Jan. 6, 1953 W. L. CHURCH 2,624,362

FLOW VALVE FOR FLUID LIFT PUMPS

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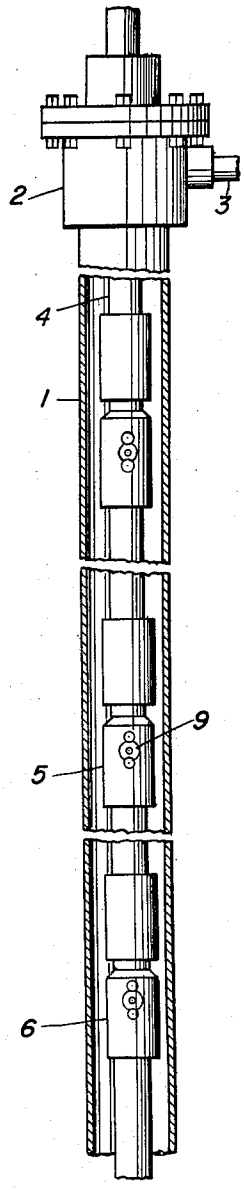

FIG. I

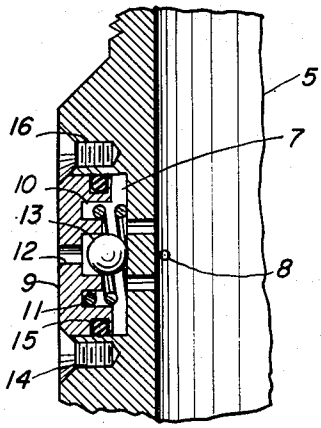

FIG. 3

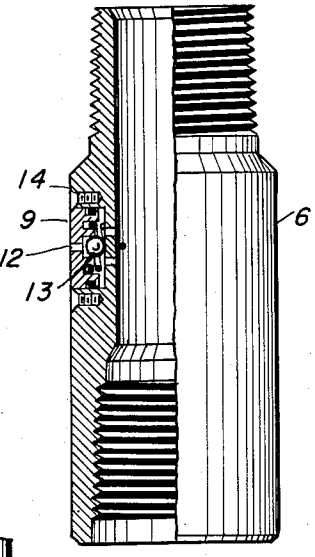

FIG. 2

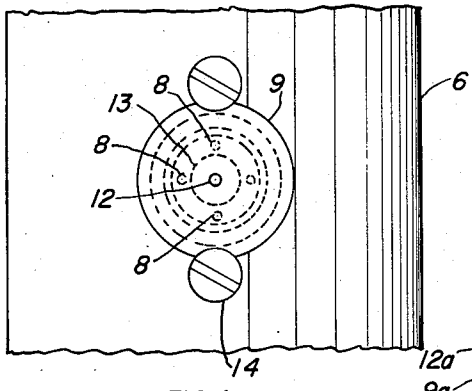

FIG. 4

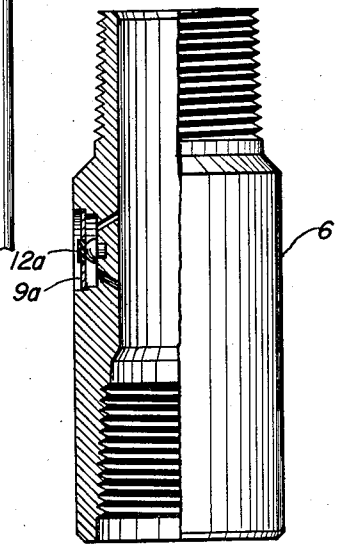

FIG. 5

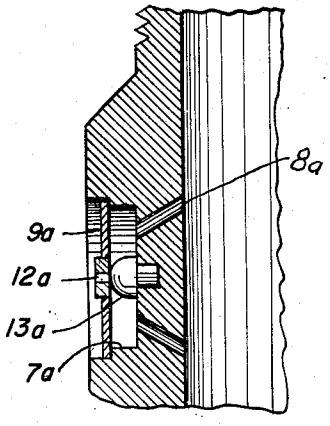

FIG. 6

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FLOW VALVE FOR FLUID LIFT PUMPS

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4 Claims. (Cl. 137—155)

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This invention relates to a flow valve for a fluid lift pump.

