

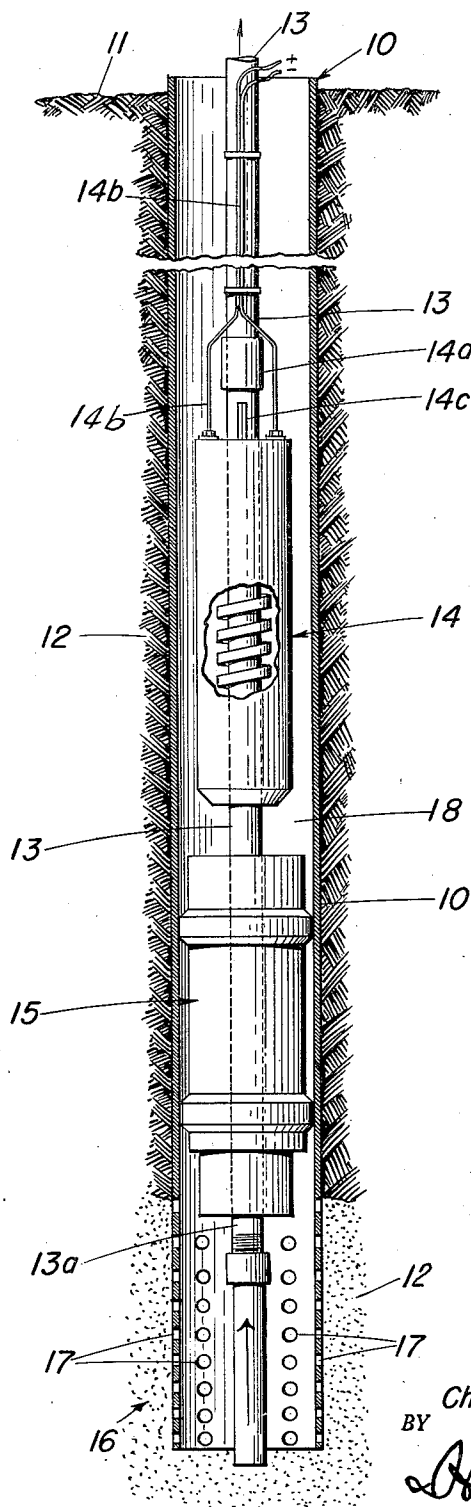
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OIL COLUMN HEATING MEANS AND METHOD

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OIL COLUMN HEATING MEANS AND METHOD

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My present invention relates to the restoration of productivity of clogged, blocked or sludged oil wells.

More particularly, my present invention relates to a method and means for maintaining an uninterrupted flow of oil from wells which have become clogged, congested or blocked by accumulations within the flow tube of paraffin, bitumen or other waxy constituents of petroleum. The accumulated deposit of such waxy material in the flow tube soon restricts, and in some instances will seal off the passage of crude oil from the well to the gathering facilities on the surface. In some wells such a condition will develop within a few days and in others in a somewhat longer time.

The usual manner of overcoming this difficulty requires the lifting and uncoupling of the flow tube from the well, in order to scrape or otherwise remove the waxy deposit from the interior of the tubes so affected. As there may be in a single well several hundred or several thousand feet of tubing comprising the flow line, it is obvious that substantial amount of time and expense is involved in the removal, cleaning and replacement of the flow tube, and causing a loss of production to the well operator.

Such a condition as above described will be found in free flowing wells where the oil is elevated to the surface by natural gas pressure, and also in wells wherein the oil must be obtained by pumping, and generally in wells producing a light gravity paraffinic or bituminous oil.

Pursuant to my invention suitable heating means is connected to the flow tube at a location within its length somewhat below the determined location where the wax formation begins to accumulate. The inner member of the heating means forms an integral part of the flow tube for the passage of oil therethrough. Co-operating with such heating means, I employ a packer which may be of conventional construction, and which is also connected to the flow tube at a location somewhat below the heater. Such packer serves to seal the annular space between the flow tube and the well casing. The well casing at the location of the packer seal is imperforate and well above any perforated casing that may be used at the bottom of the well.

Water, or like readily available liquid, is charged from the surface into the annular space between the well casing and the flow tube. Upon energizing the heating means, such column of liquid is heated to a temperature at which the clogging, waxy substances are rendered liquid thus enabling the oil to pass freely through the flow tube to the surface for treatment pursuant to conventional practice. To maintain an efficient thermal column, liquid lost by evaporation

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or seepage may be charged into the annulus from time time to a predetermined liquid level.

The heating means is preferably powered by electrical energy supplied from a suitable source of power on the surface, suitable electrical connections extending from the electrical source to the coils of the electrical heating means.

Preferably, the temperature generated by the heating means is controlled thermostatically within the range of flowability of the liquified paraffins, bitumens and other heavy constituents of the crude oil yielded by the petroliferous substrata.

The distribution of the heating energy generated by the heating means is transferred inwardly to the flow tube for a considerable distance above and below the heating means as auxiliary heat to the larger volume of heat radiated by the exterior tube of the heating means immersed in the liquid column.

Preferably, the thermostat means is disposed within the zone of heating of the heating means.

Further features and objects of the invention will be more fully understood from the following detailed description and the accompanying drawing, showing a diagrammatic view of an oil well illustrating a preferred assembly pursuant to the invention and method of carrying out my invention.

