June 11, 1929. W. T. SMITH 1,716,709

WELL PUMP

Filed May 4, 1925

Fig. 1

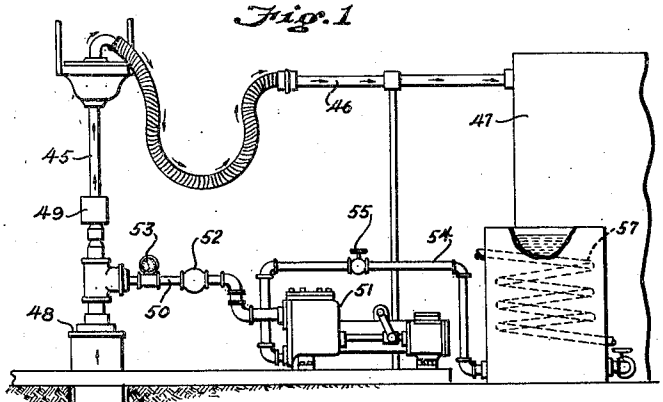


Fig. 2

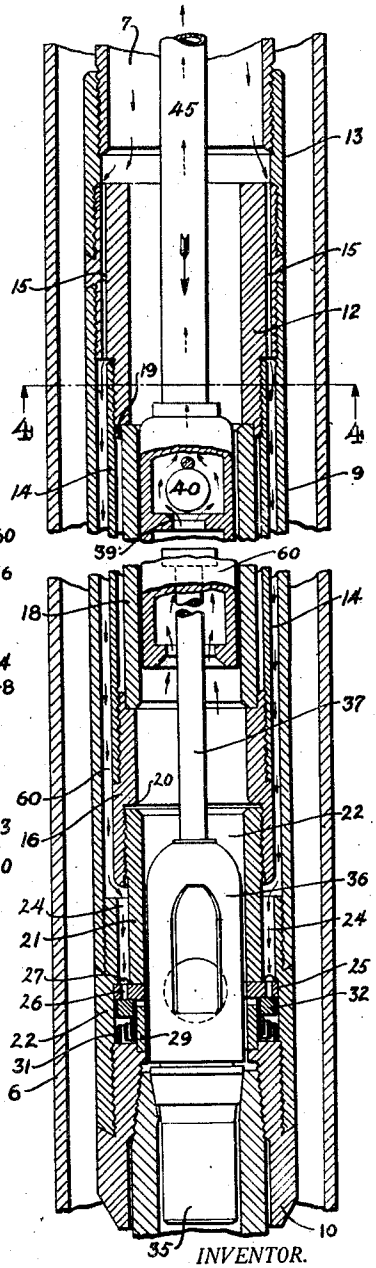


Fig. 3

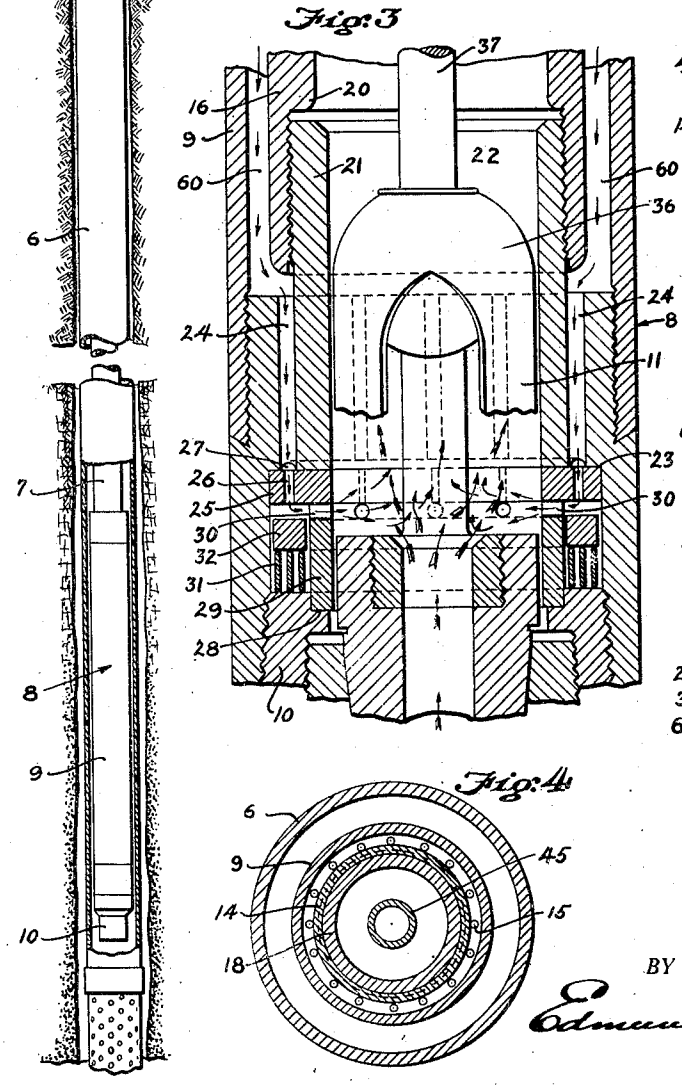


Fig. 4

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UNITED STATES PATENT OFFICE.

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WELL PUMP.

Application filed May 4, 1925. Serial No. 27,730.

This invention relates to improvements in oil well pumps of the type illustrated and described in an application for patent filed by me entitled "Method of and apparatus for pumping sand laden oil wells", Serial No. 709,887, filed in the U. S. Patent Office April 29, 1924, patented Mar. 24, 1925, #1,530,624. In the said application a solvent or liquefying agent was introduced under pressure into the pump chamber beyond the piston on a non-pumping stroke of the piston, in order to further liquefy the heavy sanded hydro-carbons so that the same could be successfully pumped without undue or excessive wear on the pump parts. This system has proved highly satisfactory in actual operation on heavily sanded wells, some wells in which the hydro-carbons were so heavily impregnated with sand and other foreign matter that the same could not be efficiently pumped, readily responding to a pumping operation, and producing oils in paying quantities.

In order to further increase the efficiency of the above described apparatus, I have provided in the structure hereinafter described a mechanism for effectively introducing the liquefying agent (such as heated oil) under pressure directly against and around the seat of the standing valve, thus effectively preventing any undue cutting action of the valve seat or its cage.

