Oct. 23, 1956 E. H. KRAMER 2,767,793

OIL WELL HEATER

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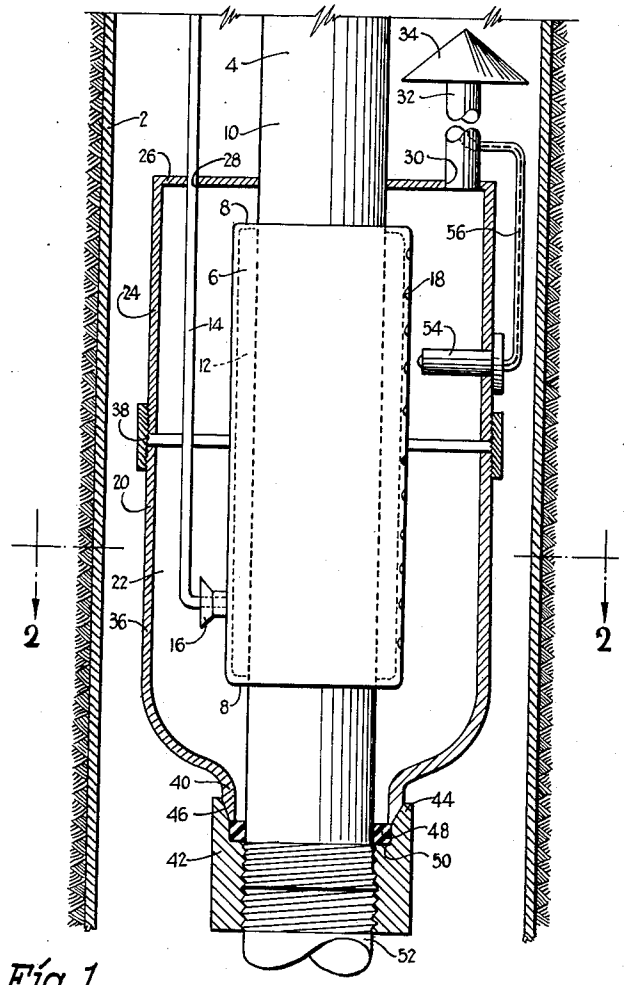

Fig. 1

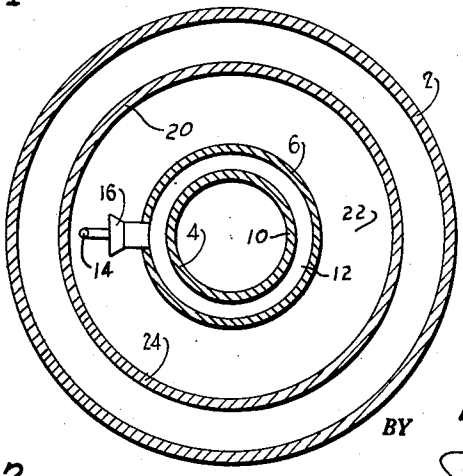

Fig. 2

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OIL WELL HEATER

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5 Claims. (Cl. 166—61)

This invention relates to improvements in oil well heaters, and more particularly, but not by way of limitation, to an improved gas type heater adapted for disposal in the lower portion of a producing oil well.

A large percentage of the present day oil wells produce a well liquid containing paraffin or having an asphalt base. Either of these types of oil, and particularly the oil containing paraffin, tends to partially solidify as the oil is pumped. When the oil enters the pumping unit the paraffin enters the working parts of the pump and often renders the valve elements inoperable in a very short time. In some wells, the paraffin will also tend to solidify in the well tubing above the pumping unit and interfere with the flow of the pumped fluid to the surface.

The present invention contemplates a novel heater which may be disposed below the pumping unit to heat the oil being drawn into the pumping unit from the oil producing strata. The heater is simple in construction and utilizes a section of tubing depending from the pumping unit as a portion of the heater to provide a thorough and efficient heating of the incoming well fluid. Furthermore, the heater dissipates a portion of its heat outwardly into the oil producing strata to enhance the recovery of oil therefrom. If the pumping unit is operating properly, but the paraffin is solidifying above the pumping unit, the present heater may be interposed in the tubing string above the pump and retain the pumped fluid in a liquid state.

An important object of this invention is to prevent paraffin from clogging or jamming the bottom hole oil well pumping unit, or the tubing containing the pumped well fluid.

Another object of this invention is to heat the oil producing strata in the vicinity of an oil well and enhance the recovery of oil therefrom.

Another object of this invention is to provide a simple and efficient heater for disposal in the lower portion of an oil well bore which utilizes a section of the well tubing as an element of the heater and which may be economically manufactured.

A further object of this invention is to heat the well fluid of a producing oil well prior to the entrance of the well fluid into a bottom hole pumping unit.

A still further object of this invention is to provide an oil well heater for disposal in the well tubing string which may be operated from the surface and operated only when desired.

Other objects and adavntages of the invention will be evident from the following detailed description, read in conjunction with the accompanying drawings, which illustrate my invention.

In the drawings:

Figure 1 is a vertical sectional view, partially in elevation, of my novel heater installed in an oil well.

