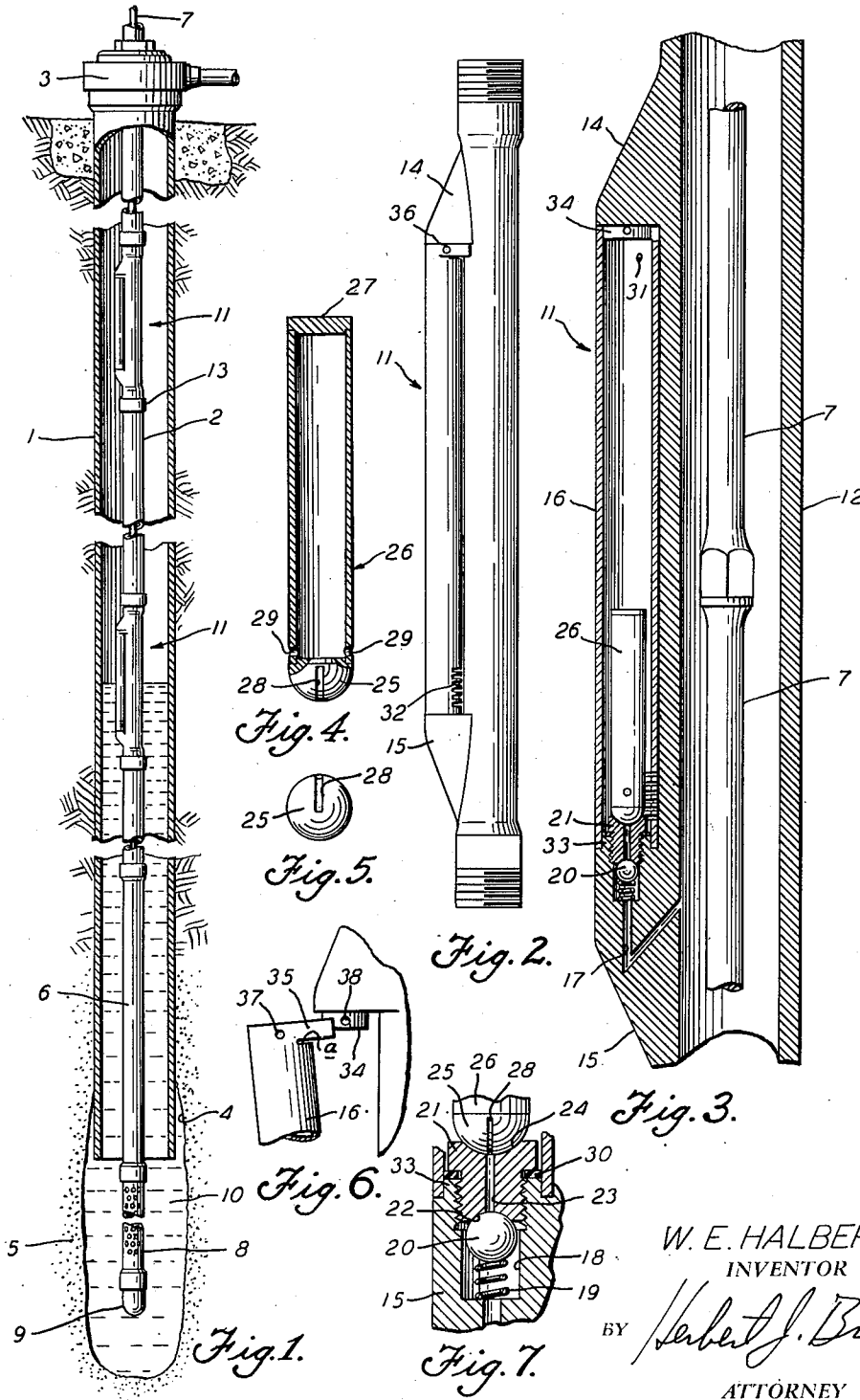


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VALVE FOR OIL WELL TUBING

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VALVE FOR OIL WELL TUBING

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3 Claims. (Cl. 103—5)

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This invention relates to oil well flow valves, such as those described and shown in United States Letters Patent Nos. 2,089,477 and 2,398,527, issued to me on August 10, 1937, and April 16, 1946, respectively.

An object of the invention is to provide a construction for valves of the referred to class whereby the same may be installed in wells and operated in conjunction with or independently of pumping equipment for raising the fluid to the earth's surface.

Another object of the invention is to provide an improved flow valve which may be operated in the usual manner and assist the pumping operation.

