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ELECTRIC HEATER FOR OIL WELLS

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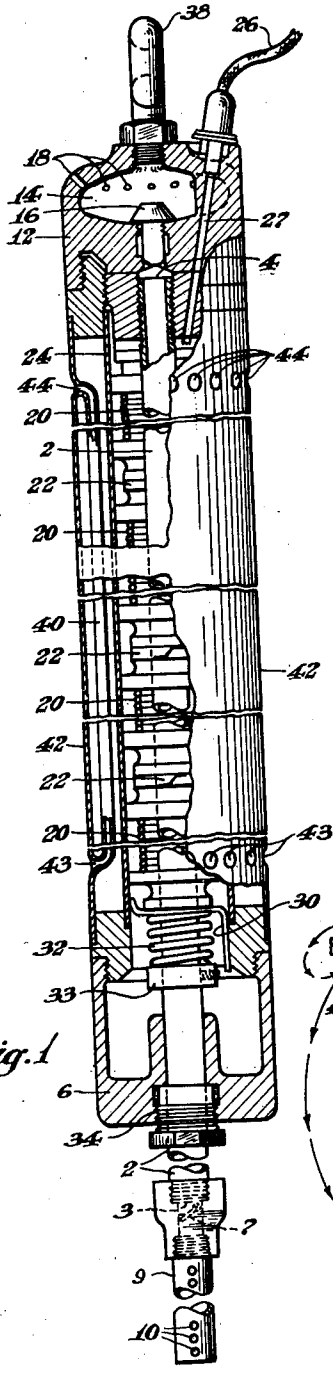


Fig. 1

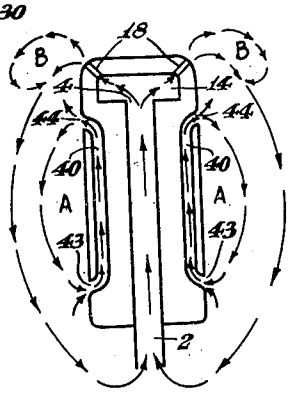


Fig. 3

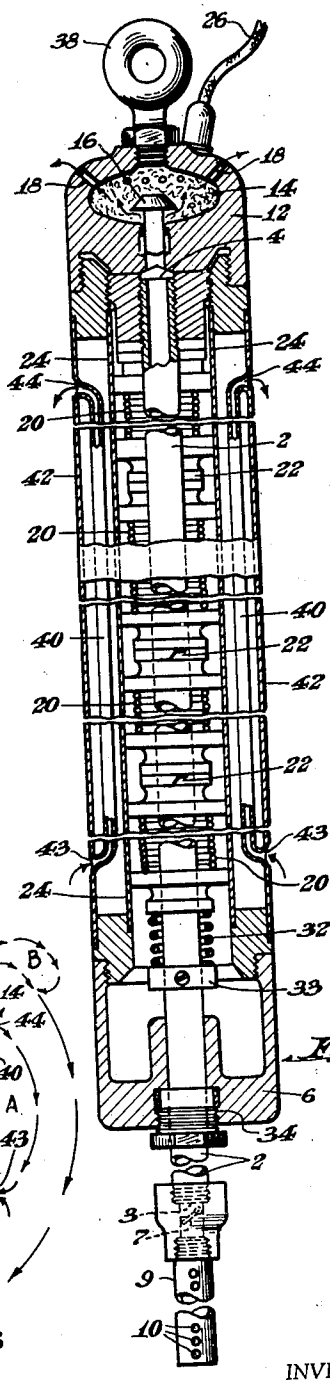


Fig. 2

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ELECTRIC HEATER FOR OIL WELLS

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3 Claims. (Cl. 219—33)

This invention relates to electric heaters, and more particularly to those which are adapted to be lowered into an oil-well and when so disposed to heat the same by electric current generated at and communicated from the surface.

In the past numerous attempts have been made to provide an apparatus of the type described which would satisfactorily function to soften and liquefy the congealed, solid, and semi-solid products of petroleum occurring in oil-wells after a period of prolonged pumping and which obstruct the natural flow of oil. So far as I am aware, none of these apparatus of the prior art have been very successful due to different shortcomings from the standpoint of design.

