April 19, 1938. J. L. HALL 2,114,765

INTERMITTENT FLOW VALVE

Filed Nov. 15, 1937

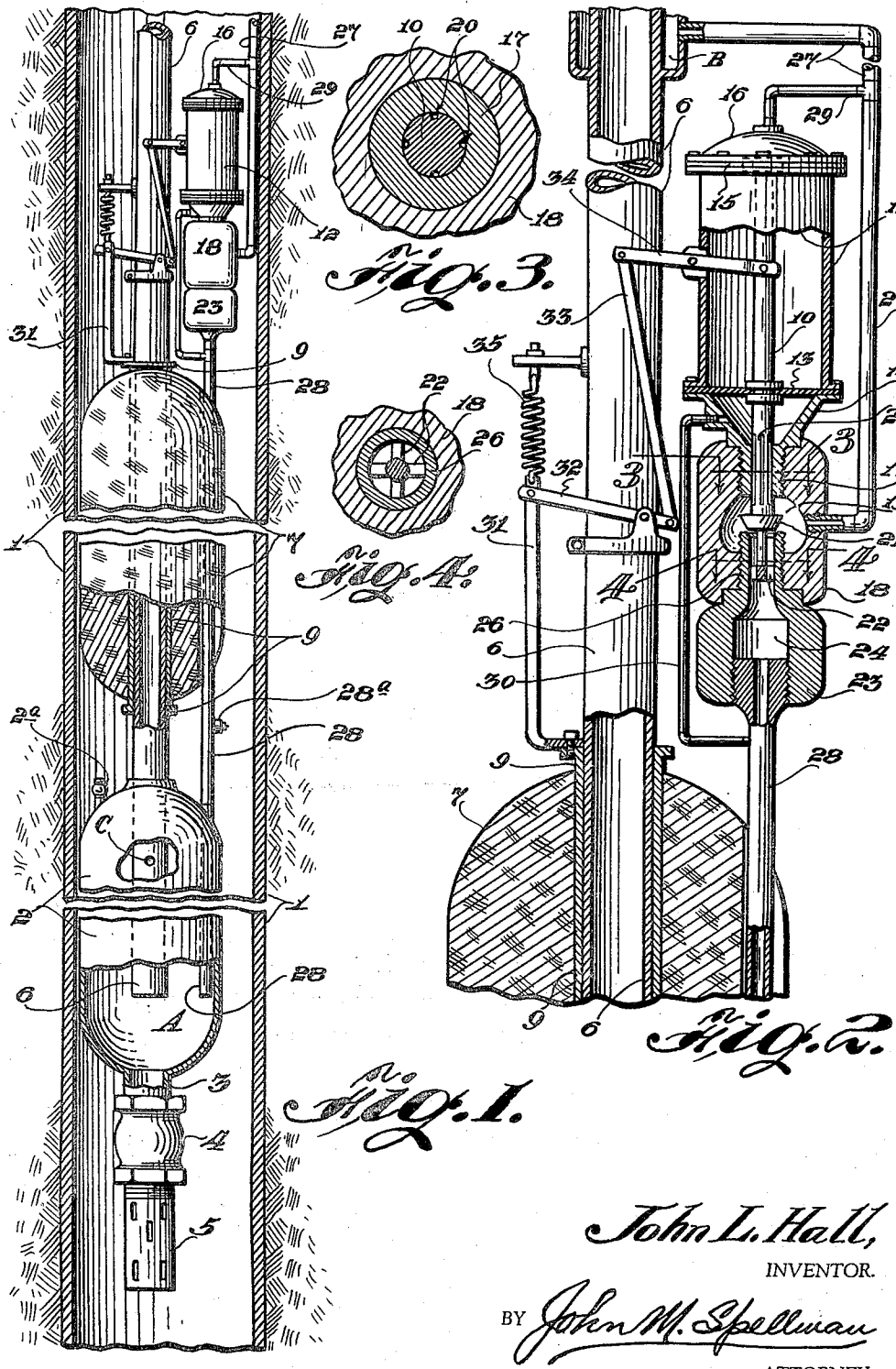


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

John L. Hall,
INVENTOR.

BY John M. Spellman
ATTORNEY.

Patented Apr. 19, 1938 2,114,765

UNITED STATES PATENT OFFICE

2,114,765

INTERMITTENT FLOW VALVE

John L. Hall, Charleston, W. Va., assignor, by direct and mesne assignments, of one-third to Frank S. Nelson, Dallas, Tex., and one-third to H. S. Christian, Tyler, Tex.

Application November 15, 1937, Serial No. 174,715

5 Claims. (Cl. 166—2)

This invention relates to oil well equipment, having more particular reference to an apparatus for use in oil wells to increase the flow thereof, and the primary object of the invention is to provide an intermittent control flow valve and parts embodying the apparatus to attain the object specified.