It is one of the objects of this invention to provide a valve mechanism adapted to be operated on the non-pumping stroke of a well pump to deliver under pressure a liquefying agent directly around and against the seat of a standing pump valve construction, whereby to effectively liquefy heavy or sand laden hydro-carbons upon their entrance into the pump barrel, and to automatically render inoperative said valve mechanism during a pumping stroke.

A further object is to provide a mechanism that is of simple construction, not easily disorganized, and one that is highly efficient in operation.

This description is to be regarded as descriptive only and not as restrictive or limitive of the invention, of which obviously an embodiment may be constructed including many minor modifications without departing from the general scope herein indicated and hereinafter claimed.

In the drawings hereto attached and forming a part of the following specification:

Fig. 1 is a longitudinal section through the upper portion of an oil well showing the pump barrel in place therein, and connected at the top with the operating mechanism.

Fig. 2 is an enlarged longitudinal section of the improved apparatus on a pumping stroke of the well pump.

Fig. 3 is an enlarged longitudinal section of the valve mechanism in an operative condition, the arrows thereon indicating the flow of oil and solvent on a non-pumping stroke.

Figure 4 is a section on line 4—4 of Figure 2.

As heretofore set forth the main features of the apparatus and method of operation are in all respects essentially the same as in my companion application, heretofore mentioned, the improvement mainly consisting in delivering the liquefying agent directly to the standing valve construction. Mounted in the well bore 5, is the usual well casing 6, composed of a plurality of coupled sections. Suspended within the casing 6 at the proper depth, and detachably secured to the lower end of the well tubing 7, is a pumping mechanism 8, preferably consisting of a stationary outer barrel 9, having a shoe 10 secured to the lower end thereof in which is mounted the standing valve 11, all of usual construction.

