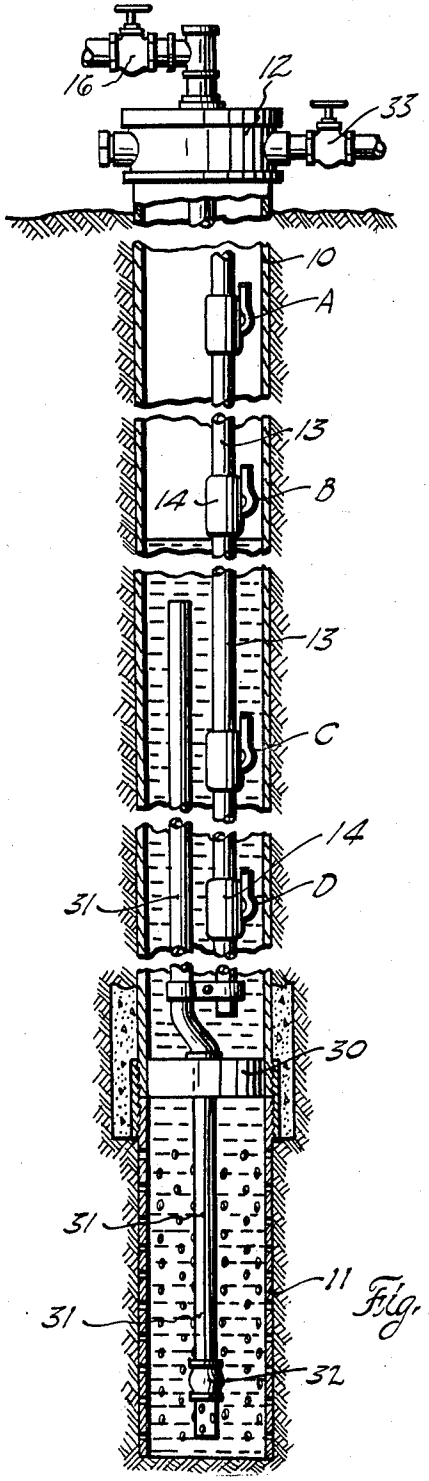


Fig. 5

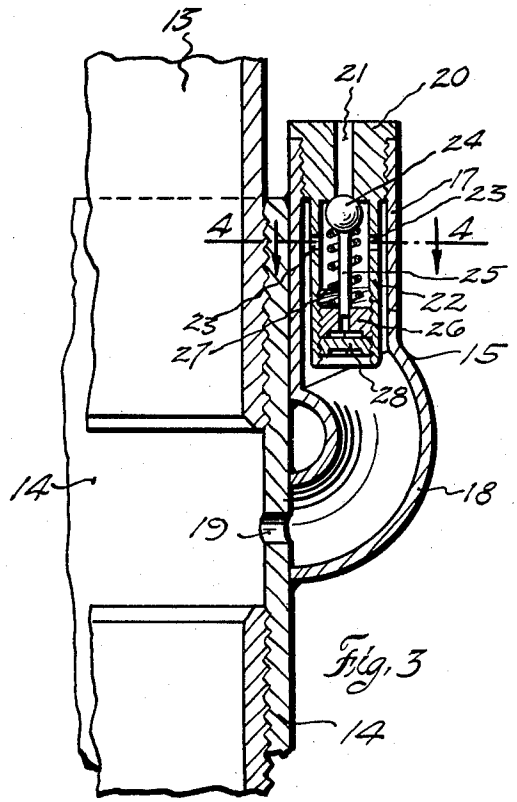


Fig. 3

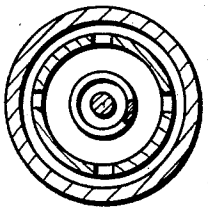


Fig. 4

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UNITED STATES PATENT OFFICE

2,008,172

MEANS FOR FLOWING WELLS

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Application July 31, 1933, Serial No. 683,026

2 Claims. (Cl. 103—233)

This invention relates to new and useful improvements in methods and means for flowing wells.

One object of the invention is to provide a method of flowing an oil well by utilizing the gas pressure in the casing above the oil level and at different stages or elevations, whereby the liquid in the tubing at each stage is elevated by the gas pressure introduced at that particular stage.

Another object of the invention is to provide a flowing method for oil wells, whereby a gas pressure is built up in the casing by agitating the oil and gas mixture and separating a part of the gas therefrom, and then introducing the built up gas pressure into the tubing at different stages or elevations to lift the oil from the point of introduction.

A further object of the invention is to provide a plurality of suitable valves mounted at different elevations in the tubing and set so as to operate at different or graduated pressures.

Still another object of the invention is to provide a valve having a housing structure so arranged as not to catch or hang in the casing when the tubing is being run in or pulled out and also which will not interfere with swabbing or pumping.

A still further object of the invention is to provide auxiliary means for supplying air or gas to the casing to build up an artificial pressure for flowing the well in case it does not build up sufficient gas pressure to flow itself.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a view of a well, partly in section and partly in elevation, equipped with valves made in accordance with the invention,

Figure 2 is an enlarged view, partly in elevation and partly in section, showing the valve arrangement,

Figure 3 is an enlarged vertical sectional view of one of the valves and its mounting,

Figure 4 is an enlarged horizontal cross-sectional view taken on the line 4—4 of Figure 3, and

Figure 5 is a view similar to Figure 1, showing another form of the invention.