A further object of the invention is to provide a gas lift valve construction which will permit swabbing of the tubing.

A further object of the invention is to provide an arrangement for relieving the loads on sucker rods, particularly in deep wells.

A further object of the invention is to provide an arrangement whereby oil will be retained within a well tubing having flow valves therein even though the weight of the column of oil within the tubing is greater than the gas pressure within the well casing.

These and other objects of the invention will become apparent from the following description of the accompanying drawings, wherein:

Figure 1 is a vertical sectional view of an oil well and casing, and showing the present apparatus installed therein.

Figure 2 is an enlarged elevational view of a flow valve.

Figure 3 is an enlarged broken and vertical sectional view of the valve illustrated in Figure 2, and showing an embodiment of the present invention positioned therein.

Figure 4 is a vertical sectional and elevational view of the float illustrated in Figure 3.

Figure 5 is a bottom end view of Figure 4.

Figure 6 is a broken elevational view showing the upper end of the float chamber partly removed from the upper end of the valve assembly.

Figure 7 is an enlarged vertical sectional view of the valve portion of Figure 3.

In the drawings, the numeral 1 generally designates a well casing having a string of tubing 2 suspended therein by means of a casing head 3. The casing 1 extends downwardly in the well bore 4 and into the upper end of the well cavity 5. Beneath the string of tubing 2 there is a working barrel 6 having a pump mechanism therein, and which mechanism (not shown) is

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operated by a string of sucker rods 7 within the tubing and extending upwardly through the casing head 3. Beneath the working barrel 6 there is a perforated tube or screen 8 having a suitable bull plug 9 for closing its lower end.

The foregoing represents a typical installation for pumping oil 10 from the well cavity 5 and casing 1, upwardly through the tubing 2 to the earth's surface. Another means for raising the oil 10 to the earth's surface is by the installation of one or more flow valves 11 in the string of tubing 2.

Reference is herein made to my prior Patent No. 2,089,477 for illustrating and describing an exemplary form of flow valve. Generally, such valves have to do with a construction and arrangement whereby the gas pressure within the casing 1 is utilized for raising oil through the tubing 2, as illustrated in the present drawings. Such valves usually include a tubular sleeve 12 connected in the string of tubing 2 by means of collars 13. In the exemplary form of the invention shown in Figures 2 through 7, there are upper and lower vertically aligned spaced bosses 14 and 15 integral with the exterior of the sleeve 12 and have tapered outer surfaces which merge into the end portions of the sleeve. As shown in Figure 3, a tubular float chamber 16 is mounted longitudinally of the sleeve 12 and against the exterior thereof and between the bosses. The lower boss 15 is formed with a substantially V-shaped duct 17 which establishes communication between the sleeve 12 and the interior of the float chamber 16. The upper end of the outer leg of the V-shaped duct 17 is provided with an enlarged recess 18 having a compression spring 19 therein and a ball check 20 positioned on the upper end of said spring. The recess 18, spring 19, and check 20 have to do with improvements in flow valves generally, and particularly in the flow valves of the referred to patents. A shouldered retainer 21 is threadably engaged in the upper end of the recess 18 and is provided with a valve seat 22 at its lower end for receiving the upper surface of the ball check 20. A duct 23 is formed through the axial center of the retainer 21 and is provided with another valve seat 24 at its upper end for receiving and seating the semi-spherical lower end 25 or valve of a hollow cylindrical float 26. The upper end of the float 26 is closed by a disk 27 which is preferably cemented in place. The semi-spherical lower end 25 is also cemented in place and is provided with a minute radial kerf 28

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in its surface. In the drawings, the width of the kerf is exaggerated to better illustrate the same. Pressure equalizing holes 29 are provided in the wall of the float 26 near the semi-spherical end 25 to prevent the float from collapsing. A washer 30 may be provided between the shoulder of the retainer 21 and the upper end of the boss 15 to prevent leakage therebetween.

A vent hole 31 is provided in the upper end of the chamber 16 so as to allow the float 26 to rise or fall with the changing level of the oil 10 within the casing 1. A plurality of parallel horizontal slits or narrow slots 32 are formed in the lower portion of the chamber wall adjacent the float valve seat 24 for establishing communication between the interior of said chamber and the annular space between the casing 1 and tubing 2. It is pointed out that the slits 32 are disposed adjacent the sleeve 12 to prevent clogging of said slits upon lowering the said sleeve through the well casing, and are relatively narrow so as to prevent the passage of sand or other debris therethrough.