Another important object of the invention resides in the arrangement and construction of the apparatus whereby the control valve is practically automatic in its operation.

A further object of the invention is to provide an apparatus of this character embodying a control valve which is operated by air or gas pressure combined with the fluid pressure of the well to open the valve, the said valve being closed by a reduction of the air pressure.

The apparatus involving the invention provides with other parts a specially constructed balanced valve, embodying spaced diaphragms in a cylinder, the diaphragms having operable connection with liquid pressure of the well, and being also subjected to air or gas pressure, the connection between the diaphragms and liquid pressure established by linkage means and a float.

The invention will be clearly understood from a perusal of the following detailed description, taken in connection with the accompanying drawing, and in the drawing:

Figure 1 represents a vertical sectional view, in broken formation, with parts broken away, of a well casing and the apparatus involving the invention,

Figure 2 is an enlarged view of the upper section of Figure 1 and partly sectioned,

Figure 3 is a cross-sectional view of Figure 2, the view being taken along the line 3—3 of said figure, and

Figure 4 is another cross-sectional view of Figure 2, taken lower down, and along the line 4—4 of Figure 2.

Referring to the drawing in detail and wherein like numerals and characters will indicate like parts, in Figure 1 is shown a well casing 1, and representing the lower end of such casing as installed in a well. The apparatus comprises a rounded end cylindrical member 2 with a valve 2—*a*, whereby there is provided a chamber A having a neck 3 to which is connected a check valve of ordinary construction as indicated at 4. Connected to the lower end of the check valve housing is a perforated stand or anchor pipe 5 for the entrance of oil into the chamber A. Extending downwardly into the member 2 at the top is a tubing 6, or eductor pipe, this pipe traversing a float indicated at 7, the float being made of balsa wood, cork or other suitable material. The float 7 is mounted on a sleeve 9, slidably arranged on the tubing 6, so that the float may rise and fall accordingly as the liquid in the well comes in contact with it. The upper end of the tubing or eductor pipe 6, as will be apparent from Figure 2, is formed integrally with or has connected thereto an air chamber B and into this chamber a constant pressure of air or gas is maintained.

The balanced valve, one of the important features of this invention, is shown in detail in Figure 2, and consists of two diaphragms in spaced relation carried on a valve stem 10 and disposed inside the cylinder 12. The lower diaphragm 13 has its marginal edges interposed between the bottom of the cylinder 12 and its conical terminating member 14, and the upper diaphragm 15 is placed in a similar manner between the upper end of the cylinder 12 and the cap thereof at 16. Both diaphragms are connected at their centers to the valve stem 10 in the manner shown or in any other suitable or convenient way.

Connected to the valve cylinder member 14, which has a screw threaded projection or neck 17, is a block 18, having a chamber 19, and through this neck extends the lower portion of the valve stem. The stem 10, between the lower diaphragm 13 and the chamber 19, is splined as at 20, and includes a tapered portion 21 and a slotted stem guide 22. The remainder of the valve assembly consists of the block 23, with a bore 24, and a threaded neck 26, the latter projecting upwardly into the chamber 19 and having a valve seat for the tapered portion 21 of the valve stem. The pipes which conduct the compressed air or gas from the chamber B are shown at 27 and 28, the lower end of the pipe 27 communicating with the chamber 19, and the pipe 28, communicating with the bore 24 in the block 23, leads to the chamber A in the bulb 2, as shown in Figure 1. The pipe 28 is provided with a safety valve 28—*a* for keeping oil from the working parts of the valve while being lowered into the oil of the well. Connected to the pipe 27 and communicating with the cylinder 12 is an equalizing air pipe 29 for the upper diaphragm 15; and similarly there is provided a differential equalizing air pipe 30, which is connected with the conical member 14 of the cylinder 12, and below the lower diaphragm 13, and this pipe leads to a point of connection with the pipe 28 below the block 23.

The float 7, carried on the slidable sleeve 9, is provided for the purpose of applying liquid pres-

sure of the well to the valve stem 10 of the valve assembly. The sleeve 9, through the linkage or tripper arrangement embodied in the bars 31, 32, 33 and 34, and spring 35, moves the valve stem upwardly, and thus lifts the tapered portion 21 from its seat in the neck 26 of the block 23, as in Figure 2. The bar 34 is provided with a yoke and is pivoted to the stem 10 connecting the two diaphragms, its central part being pivoted to the wall of the cylinder 12. The bar 32 is pivoted to the bar 31, and the longer of the bars, 33, is similarly connected to the bars 32 and 34.

