H. PENNINGTON.

OIL WELL HEATER.

APPLICATION FILED OCT. 29, 1920.

1,426,407.

Patented Aug. 22, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

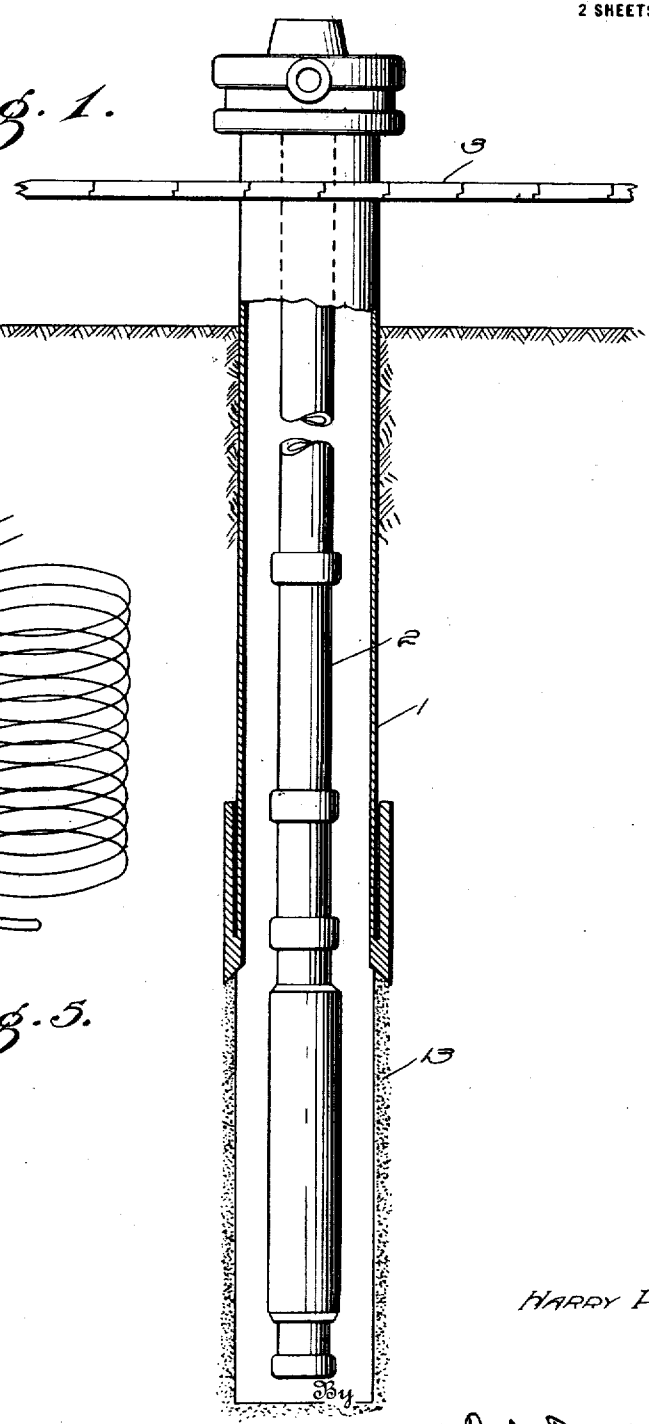


Fig. 5.

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2 SHEETS—SHEET 2.