A suitable annular projection 33 is provided on the upper surface of the lower boss 15 to receive the lower end of the chamber 16. Similarly, another annular projection 34 is provided on the lower end of the upper boss 14 for receiving the upper end of the chamber 16. The upper end of the chamber is notched, as at *a*, on one side thereof and a yoke 35 is provided on each side of the notch for engaging the surface of the sleeve 12 and preventing rotation of said chamber. By reason of the notch *a*, the upper end of the chamber 16 may be moved outwardly, and by then lifting the same upwardly, the chamber 16 may be removed from its position adjacent the sleeve 12. By reversing the last procedure, the chamber 16 may be installed adjacent the sleeve 12. A removable pin 36 is positioned through aligned openings 37 and 38 in the upper end of the chamber 16 and the projection 34 of the upper boss 14, respectively, for securing the chamber in place.

In operation, one or more of the flow valve units 11 are connected in the string of tubing 2 at spaced elevations. If the liquid rises above one of the units, it will enter the chamber 16 through the slots or openings 32 and elevate the float 26, whereby the valve end 25 will be lifted from the valve seat 24. As the tubing 2 will contain liquid up to the level in the casing 1, no liquid will flow through the duct 17. However, when gas pressure is built up on top of the liquid it will be forced through the retainer 21, past the ball check 20, through the V-shaped duct 17, and into the string of tubing, whereby the liquid in the tubing will be elevated in the same. When the liquid level recedes below the slots 32 in the lower end of the chamber 16, the float 26 will recede and substantially close the duct 23 through the retainer 21, and thereby allow gas pressure to build up again within the casing 1 above the affected unit 11.

When the liquid is below one or more of the units 11, gas under pressure within the casing 1 will enter the tubing 2 by way of the described minute kerf 24 in the semi-spherical end 25 of the float 26. The gas thus entering the tubing 2 will aerate the liquid therein and thereby lighten the pumping loads.

Heretofore, flow valves could not, in most cases, be used in conjunction with pumping apparatus because the weight of the oil within the tubing

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exceeded the gas pressure within the casing. The differential of pressures caused the liquid to run outwardly through the valve units. By reason of the described check 20, oil within the tubing 2 may be maintained in spite of its weight, and pumped to the earth's surface. Manifestly, when the gas pressure within the casing 1 is sufficient it will enter the tubing through one of the flow valve units 11 and assist in raising the liquid. Less power will be required for the pumping operation, and the loads on the sucker rods 7 will be reduced. It will also be apparent that swabbing of the tubing 2 will be made possible by reason of the check 20 since pressures within the tubing will be retained.

The improvements herein described are not limited to United States Letters Patent Nos. 2,089,477 and 2,398,257, but may be used in connection with other flow valves within the scope of the appended claims.

What is claimed is:

1. In a fluid pumping mechanism having a well tubing and pump connected with the lower end thereof positioned within a well casing and including a string of reciprocating sucker rods extending through said tubing and connected with said pump, a tubular member of substantially the same diameter as said tubing connected within the length of the latter above said pump and receiving said string of sucker rods therethrough, a valve seat in said tubular member positioned to one side of said string of sucker rods, a valve element of the type which is at least partially operated by gas pressure in the well annulus between said casing and said tubing, said element being movably supported by said tubular member and adapted to engage said valve seat, a passage connecting said valve seat with the interior of said tubular member, another valve seat within said passage and oppositely arranged relative to the first said valve seat, and a check valve member within said passage adapted to engage the second said valve seat.

2. In apparatus for raising liquid upwardly through tubing within the casing of an oil well as defined in claim 1, the construction wherein the first said valve element is in the form of a float adapted to be raised from the first said valve seat by well formation liquids rising upwardly in the annulus between said tubing and said casing.

3. In a fluid pumping mechanism having a well tubing and a pump connected with the lower end thereof and including a string of reciprocating sucker rods extending through said tubing and connected with said pump, a tubular member of substantially the same diameter as said tubing connected within the length of the latter above said pump and receiving said string of sucker rods therethrough, a valve seat in said tubular member positioned to one side of said string of sucker rods, a float valve carried by said tubular member and adapted to engage said valve seat, a passage connecting said valve seat with the interior of said tubular member, another valve seat within said passage and oppositely arranged relative to the first said valve seat, a check valve member within said passage and adapted to engage the second said valve seat, and a spring mounted within said passage and engaging said check valve member for normally retaining the latter in engagement with the second said valve seat.

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