Figure 2 is a transverse sectional view of the heater as taken along lines 2—2 of Fig. 1.

Referring to the drawings in detail, reference character 2 designates the usual well casing which extends downwardly in the well bore to the producing strata (not shown). Suspended concentrically in the well casing 2 is the usual well tubing 4 which interconnects the bottom hole pumping unit (not shown) with the surface equipment (not shown).

A tubular jacket 6, having its opposite ends 8 bent inwardly into close contact with a section 10 of the tubing 4, is welded or otherwise rigidly secured on the tubing section 10 to form a closed annular chamber 12 around a portion of the tubing section 10. The chamber 12 is provided to receive combustible gas which is supplied thereto through a small tubing 14 from the surface of the well. An ordinary air regulator 16 is secured in the side wall of the inner jacket or housing 6 to receive the lower end of the gas tubing 14 and control the air-fuel ratio in a well known manner. A plurality of vertically spaced apertures 18 are formed transversely in the side wall of the jacket 6 throughout substantially the entire length thereof to discharge the gas mixture from the chamber 12. Although only one vertical row of apertures is shown, it is preferred that two or more circumferentially spaced rows are formed in the jacket 6 to provide a discharge of the gas from the chamber 12 in various directions.

An outer sectional jacket 20 is disposed around the inner jacket 6 and the tubing section 10 to form a closed substantially annular shaped chamber 22. The upper section 24 of the housing or jacket 20 has its upper end 26 enclosed and welded or otherwise rigidly secured to the tubing section 10 slightly above the upper end of the inner jacket 6. A small aperture 28 is provided in the upper end 26 to receive the gas tubing 14. Another and larger aperture 30 is also provided in the upper end 26 of the housing section 24 to receive a flue pipe 32. The flue pipe 32 extends upwardly from the outer jacket 20 through a suitable packer (not shown) to provide an escape of exhaust fumes or gases from the chamber 22 and supply fresh air for the regulator 16 in such a manner to minimize air currents in the chamber 22. It will also be apparent that the flue pipe 32 may extend upwardly to the surface of the well in the event it is not feasible to install a packer above the outer jacket 20, and may be provided with the usual flue cap 34. It will also be understood that more than one flue pipe 32 may be provided, depending upon the size of the chamber 22 and rate of combustion therein.

The lower section 36 of the outer jacket 20 is threadedly secured to the upper section 24 by means of a suitable collar or coupling 38. The lower section 36 extends downwardly beyond the lower end of the inner jacket 6 and is reduced in diameter at its lower end 40 to enter a coupling member 42 which is threadedly secured on the lower end of the tubing section 10. An upwardly extending circumferential flange 44 is provided on the upper end of the coupling 42 to tightly receive the lower end portion 40 of the jacket section 36. Cooperating tapered surfaces 46 may be formed on the outer periphery of the jacket end 40 and the inner periphery of the flange 44 to provide a substantially gas tight fit of the jacket 20 in the coupling 42, if desired. Also, a suitable gasket 48 may be disposed in the coupling 42 on an upwardly facing circumferential shoulder 50 to receive the lower end of the jacket 20 and enhance the seal of the jacket 20 around the tubing section 10. Another section 52 of the tubing string 4 may be threaded into the coupling 42, depending upon the height of the outer jacket 20 with respect to the bottom hole pumping unit, as will be hereinafter set forth.

As previously stated, the chamber 22 provides a combustion chamber for the gas mixture discharging through the apertures 18. A suitable igniter 54 is supported in the outer jacket 20 and extends transversely through the chamber 22 into proximity with the inner jacket 6 and substantially in alignment with one of the rows of aper-

tures **18**. Although only one igniter **54** is shown, one is preferably provided for each row of apertures **18**. Each igniter **54** is bolted or otherwise rigidly secured to the jacket **20** in such a manner to provide a seal around the igniter **54** and prevent a leakage of fumes or well fluid through the jacket **20**. An insulated electrical lead line **56** interconnects with each igniter **54** outwardly of the jacket **20** and extends upwardly through the well casing **2** to the surface. As shown in Fig. 1, the lead line **56** may extend into the flue pipe **32** upwardly of the outer jacket **20**, if desired. Also, the gas tubing **14** may be inserted in one of the flue pipes **32**, whereby the flue pipes will provide housings for the gas conduit **14** and the lead line **56**.

Operation

When it is desired to heat the tubing section **10**, gas is supplied from the surface through the tubing **14** and air regulator **16** into the inner chamber **12**. The gas will gradually escape from the chamber **12** through the restricted apertures **18** where it is ignited by the igniter **54**. It will be apparent that the igniter **54** is operated from the surface only when it is desired to ignite the gas escaping from the apertures **18**. When the gas escaping from one aperture **18** is ignited, the flame will spread to the remaining apertures in the respective row. The combustion of the gas in the chamber **22** will heat the tubing section **10** and will also emit heat outwardly through the outer jacket **20** into the surrounding strata.