In the drawings the numeral 10 designates a well casing which may have a well screen 11 at its lower end. A suitable casing head 12 is mounted on top of the casing and closed so that gas may be trapped in the casing. A string of tubing 13 is mounted in the casing and suitably packed off in the head so as to make a gas tight joint therewith.

It is customary to screw sections of tubing together with collars 14 and I have utilized these collars in carrying out my invention, but the same is not to be limited thereto. I mount a plurality of valves 15 on certain of the collars, which I have designated by the letters A, B, C and D. These valves are suitably spaced apart so as to be located at different elevations or stages. Before proceeding to describe the valve in detail, I wish to point out that the valve must have certain general features for carrying out the method.

It is customary to mount at least one of the valves below the oil level and it is important to have the valves arranged so that the lower valve will open at a much lower pressure than the upper valve. When the gas pressure is built up in the casing above the oil level, the two upper valves A and B will open and admit gas to the tubing to elevate the fluid thereabove. As the gas pressure reduces, the valve A will close, leaving the valve B open. I have shown the valves C and D as submerged and it is likely that the pressure of the liquid will be sufficient to open the same, or at least the lower valve, whereby the oil will enter the tubing through at least one of the lower valves. It will be seen that only gas will enter the valves above the liquid level, but as the liquid is elevated the level in the casing will recede to the point where it uncovers the valve C and then the valve D. The tubing is provided with a cut-off valve 16, which is closed in order to give the gas an opportunity to build up a pressure in the casing 10 when necessary.

The particular valve which I have illustrated includes a cylindrical or tubular case 17 having an elbow 18 integral with its lower end. The case and elbow may be welded to the side of the collar 14 so that the elbow covers a port 19 in the collar for communicating with the tubing. A plug 20 is screwed into the top of the case and this plug is provided with an axial bore or duct 21. The plug carries a barrel 22, which depends therefrom and is of less external diameter than the internal diameter of the case so as to provide a space therebetween. The barrel has ports 23 communicating with said space which in turn communicates with the elbow and the tubing through the port 19.

A ball valve 24 is mounted in the barrel so as to seat against the lower end of the bore 21. This ball has a depending stem 25 telescoping into a tension disk 26 screwed into the lower end of the barrel. A coiled spring 27 is confined on the stem between the disk and the ball. By adjusting the nut, the tension of the spring is regulated and thus the valve may be set to open at any given pressure. A plug 28 is screwed into the bottom of the barrel against the disk for locking the same in its adjusted positions.

It is obvious that the greater the distance the fluid must be lifted, the greater the pressure of the gas must be to affect such lifting, and, therefore, by admitting more gas at different stages, a greater pressure may be built up. Reference is made to Figure 2, in which the bore 21 of each succeeding valve from the top to the bottom is made larger than the one above it, so that as the length of the lift increases the volume of the gas admitted will likewise increase. It is obvious that the elbows 18 projecting laterally of the casing 17 will form guides for engaging the casing and preventing the valves catching therein when the tubing is raised and lowered.

In Figure 5, I have shown the tubing 13 terminating above a packer 30. This packer is set above the screen 11 and a string of pipe 31 extends from the screen through the packer. This pipe extends a goodly distance up the casing, as is shown. A check valve 32 is connected in the pipe 31 near the bottom of the screen so as to prevent an abnormal pressure being exerted on the oil sands. When the gas pressure in the casing 10 is reduced by escaping through the valves, oil discharged from the pipe 31 into the casing will release fresh gas, whereby a gas pressure is built up in the casing and the valves again operated. The oil level will be lowered and the upper end of the pipe 31 will be uncovered when the gas pressure has been reduced in the casing. The oil which flows from the pipe will collect in the casing above the packer, whereby it may be carried off through the lower valves C and D.

I have shown a valve 33 connected to the casing head 12. In case the well goes dead or loses its head of gas, compressed air or gas from an outside source may be admitted by opening the valve 33. By this means a gas pressure may be built up in the casing 10 and the well started to flowing. It has been found that when a well is once started flowing it will do so continuously. The valves act as boosters to admit gas to the tubing whenever necessary to lift the load. Their action is entirely automatic and they function when needed to maintain the flow.

The number of valves used depends upon the depth of the well, as well as the pressure therein. While I have shown four valves, in practice ten or more may be used. Satisfactory results have been had by locating the valves at intervals of from 100 to 300 feet, according to the liquid level and the depth of the well.

The description which has been given, recites more or less detail of a particular embodiment of the invention which is set forth as new and useful, however, I desire it understood that the invention is not limited to such exact details of construction, because it is manifest that changes and modifications may be made, within the scope of the appended claims, without departing from the spirit of the invention.

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

1. A well flowing device comprising, a collar for coupling in a string of well tubing, a tubular valve case connected to the collar at its lower end and having communication with the interior of said collar, a valve seat at the upper end of the case having an inlet, and a spring pressed valve mounted in the case for engaging the valve seat.

2. A well flowing device comprising, a collar for coupling in a string of well tubing, a tubular valve case connected to the collar at its lower end and having a communication with the interior of said collar, a valve seat at the upper end of the case having an inlet, and a spring pressed valve mounted in the case for engaging the valve seat, the valve case having an elbow projecting outwardly and forming a guide to prevent the valve catching in the casing of a well.

ROY B. BRYANT.