In the operation of the apparatus, a constant pressure of air is held at the point B or in the chamber indicated thereby, which causes the same pressure to be exerted on top of the diaphragm 15 and also on top of the tapered portion 31 of the valve stem, when the valve is in a closed position. This, in turn, exerts approximately the same pressure on the lower diaphragm 13, but the pressure is a few pounds less due to the amount of air passed through the capillary differential equalizing pipe 30 and the size of the splines 20 in the valve stem 10. This air, passing through the equalizing pipe flows constantly during all operation and plays a very important part in the manipulation of the flow valve. As the fluid in the well rises in the bulb indicated at 2, it gradually covers the lower end of the air line or pipe 28, exerting a static pressure against the lower diaphragm 13, which, with the aid of the float 7, with its sleeve and pivotal linkage referred to, throws the valve, or tapered portion 21, from its seat, to an open position. When the valve opens, the pressure is equalized on the bottom diaphragm to that of the top diaphragm and is held open by the float, and the air passing down the pipe 28, closes the check valve 4 and the valve 2—*a* on the bulb 2, and thus forces the liquid of the well up and out of the eductor tube 6, to the top of the well. At the same time, this fluid or liquid is aerated by means of the orifices C. Upon the emptying of the bulb 2, and as the air velocity increases in the eductor tube 6, the pressure on the lower diaphragm 13 drops to such an extent that the valve slams shut, whether the float is in the liquid or not, and holds the valve in that position until the air line or pipe 28 is covered with sufficient fluid to throw the valve again in an open position. The oil that is standing up around the float surges with such force downwardly to fill the bulb 2, that the oil sands are kept clean; the parts are unaffected by sand because of the sand that slips off being forced out of the well with the oil, up the eductor tube. The cycle of operation is then repeated.

While there is shown and described, a practical working embodiment of the invention, it is to be understood, and will be obvious, that changes and modifications are possible therein, such as may be said to fall fairly within the scope and meaning of the appended claims.

What is claimed as new is:

1. An intermittent flow valve for oil wells, comprising a bulb-like body providing a chamber having an oil inlet pipe and check valve and adapted to be positioned in the lower part of a well, an oil eductor pipe projecting into said chamber and extending to the top of the well; a slidably arranged float; a cylindrical body positioned at the top of the well and providing an air chamber having spaced diaphragms therein and mounted on a splined valve stem, a valve element carried on said valve stem, a valve seat for the element; linkage means connecting said float to said valve stem, and an arrangement of pipes for applying air pressure to said diaphragms and to said chamber in the bulb-like body to operate said valve in connection with said float in lifting oil to the top of the well.

2. An intermittent flow valve for oil wells, comprising a hollow body providing a chamber having openings for pipe connections for inlet of oil and air pressure, a check valve, said body adapted to be positioned in the lower part of a well; an oil eductor pipe projecting into said chamber and leading to the top of the well; a float slidably arranged on said eductor pipe; a cylindrical body positioned adjacent the upper end of said eductor pipe and providing an air chamber, a splined valve stem in said air chamber, an upper and a lower diaphragm mounted in spaced relation on said valve stem; a block disposed below and connected to said air chamber and a block connected to said second block, one of said blocks having an air chamber and the other block having a bore; linkage means for operably connecting said float with said valve stem, and an arrangement of pipes for conducting air from a source under pressure to said air chamber in the cylindrical body and to said chamber in the hollow body in educting oil from the well.

3. An intermittent flow valve for oil wells, comprising a bulb-like body providing a chamber having an oil inlet pipe and a check valve, and adapted to be positioned in the lower part of a well, an oil eductor pipe and an air pipe projecting into said chamber; a slidably arranged float; a cylindrical body positioned at the top of the well and providing an air chamber having spaced diaphragms therein and mounted on a valve stem, a valve element carried on said valve stem, a valve seat therefor; linkage means connecting said float to said valve stem, and an arrangement of pipes for applying air pressure to said diaphragms and to said bulb-like body, in operating said diaphragms to maintain a balanced position of same, and in educting oil from the well; said arrangement of pipes including by-pass air pipes to maintain the diaphragms in said balanced and even pressure positions.

4. An intermittent flow valve such as claimed in claim 2, and wherein said air chamber and said bore in the blocks have a passageway connecting one block with the other, and a tapered valve stem element for opening and closing said passageway, accordingly as the diaphragms and the valve stem on which they are mounted are actuated by pressure of the well and air pressure.

5. An intermittent flow valve such as claimed in claim 3, and wherein said air pipe leading to said chamber includes a safety valve, said bulb-like body also including a valve at the upper part thereof, and said eductor tube having spaced orifices on the lower end thereof for aeration of liquid.

JOHN L. HALL.