It is among the objects of the present invention to provide an electric heater for oil-wells and the like which will efficiently function in the desired manner.

Another object is the provision of an apparatus of the class described which is simple and inexpensive to manufacture, operate and maintain.

Still another object is to provide an apparatus for the purpose stated which will produce the desired results in a very short period of time.

The invention, then, comprises the features hereinafter more fully described and as particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative of but one of a number of ways in which the principles of the invention may be employed.

In said drawing:

Figure 1 is a vertical elevation, mostly in section, of the apparatus of the present invention, illustrating the position it will assume when in operation.

Figure 2 is a view similar to that of Figure 1, but at right angles thereto, some of the parts thereof being shown in positions they will occupy during one stage of their operation, as will be described more fully hereinafter.

Figure 3 is a flow diagram illustrating the manner in which primary and secondary circulation and agitation is provided, whereby the rate of heating of the oil well is materially increased.

Referring more particularly to the drawing, the numeral 2 designates an elongated tube defining a vertical passageway having a liquid intake port 3 at the bottom thereof and a liquid exhaust port 4 at the top. This tube 2 is adapted to receive oil in liquid form through the intake port 3, vaporize the same, and to discharge the vaporized oil through the exhaust port 4 at the upper end of the tube after it has attained a predetermined temperature.

Adjacent its inlet port 3 the tube 2 is provided with a check valve 7 from which there depends an anchor pipe 9 having perforations 10 therein to permit the ingress of oil in liquid form.

To the upper end of the tube 2 there is secured an upper header 12 having a pressure dome 14 therein. The exhaust port 4 of the tube 2 communicates with the pressure dome 14 by means of a check valve 16. From the pressure dome 14 the vaporized oil is diffused through a series of apertures 18 arranged in the side wall of the upper header 12.

In order to enable the softening and liquefication of the congealed, solid, or semi-solid products of petroleum, and the vaporization of liquid oil which is received within the tube 2, there is arranged around and exteriorly of the latter a plurality of superposed electrical heating elements 20 which are electrically conected to each other in order that all may be energized from a single source.

Preferably these electrical heating elements 20 are tubular-shaped, and are assembled by telescoping th same over the tube 2. Preferably, too, the superposed electrical heating elements 20 are electrically connected for quick detachability and reassembly, in order to enable rapid replacement. For this purpose there may be employed a bayonet type of connector which is generally indicated in figure at 22.

The superposed electrical heating elements 20 are enclosed by a tubular casing 24 which extends between the lower and upper headers 6 and 12, respectively.

The uppermost of the electrical heating elements 20 is supplied with electric current from an input wire 26 which leads to the surface of the well and is connected to a suitable source of energy (not shown). This input wire 26 is connected to a conductor 27 which extends through the upper header 12 and makes contact with the upper end of the wire of the uppermost electrical heating element 20 in any suitable manner. The lower end of the wire of the lowermost electrical heating element 20 is grounded to the tube 24 by means of a conductor clip 30, thus completing the circuit.

The lowermost of the electrical heating elements 20 rides upon a retainer spring 32 which encricles the tube 2 and rests upon a lock ring 33 which is secured to the latter. This construction and arrangement permits the electrical

heating units 20 to move relative to the tube 2 due to temperature changes, and also provides a cushioning effect against shock. In addition, it has been found desirable to provide that portion of the bottom header 6 through which the tube 2 extends with a packing gland 34 to thereby eliminate the ingress of liquids and gases at this point.