The upper and lower ends of the barrel 9 are internally threaded, a sleeve member 12 having exteriorly threaded ends engaging the upper end of the barrel, and coupling 13 securing the barrel 9 to the well tubing 7. The lower end of sleeeve 12 is of smaller exterior diameter than the upper end and is adapted to threadingly engage the upper end of an elongated tube 14. Formed in the thicker wall of sleeve 12, are a plurality of circularly arranged vertically disposed oil ports or bores 15, designed to direct the liquefying agent introduced through the well tube 7 to the standing valve, as will be more particularly explained hereinafter.

Secured in screw threaded engagement with the lower end of tube 14, is a short sleeve 16 having an annular seat 17 on its upper end for the reception of the lower end of the pump liner 18, the upper end of the liner being seated in a similar seat 19 formed

on the lower end of sleeve 12, the sleeves 12 and 16 when attached to the ends of tubes 14 securely holding the liner 18 in position in the pump barrel. The lower end of sleeve 16 is of larger diameter than the upper end to provide an annular shoulder 20 for the upper end of a cylindrical valve housing member 21. This member is provided with a bore 22 at its upper end substantially equal to the diameter of the pump liner, while the bore 23, at the lower end is considerably larger in order to provide space for mounting a spring operated valve mechanism. The external diameter of the upper end of the housing is considerably less than the diameter at its lower end, in order to provide for a plurality of circularly arranged vertically disposed ports 24 formed in its cylindrical wall, said ports leading from the annular space 60 surrounding the tube 14 and communicating with the enlarged bore 23, as clearly shown in Fig. 3 of the drawings. Mounted within this bore at the upper end thereof, is a flat ring 25, provided with a plurality of vertically disposed ports or bores 26, their upper ends communicating with a circular groove 27 that connects the ports 24 formed in the housing wall. The lower end of the housing member 21 is internally threaded for the reception of the upper threaded end of the shoe 10, of usual form, its upper inner edge being provided with a seat 28 in which is mounted a short sleeve or ring 29, its upper edge provided with a plurality of radially disposed ports 30 and bearing against the under face of the flat ring 25, to hold the same in position when the pumping mechanism is assembled. Disposed within the annular space formed by the ring 29 and the inner peripheral wall of the enlarged bore, is a flat helical spring 31, which supports a valve closure ring 32, that normally contacts with the under face of ring 25 to close the ports 26 formed therein, as shown in Fig. 2.

The standing valve seat 35 is secured to the shoe 10, in the usual manner, and the cage 36 is provided with the usual "Garbutt" rod 37, that projects through the opening formed in the lower end of the pump plunger 38 that reciprocates in the pump liner. Pump plunger 39 is hollow and provided midway of its ends with a partition 40 having a centrally disposed opening therein, the upper edge of the opening being beveled to form an annular seat for the ball valve 41. As all of the above described mechanism is of usual form, and further as it does not form a part of the invention, a more specific description of the same together with its operation is not thought to be necessary.

Well tubing 45 connects at its lower end with the plunger 39, and at its upper end by a pipe line 46 to an oil storage tank 47 located at a suitable distance from the well being pumped. The upper end of the pump barrel is sealed by a screw plate 48, and the well tube reciprocates vertically through the usual stuffing box 49 at the upper end of the pump barrel.

In order to intermittently introduce a solvent or liquefying agent to the interior of the pump barrel in advance of the plunger, a pipe line 50 leads from the upper end thereof and is connected to a lubricant feed pump 51 of any approved design. Interposed in pipe line 50 is a ball check valve 52, and a pressure gage 53 designed to indicate the pressure of the oil within the pump barrel during the operation of the pump. Pump 51 is supplied with a liquefying agent, preferably crude petroleum, through pipe line 54, controlled by a valve 55 connected to a pump supply tank 56, that is in turn connected by valve controlled pipe line to the storage tank. In order to increase the fluidity of the oil in the tank 56 should the same be of excessive sand laden character, a steam coil 57 suitably connected to a steam line is mounted therein.