Fig. 2

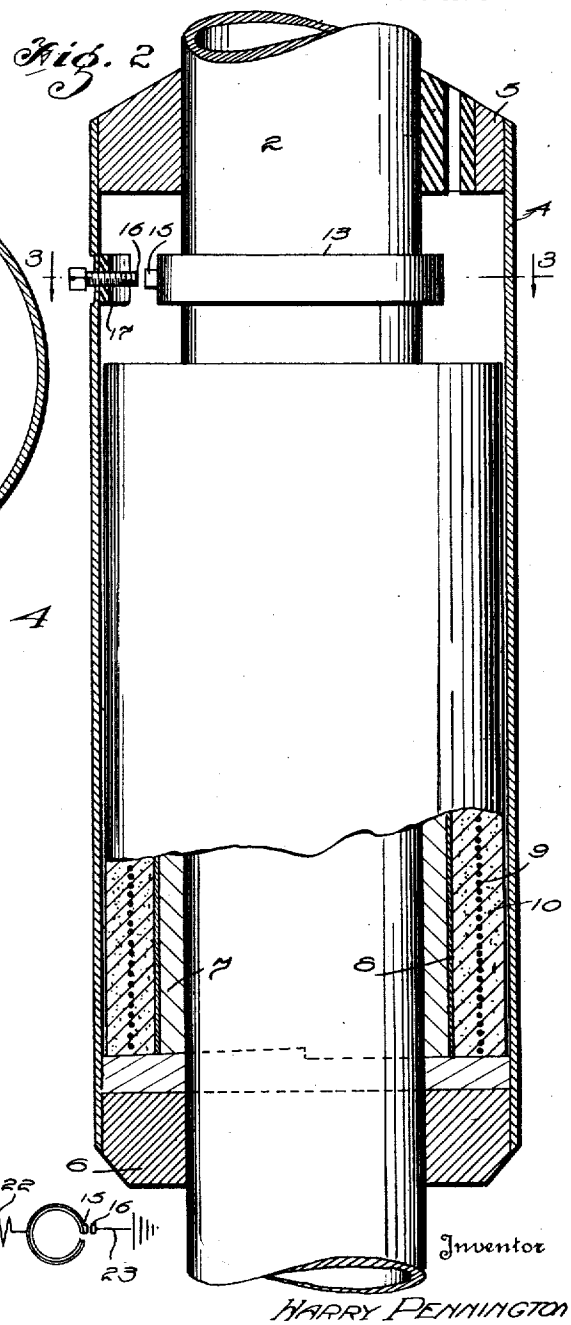


Fig. 3.

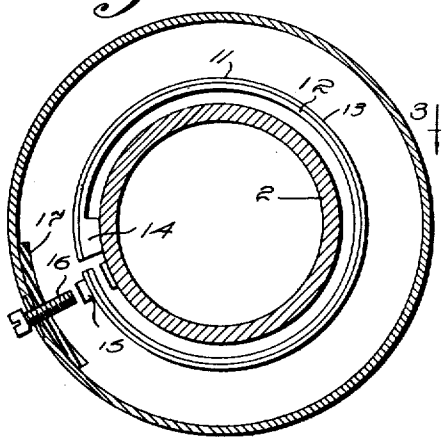
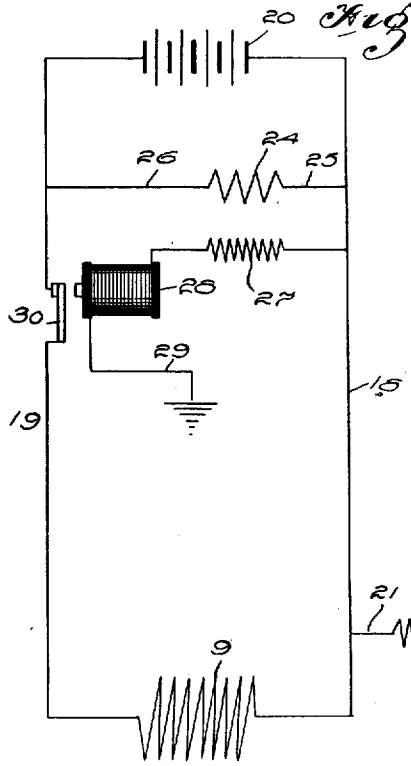


Fig 4



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UNITED STATES PATENT OFFICE.

HARRY PENNINGTON, OF WICHITA FALLS, TEXAS.

OIL-WELL HEATER.

1,426,407. Specification of Letters Patent. Patented Aug. 22, 1922.

Application filed October 29, 1920. Serial No. 420,498.

To all whom it may concern:

Be it known that I, HARRY PENNINGTON, a citizen of the United States, residing at Wichita Falls, in the county of Wichita and State of Texas, have invented certain new and useful Improvements in Oil-Well Heaters, of which the following is a specification.

This invention relates to oil well heaters, and it comprises a heater arranged in an air tight casing at the bottom of an oil well, said heater surrounding the well tube and being separated therefrom by a layer of heat insulating material, and a layer of air and water tight material, said heater comprising a coil of resistance or heating wires arranged in a body of cement of electrical refractory material, a thermostat arranged in the well, and a relay in circuit with said thermostat, and adapted, when energized, to open a switch in the main circuit and cut off the supply of current to the heater; all as more fully hereinafter set forth and as claimed.

In obtaining oil from wells, the oil is raised by pumps or like apparatus from the sand in which it is present. Oil is held in sand by capillary attraction and by accumulations of paraffin or asphalt. The viscosity of crude oil is relatively high and it does not flow readily. It is therefore impossible, under present methods, to obtain very efficient extractions.

The present invention relates to a method of extracting oil from wells, wherein the oil is heated to reduce its viscosity and lower the capillary attraction between the oil and sand whereby the oil flows more readily and a larger percentage may be removed from the oil sand. When the well is heated, the paraffin or asphalt is liquefied, permitting the oil to flow more freely through the pores of the sand.