An object of the invention is to provide a valve assembly having a tubular body, or casing, which may be connected into a flow line and which is normally open and which is so constructed that it will be closed by an increase of external pressure.

Another object of the invention is to provide a valve assembly having inlet passageways with a movable seat subject to fluid pressure and which will control the flow of fluid through said passageways in accordance with variations in pressure against the seat.

The valve assembly has been especially designed for incorporation into a flow line in a well. In a practical application of the valve assembly a number of said assemblies will be incorporated into the flow line beneath the level of the liquid in the well casing and will be spaced a selected distance apart vertically so that as the pressure of the liquid in the well varies the valve assemblies will open and close to admit liquid from the well into the flow line in accordance with variations in pressure applied against the surface of the liquid in the well casing.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawing wherein:

Figure 1 is an elevational view of a well casing in a well, shown partly in section and showing the flow line therein.

Figure 2 is an elevational view, partly in section, of one type of the assembly.

Figure 3 is an enlarged, fragmentary sectional view thereof.

Figure 4 is an enlarged fragmentary side elevation thereof.

Figure 5 is an elevational view, partly in section of another embodiment of the assembly and,

Figure 6 is an enlarged, fragmentary, sectional view of the embodiment shown in Figure 5.

Referring now more particularly to the drawings the numeral 1 designates a conventional well casing having the well head 2 fixed thereon and provided with an inlet pressure line 3.

Within the well casing there is a flow line 4 whose lower end extends down into the well and is submerged in the liquid in the well casing.

Incorporated into the lower end of the flow line there are a plurality of flow valve assemblies indicated generally by the numeral 5. These assemblies are spaced apart a selected distance, usually about five hundred feet apart although they may be spaced further apart or closer together as the circumstances may require.

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Each assembly includes a tubular valve casing 6 forming a coupling member to couple the adjacent sections of the flow line. At one side the valve casing has an external recess 7 preferably circular in shape and leading inwardly from the recess through the wall of the casing 6 there are the spaced inlet ports 8, four of said inlet ports being shown.

Fitted in the recess 7 there is a valve disc 9 provided with an inside annular groove 10.

In this groove 10 and fitted against the bottom of the recess 7 there is a yieldable member, preferably a coil spring 11.

The disc 9 has a central inlet opening 12 and the inner side of the disc is counter-sunk around the opening thus forming an inside valve seat.

Between said seat and the bottom of the recess 7 there is a ball valve 13 which is located between the openings 8.

The disc 9 is retained against detachment in any preferred manner. As shown there are the oppositely disposed screws 14 which are screwed into the casing 6 and whose heads overlap the disc 9 as more clearly shown in Figures 3 and 4.

The spring 11 normally holds the seat disc 9 outwardly thus maintaining the seat open but external pressure in the well casing, which may overcome the pressure of the spring 11, may force the disc inwardly so that the seat will come into close contact with the valve 13 and close the inlet opening 12.

The valve seat disc 9 also has an external, annular groove 15 therearound to receive a ring 16 to prevent leakage past said disc.

In the form shown in Figures 5 and 6 the valve casing 6 has the inlet ports 8a similar, in purpose, to the ports 8 and between said ports 8a there is fixed to the casing a valve 13a having an outer oval head.

In this embodiment the casing 6 also has the countersunk recess 7 and spanning this recess there is a circular diaphragm 9a whose margins are countersunk into, and secured to, the valve casing around said recess.

The diaphragm 9a is preferably corrugated circularly so as to give the diaphragm the required flexibility.

This diaphragm has a central valve seat with an inlet opening 12a therethrough opposite the valve 13a and normally spaced outwardly from the valve so as to remain open.

In case of excessive outside pressure the diaphragm 9a will be forced inwardly by the pressure, moving the seat against the valve and closing the opening 12a.

In both forms of the valve assembly, if the

outside pressure is equal to or less than the pressure within the line the valves will remain open. But in case the pressure outside of the disc 9 or the diaphragm 9a is greater than the pressure within the line the corresponding valve will be closed by said outside pressure.