It will be understood that the above described apparatus is exactly similar in form and operation to the apparatus described in my companion application heretofore mentioned, the function of that apparatus, which is the main object of this invention, being to sufficiently liquefy the sand laden oil in order that the same may be pumped without injury to the mechanism.

When the pump is started and the plunger is in its lowermost position (see Fig. 2), the feed pump is set in operation to deliver a volume of heated oil under pressure to the pump barrel at the upper end thereof, the heated oil completely filling the chamber of the pump barrel and the chambers of the plunger, the oil passing upwardly through the well tubing 45 through pipe line 46 to the storage tank. In this position the pressure exerted by the pump plunger on the oil in the barrel will be sufficient to overcome the pressure of the feed pump, and as a consequence the flat helical spring will force the flat valve ring 32, against the ports 26 in ring 25 to close the same.

On a return movement of the plunger (its non-pumping stroke), as shown in Fig. 3, the oil in the pump barrel above the plunger will exceed the pressure of the oil beyond the check valve 55, to close the same and force the heated oil downwardly through the well tubing, ports 15 in the sleeve 12, and the annular space 60, surrounding tube 14, through the ports 24 in the housing, ports 25 in the ring 26, the pressure of the oil forced by the feed pump being sufficient to operate the valve 32, to unseat the same and permit the oil to flow through ports 30, into the chamber directly above the seat of the standing valve (see

Fig. 3). As the streams of heated oil are forced directly against the valve seat they will co-mingle with the stream of sand laden oil flowing upwardly through the standing valve completely liquefying the same so that they may be efficiently pumped without injury to the pump packings and mechanism. Further as the heated oil is delivered directly against the standing valve seat, no choking will occur, the ball valve seating properly on a return stroke of the plunger.

When the pump plunger has reached the limit of its upward movement and the downward or pumping movement is begun, the check valve 55 will automatically open as the pressure on the oil in the upper portion of the pump barrel is relieved to permit of a fresh supply of liquefying oil to the chamber of the pump barrel and from thence through the valve ports to the standing valve. As the plunger continues to descend the standing valve will automatically be sealed, and the oil thereabove will be forced upwardly through the hollow plunger and the well tubing 45 to the storage tank. It will be understood, as heretofore explained, that the pressure in the pump barrel below the plunger exceeds the pressure above the pump plunger, and the helical spring 31 will force the valve ring 32 against the ports 26 and 30 to close the same.

By placing a check valve in the pipe line 50 all back pressure on the feed pump 51 is relieved, thereby eliminating any danger of destroying or otherwise injuring the pump packings or valve seats of the pump.

By intermittently introducing on the non-pumping stroke of the pump, a fluid oil for liquefying the heavy sand laden oil issuing from the well, I am enabled to efficiently pump such oil with little difficulty.

What I claim is:

1. A valve construction for deep well pumps comprising a pump barrel, a tube concentrically mounted within said barrel and rigidly secured thereto in spaced relation to form an annular fluid passage, said passage open at its upper end and communicating with the pump barrel at its lower end, a valve for controlling the lower end of the passage, and a spring acting against the valve to normally seat the same.

2. A valve for oil well pumps comprising a pump barrel, a tube concentrically mounted within said barrel and spaced therefrom to form an annular fluid passage open at its upper end, said barrel and tube being rigidly connected together at their lower ends, said tube having a series of fluid ports communicating with the annular fluid passage at its lower end, a valve closure for controlling the ports, and a spring for normally seating the valve closure.

3. A valve construction for oil well pumps comprising a pump barrel, a tube concentrically mounted in said barrel and rigidly secured thereto at its lower end to form a fluid passage open at its upper end, said tube having a series of fluid ports at its lower end communicating with similar ports leading to the lower end of the fluid passage, a ring valve for controlling all the ports leading to the fluid passage, and a flat helical spring for normally seating the valve ring.

In witness that I claim the foregoing I have hereunto subscribed my name this 13th day of April, 1925.

WILSON T. SMITH.