The tubing section **10**, with the outer jacket **20** and inner jacket **6** secured thereto, may be interposed in the tubing string **4** at any desired height in the well casing **2**. In wells where paraffin contained in the well fluid causes difficulty in the operation of the bottom hole pumping unit, the tubing section **10** may be disposed below the bottom hole pumping unit to heat the well fluid flowing upwardly therethrough prior to its entrance into the pumping unit. However, in wells where paraffin disposed in the vicinity of the oil producing strata is at a sufficiently high temperature to flow readily and not interfere with the moving elements of the pumping unit, but will cool as it is pumped upwardly through the tubing string **4**, the tubing section **10**, with its connected jackets **20** and **6**, may be interposed in the tubing string **4** above the bottom hole pumping unit. It will then be apparent that the oil pumped by the pumping unit will be heated by the combustion of gas in the chamber **22** and facilitate the upward flow of the pumped fluid through the tubing string **4**.

It will be observed that in any location of the heater, the tubing section **10** forms a dual function in that it transports the well fluid and simultaneously serves as an element of the heater. The outer jacket **20**, being completely closed, permits complete emersion of the heater in well fluid contained in the casing **2** without disrupting operation of the heater. It is also to be noted that the lower section **36** of the jacket **20** may be removed by unthreading the couplings **42** and **38** to provide access to the inner jacket **6** for cleaning and repair.

From the foregoing, it is apparent that the present invention provides a novel heater which may be disposed below the bottom hole pumping unit of a producing oil well to heat the well fluid drawn into the pumping unit and prevent paraffin from clogging or jamming the movable elements of the pumping unit. Also, heat will be emitted into the surrounding strata to enhance the flow of the well fluid and increase the production of the pumping unit. It will also be apparent that my novel heater may be interposed in the tubing string above the pumping unit to facilitate flow of the pumped fluid through the tubing string when deemed feasible. Also, the heater may be conveniently operated from the surface of the well and started or stopped at the will of the operator.

Changes may be made in the combination and arrangement of parts as heretofore set forth in the specification and shown in the drawings, it being understood

that any modification in the precise embodiments of the invention may be made within the scope of the following claims without departing from the spirit of the invention.

I claim:

1. A gas heater for an oil well having a string of tubing therein, comprising an inner jacket rigidly secured to a section of the tubing and forming an annular chamber around the tubing, said jacket having a plurality of transverse apertures therein, conduit means extending through the well and communicating with the chamber to supply gas to the chamber, an outer jacket surrounding the inner jacket and forming a closed combustion chamber around the inner jacket and a portion of the tubing, and igniter means carried by the outer jacket arranged to ignite the gas escaping from said transverse apertures, and vent means for supplying air to the combustion chamber and discharging fumes therefrom.

2. A gas heater for an oil well having a pumping unit in the lower portion thereof, comprising a tubing section depending from the pumping unit and forming an inlet conduit for well fluid, an inner jacket secured around the tubing section and forming an annular chamber around the tubing, a plurality of restricted transverse apertures in the inner jacket, a gas conduit extending downwardly in the well from the surface and communicating with the inner jacket for supplying gas thereto, an outer jacket secured to the well tubing and forming an annular chamber around the inner jacket and a portion of the tubing, and an igniter carried by the outer jacket arranged to ignite the gas ejected through said apertures, and vent means for supplying air to the annular chamber and discharging fumes therefrom.

3. A gas heater for an oil well having a string of tubing therein, comprising a housing adapted for tandem connection with the well tubing and having an inner bore therethrough for the passage of well fluid, tube means extending through the well into the housing, an air regulator on the lower end of the tube means, a gas chamber around the inner bore and communicating with the air regulator, said gas chamber having a plurality of gas outlets, a combustion chamber in the housing surrounding the gas chamber and communicating with said outlets, and an igniter in the combustion chamber arranged to ignite gas ejected through said outlets, and means for supplying air to the air regulator and venting fumes from the combustion chamber.

4. A gas heater for an oil well having a string of tubing therein, comprising a housing adapted for tandem connection with the well tubing and having an inner bore therethrough for the passage of well fluid, tube means extending through the well into the housing, an air regulator on the lower end of the tube means, a gas chamber around the inner bore and communicating with the air regulator, restricted outlets communicating with the gas chamber, a combustion chamber in the housing surrounding the gas chamber and communicating with said outlets, an igniter in the combustion chamber arranged to ignite gas ejected through said outlets, an insulated electrical lead line extending from the surface through the well into connection with the igniter for controlling the operation of the ignited, and covered vents extending upwardly in the well from the combustion chamber to vent off fumes from the combustion chamber and supply air to the air regulator.

5. A gas heater for an oil well having a string of tubing therein, comprising an inner jacket rigidly secured to a section of the tubing and forming an annular chamber around the tubing, said jacket having a plurality of transverse apertures therein, conduit means extending through the well and communicating with the chamber to supply gas to the chamber, an outer jacket surrounding the inner jacket and forming a closed combustion chamber around the inner jacket and a portion of the tubing, at least one electrical igniter secured in the wall of the outer jacket

and extending into the vicinity of one of said apertures, insulated electrical lead lines extending through the well from the surface and connected to the igniter for controlling the action of the igniter, and covered vents extending upwardly in the well from the combustion chamber to vent off fumes from the combustion chamber.

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