As shown each form of the valve assembly is equipped with only one valve but, as is obvious, each assembly may have two or more valves incorporated into the casing similar to those shown.

As hereinabove stated the valve assemblies will be incorporated into the flow line as shown in Figure 1 all beneath the level of the liquid standing in the well casing 1.

Fluid pressure is then applied through the pressure line 3 into the well casing against the upper surface of the liquid of the well and the liquid in the well casing will be forced in through the passageways 12, 8 or 12a, 8a into the flow line so as to force the liquid in the flow line upwardly and the flow will continue until the pressure of the liquid about the upper valve assembly is greater than the pressure in the flow line whereupon the disc 9, or diaphragm 9a, will be forced inwardly to close the valve and the fluid in the well casing, under the influence of the pressure against the liquid, will flow through the next succeeding valve assembly beneath, thus forcing the liquid on upwardly until said last mentioned valve assembly is closed, as hereinabove stated, and thereafter liquid will be forced inwardly through the next succeeding valve assembly beneath; however, the pressures within the flow line and within the casing outside the flow line vary depending upon conditions in the well. For example, the liquid level in the well casing may be forced downwardly beneath a valve assembly and the gas used as an operating fluid may flow in through said valve assembly and eject a quantity of liquid from the flow line above or break through the liquid in the flow line above, thus allowing the liquid above in the flow line to fall back down and temporarily increase the pressure of the liquid in the flow line.

In other words, the pressure of the liquid in the flow line within a valve assembly and the pressure of the liquid in the valve casing outside of a valve assembly may vary. So a number of valve assemblies should be distributed along the flow line beneath the normal level of the liquid in the well casing to the end that if one valve assembly is closed another assembly may be open to permit the pressure of the operating fluid to be at all times effective in forcing liquid from the well casing through one or the other of the valve assemblies to permit a constant upward flow of liquid through the flow line to be discharged at the ground surface through ordinary flow equipment of any selected construction.

What I claim is:

1. A flow valve assembly comprising, a tubular valve casing having a side inlet port, a movable valve seat carrier on the casing and sealed therewith and having an opening therethrough providing a valve seat and through which outside fluid may be admitted to said port and an inwardly opening recess surrounding said seat, a valve loosely mounted on the carrier and guidingly engageable with the carrier within said recess, abutment means on the casing engageable by the valve to limit inward movement of the valve to cause the seat to sealingly engage the valve to close the valve seat opening and exclude said fluid upon inward movement of the carrier, and means normally holding the carrier in its outer position to maintain the seat open.

2. A flow valve assembly comprising, a tubular valve casing having a side inlet port, a yieldably mounted movable valve seat carrier on the casing and sealed therewith and having an opening providing a valve seat through which outside fluid may be admitted to said port and an inwardly opening recess surrounding said opening, and a valve loosely mounted on said carrier and in guiding engagement with the recessed portion of the carrier, abutment means on the casing engageable by the valve to limit inward movement of the valve to cause the seat to sealingly engage the valve to close the seat opening and exclude said fluid upon inward movement of the carrier.

3. A flow valve assembly comprising, a tubular valve casing having a side inlet port and an external recess around the port, a movable valve seat carrier spanning said recess and in sealed relation with the casing, said carrier having an opening through which outside fluid may be admitted to said port and an internal recess about the opening, and a valve loosely mounted in the internal recess enclosed by said carrier and in guiding engagement with the carrier within said internal recess, abutment means on the casing engageable by the valve to limit inward movement of the valve to cause the carrier to sealingly engage the valve about said opening to close said opening and exclude said fluid upon inward movement of the carrier.

4. A flow valve assembly comprising, a tubular valve casing having a side inlet port and having an external recess around said port, a movable valve seat carrier on the casing enclosing said recess and having an inlet opening and an internal recess surrounding said opening, a valve loosely mounted in the internal recess and enclosed by said carrier and in guiding engagement with the carrier within said internal recess, abutment means on the casing engageable by the valve to limit inward movement of the valve to cause the carrier to sealingly engage the valve about said opening to close said opening and exclude said fluid upon inward movement of the carrier.

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