Several methods of removing oil from wells wherein a heater is placed in the bottom of the well, have been proposed, but such methods have not been wholly satisfactory. In some cases, heating wires have been arranged in the well in an exposed position and water, especially salt water, coming in contact with the wires has caused short circuiting and corrosion. To elimilate the difficulty the heating wires have been inclosed in a casing, but no efficient means have been provided for transmitting the heat outwardly to the oil sand. Air is a poor heat conductor and in such constructions, it has generally been necessary to transmit the heat through air in the casing of the heater.

In heaters for wells, it is also necessary to control the heat to prevent heating beyond a desired degree. If too much heat is furnished, the lighter and more valuable constituents of the oil are vaporized and lost, and the face of the oil sand becomes covered with petroleum coke, which is detrimental to the further recovery of oil.

In the present invention, I have provided a heater for wells wherein the heater is arranged in an air tight casing to remove the possibility of short circuiting, and an efficient conductor is provided for the purpose of transmitting or radiating the heat outwardly to the oil bearing sand. The invention further comprises means for preventing radiation of heat inwardly to the oil tube, thereby preventing further heating of the oil after it has been extracted.

In the present invention, I have also provided means for controlling the temperature in the well to prevent heating beyond a predetermined degree. Said means comprises a thermostat so arranged that it may be operated without the necessity of additional lead wires running into the well and without the necessity of grounding the main circuit which is of comparatively high voltage.

In the accompanying drawings, I have shown one embodiment of this invention. In this showing,

Figure 1 is a partial sectional view of a well casing showing the well tube and heater in position.

Figure 2 is a vertical sectional view through the lower end of the tube showing the heater in position.

Figure 3 is a horizontal sectional view on the line 3—3 of Figure 2.

Figure 4 is a diagrammatic illustration of the electric circuits, and

Figure 5 is a detail perspective view showing one manner of winding the heating wires.

Referring to the drawings, the reference numeral 1 designates a well casing having a well tube 2 arranged therein. The well tube is of the usual sectional construction. A portion of the derrick platform 3 arranged above the well in the usual manner is shown and the usual operating mechanism (not shown) is arranged adjacent the top of the

well. The heater comprises a casing 4 arranged around the lower section of the well tube and provided with end closures 5 and 6 at the top and bottom, the closures being sealed or otherwise arranged to prevent entrance of air and water. A layer of heat insulating material 7 is arranged around the well tube. Any suitable heat insulating material may be employed. One of the forms of insulating material I find to be advantageous is kielselguhr. Kielselguhr is mixed with water to form a cement and then placed on the tube to the proper thickness and dried. A thin tube 8 of metal or other non-porous material is then arranged over the layer of heat insulating material and sealed at the top and bottom. The wires of the electric heater are embedded in an electrical refractory cement 10, which is a good conductor of heat and will transmit the heat outwardly to the oil bearing sand 13. The heater is assembled by applying a layer of the electrical refractory material and baking or otherwise drying it. The resistance wires are then wrapped around the outer surface and another layer of refractory cement applied. The unit is again baked or otherwise dried, a ground detector or other suitable apparatus being employed to ascertain when the unit is entirely free of moisture. The outer casing 4 may then be arranged in position.

To prevent any possibility of moisture accumulating on the wires of the heater and causing short circuiting, the air may be exhausted from the annular space between the tubes and the casing sealed. I have found, however, that this method does not provide a good conductor of heat in the electrical refractory material, and it is advantageous to saturate the material 10, in which the heating wires are embedded, and its pores with a petroleum fraction that is a good conductor of heat. For this purpose, I preferably employ a transformer oil with a high flashing point.

The thermostat 11 is arranged within the casing of the heater and comprises two circular strips of metal 12 and 13 surrounding the well pipe 2 and secured thereto at one end as at 14. The opposite ends thereof are provided with a contact 15 adapted to engage the contact 16 carried by the casing of the heater and insulated therefrom as at 17. The circuits whereby current is conveyed to the heater and the heating coil short circuited when the thermostat closes the contacts 15 and 16, is diagrammatically shown in Figure 4 of the drawings. The reference numerals employed in the other figures are employed in this figure to represent the thermostat contacts and the heating coil. As shown in this figure, a pair of lead wires 18 and 19 is connected to the coil and extend to a source of current 20, which is usually arranged out of the well at a convenient point. The thermostat is connected to one of the lead wires by wire 21 having suitable resistance 22 arranged therein. The contact 16 is connected to a ground by wire 23. A transformer coil 24 is connected to the two lead wires by wires 25 and 26, and is adapted to energize a secondary coil 27. The coil 27 is connected to a relay 28 which is connected to a wire 29 leading to a ground. A switch 30 is arranged in the main lead wire 19 and is adapted to be opened when the relay coil is energized by the closing of the contacts 15 and 16.