Referring to the drawing, 10 indicates generally the casing installed in the indicated oil well. The casing extends from the earth's surface indicated at 11, to a location proximate the petroliferous strata under treatment, indicated at 12. The flow tube is designated 13.

Pursuant to my invention, the heating means, designated 14, of suitable construction, is connected in the line of the flow tube 13, the heating means being coupled to the flow tube as indicated by 14a. The packer, designated 15, is connected exteriorly of and in sealed relation about the flow tube at a location between the heating means and the bottom 13a, of the flow tube.

Suitable constructions of heating means applicable to my present invention are set forth in Patent No. 2,484,063 granted to me October 11, 1949, for "Electric Heater for Subsurface Materials"; and Patent No. 2,500,305 granted to me March 14, 1950, for "Electric Oil Well Heater." It is preferred to employ a resistance heater since such a heater does not set up electrical currents in the flow tube, and no danger of creating a "flash" in the well results from heating by such means.

The well casing 10 is imperforate from the earth's surface to a location below the packer, and is perforated therebelow to the end of the casing extending into the oil sand indicated generally at 16; the perforations are designated 17.

Pursuant to my present invention water, or the like thermal liquid, designated 13, is charged into the annular clearance between the flow tube and the well casing, inclusive of the annular clearance between the heating means 14 and the imperforate well casing. Water is advantageous in that it is of low cost and readily available. Such supplied thermal liquid flows down the annular clearance until bottomed by the packer 15, thus resulting in an annular column of the thermal liquid extending from the packer upwardly to a predetermined elevation therefrom. It will be observed that the resulting annular column of liquid is static, merely filling the annular clearance between the flow pipe and the casing and surrounding the heater 14. The liquid 13 is not circulated nor is there any reason for circulating it.

Upon supplying electrical energy to the heater by means of cable 14b, the thermal liquid column is heated to a range of temperature causing the liquification of paraffins or other relatively high viscous constituents of the crude oil clogging the flow tube. The elevation of temperature transmitted by the heated thermal liquid column ensues by transmission of thermal energy through the material of the flow tube to the therein contained clogging material. The temperature generated by the heater is controlled within the range from the minimum of average temperature at which the clogging material is liquified to a maximum temperature determined by the character of clogging material contained in the crude oil yielded by the petroliferous substrata. The range of temperature of the heating means is preferably controlled by a thermostat 14c responsive to the temperature of the thermal fluid adjacent the heater 14; and a mean temperature of the thermal fluid is provided which may be defined as the degree of heat between the "on" and "off" setting of the thermostat. The delivery to the surface of the thus liquified petroliferous material is carried out in a manner pursuant to approved practice.

The conventional packer generally illustrated in the drawing is joined to the flow tube at a suitable or predetermined spacing from the lower end of the flow tube, but below the heating means. The packer and the heating means are assembled section by section to the flow tube on the surface and such assembly is then lowered into the well. When the flow tube with its packer and heating means, now a connected unit, has reached its predetermined depth within the well, the packer by the usual means employed is expanded to seal the annular clearance between the flow tube and the well casing.

I claim:

1. The combination with a flow tube and a well casing, of electrical resistance heating means connected with the flow tube, said heating means having a hollow passage therethrough forming a continuous part of the flow tube, a packer surrounding the flow tube at a location below that of the heating means, and a static thermal liquid column filling the annular clearance between the flow tube and the well casing and extending from said packer to a location above said heating means.

2. The combination as defined by claim 1 in which the heating means is provided with thermostatic means responsive to the temperature of the thermal fluid adjacent said heating means

for controlling the range of its generated heat energy to include the temperature of fluidity of the heavy constituents of the crude oil extracted from the treated petroliferous substrata.

3. The method of restoring an oil well clogged by paraffin, heavy bitumens and the like, which comprises providing suitable heating means at a zone of the flow tube proximate the bottom thereof, sealing the well about the flow tube between the heating means and the bottom of the flow tube; filling the annulus surrounding the flow tube with a static thermal fluid from the point of sealing to a point above the heating means; and energizing the heating means to maintain the thermal fluid at a mean temperature at which the waxy components of the oil in the flow tube are retained in a fluid condition.

4. The method of restoring an oil well clogged by paraffin, heavy bitumens and the like, which comprises providing suitable heating means at a zone of the flow tube proximate the bottom thereof; expanding a packing member between the heating means and the bottom of the flow tube to block the annular passage between the flow tube and the well casing; charging from the earth's surface a liquid serving as a static thermal medium to substantially fill the annular clearance between the flow tube and the well casing upwardly of the packing member to a point above the heating means; and energizing the heating means to thereby elevate the temperature of the annular column of thermal medium.

5. The method as defined by claim 4 in which the range of temperature of the heating means includes the temperature of liquification of the paraffin, bitumen or other heavy viscous material clogging the interior of the flow tube.

6. The method as defined by claim 4 in which the range of heating of the heating means is controlled thermostatically.

7. The method as defined by claim 4 in which the range of heating of the heating means is controlled thermostatically within the zone of heating by the heating means.

8. A method of restoring a paraffin clogged oil well having a casing, a flow tube within the casing and a packer surrounding the flow tube near its lower end to seal the annular space between the casing and the flow tube, said method comprising filling the annulus between the flow tube and the casing above the packer substantially to the earth's surface with a static thermal liquid, and heating the flow tube and the thermal liquid above the packer and adjacent thereto to liquify the paraffins and other relatively highly viscous constituents of the oil.

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