When the apparatus described hereinbefore is lowered into an oil-well, as by mean of a cable secured to a cable ring 36 which is carried by the upper header 12, and the electrical heating elements 20 are energized through the input wire 26, there will be softened and liquefied the congealed, solid and semi-solid products of petroleum occurring in oil-wells after a period of prolonged pumping, which obstruct the natural flow of oil. The check valve assembly carried on the lower end of the tube 2, and exteriorly of the lower header 6, admits liquefied oil into the tube 2 after it has reached a predetermined temperature. In this manner liquefied oil rises in the tube 2 until it reaches the check valve 16, which provides communication between the exhaust port 4 of the tube 2 and the pressure dome 14 provided within the upper header 12. The check valve 16 remains closed until the liquefied oil within the tube 2 reaches the boiling point, at which time it will open and permit the vaporized oil to be released into the pressure dome 14, from which it is diffused into the atmosphere in the well through the apertures 18.

In the foregoing manner there will be provided a circulation of vaporized oil and the induction of flow of oil in the direction of the arrows B of Figure 3.

In accordance with the teachings of the invention, there is enhanced the heating and circulation of the liquefied oil by means of a primary heater and agitator which is disposed exteriorly of the vertical passageway provided by the tube 2. According to a permissive embodiment, this means takes the form of a series of vertically-extending tubes 40 which are disposed peripherally of the tubular casing 24 and axially parallel therewith. Enclosing these tubes 40 is a housing member 42 which is connected at its lower and upper ends to the lower and upper headers 6 and 12, respectively. This housing member 42 is provided in its side wall with a series of lower apertures 43 and a series of upper apertures 44 which communicate respectively with the lower and upper ends of the tubes 40. It is to be noted that the tubes 40 are not provided with check valves or other instrumentalities designed to impede the flow of liquid oil therethrough. Accordingly the liquid oil is permitted to flow into the apertures 43 in the lower end of the housing 42 at all times, and to rise therein due to the heat imparted thereto by the electrical heating elements 20. Thus the heated oil continuously circulates upwardly through the tubes 40 and out of the apertures 44 adjacent the upper end of the housing 42. This provides for a continuous circulation or agitation, as illustrated by the arrows A of Figure 3.

Due to the two separate circulating systems collectively functioning in the manner set forth, the rapid transfer of heat and liquefication of the oil is materially enhanced.

In addition to the foregoing elements, it will be understood that numerous refinements may be incorporated, as, for example, a thermocouple (not shown) whereby the temperature attained may be determined from the surface of the well.

While I have shown and described certain specific embodiments of the present invention, it will be readily understood by those skilled in the art that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention as defined by the following claims.

I claim:

1. An elongated tubular oil well heater, including a central axial flow tube having a spaced inlet and outlet, a second axial flow tube spaced laterally from the first tube, electrical heating means adjacent to and heating both tubes, a tubular housing enclosing said tubes and heating means, the second tube having an axially spaced inlet and outlet laterally through said housing, an upper hollow header communicating with the central tube and having fluid discharge ports therein, and a pair of axially spaced fluid actuated valves in the central tube controlling the flow of fluid to and from the latter.

2. An elongated tubular oil well heater, including a central axial flow tube having a spaced inlet and outlet, electrical heating means surrounding said tube, a series of second axial flow tubes surrounding said heating means, a tubular housing enclosing all of said tubes and the heating means, the second tubes each having an axially spaced inlet and outlet laterally through said housing, an upper hollow header communicating with the central tube and having fluid discharge ports therein, a fluid actuated valve controlling the admission of fluid to said header, and a fluid actuated valve controlling the admission of fluid to said central tube.

3. An elongated tubular oil well heater, including upper and lower headers and an outer tubular housing extending therebetween, the upper header being hollow and having fluid outlets in the upper portion thereof, a flow tube communicating with the interior of the upper header and extending centrally of the housing, said tube having a fluid intake port, electrical heating means surrounding the tube within the housing, a tubular casing enclosing the heating means and spaced inwardly from the outer housing, a second flow tube disposed between said casing and the outer housing having a fluid inlet and outlet through the latter spaced axially of the heater, fluid actuated valves in the first flow tube spaced axially of the heater, and said second flow tube extending in the region of the electrical heating means, whereby the heat from the latter induces a flow of oil upwardly through the first tube for discharge through the outlets in the upper header, and sets up a continuous heating and circulating flow in a body of oil in which the heater is immersed by flow through said second flow tube.

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