In Figure 5 of the drawings, there is shown one method of arranging the windings of the heater to avoid inductance. Inductance caused by the windings around the well pipe will heat the well pipe which is disadvantageous. When the wire is arranged in double helix with the wires of the two helixes parallel to each other, inductance will be reduced to a minimum.

With the well heater of the type shown, very efficient results can be obtained. The heat generated is transmitted outwardly through the electrical refractory material, which is a good conductor of electricity, and the outer casing 4 to the oil sand. The casing being made air tight, danger of short circuiting due to the collection of moisture contained in the air is obviated. As stated, in some forms of the invention, I find it advantageous to saturate the electrical refractory material with a petroleum fraction such as transformer oil for the purpose of increasing the conductivity thereof. When the oil has been extracted from the sand, it is no longer desirable to further heat it. If the oil that has entered the well pipe is further heated, there is a possibility that some of the lighter and valuable fractions may be vaporized and lost. It is therefore highly important to prevent the transmission of heat inwardly to the well pipe and this is accomplished in the present construction by means of the layer of heat insulating material 7.

The thermostat is employed to prevent over-heating of the oil sand and the formation of petroleum coke. In operation, when the switch 30 is closed, the main circuit is complete and current is transmitted to the heater 9 through the main lead wires 18 and 19. When the contacts 15 and 16 of the thermostat are closed, current passes through the coil 27, the resistance 22, the relay 28 to the wires 29 and 23, leading to grounds, and thus completing a circuit. The switch 30 is then opened and the main circuit broken. The thermostat and relay are so arranged that it is only necessary to employ two wires from the source of current to the thermostat and heater arranged at the bottom of the well, or a single wire

where the circuit is grounded and the well pipe forms a part thereof. The provision of the transformer coils 24 and 27 lowers the voltage of the current passing through the grounds and removes the objection of having a current of high voltage grounded.

A further advantage of the provision of a transformer to produce a current of low voltage passing through the thermostat is that the possibility of arcs caused by the making and breaking of the contact by the thermostat is reduced to a minimum.

It is to be understood that while I have described the preferred embodiment of my invention, various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In combination with the well pipe of an oil well, of an electric heater arranged adjacent the lower end thereof, said heater comprising a layer of heat insulating material surrounding the well pipe, an air and water tight casing surrounding said heat insulating material, a layer of electrical refractory material surrounding said casing, and electrical heating wires embedded therein.

2. In combination with a well pipe of an oil well, of a heater adapted to be arranged adjacent the lower end thereof, said heater comprising a layer of heat insulating material surrounding said tube, a layer of electrical refractory material surrounding said heat insulating material, heating wires embedded therein, and an outer air and water tight casing surrounding said electrical refractory material.

3. In combination with a well pipe of an oil well, of a heater for said well comprising an air and water tight casing arranged adjacent the bottom of said well pipe, electric heating wires arranged therein, said heating wires being embedded in a layer of electrical refractory material saturated with a fluid of high dielectric strength, and a layer of heat insulating material disposed between said heating wire and said well pipe.

4. In combination with the well pipe of an oil well, of a heater for said well comprising a casing arranged adjacent the bottom of said well pipe, electrical heating means arranged therein, means for transmitting heat outwardly through said casing, means for preventing transmission of heat inwardly to said well pipe, a thermostat arranged in said casing adapted to establish an auxiliary circuit when a predetermined temperature is reached, a relay arranged in said auxiliary circuit, and a switch in said main circuit adapted to be opened by said relay when the relay is energized.

5. In an electric heater for oil wells, a casing arranged adjacent the bottom of the well, electrical heating means arranged therein, a pair of electrical conductors connected to said heater and adapted to transmit current thereto, a thermostat arranged in said casing, said thermostat being connected to one of said conductors and to a ground, a relay coil arranged in circuit with said thermostat, and a switch arranged in the other conductor and adapted to be opened when said relay is energized.

6. In a heater for oil wells, the combination of heating means arranged adjacent the bottom of said well, a pair of conductors connected to said heater and to a source of current, a thermostat connected in parallel with one of said conductors and to ground, a transformer having one coil connected to each of said conductors, a relay coil connected to said transformer and to a ground to establish an auxiliary circuit when said thermostat is closed, and a switch arranged in one of said main conductors and adapted to be opened by said relay when the relay is energized.

In testimony whereof I affix my signature.

HARRY PENNINGTON.