Nov. 6, 1962 J. H. EADES 3,062,289

OIL WELL HEATER

Filed Jan. 21, 1960 2 Sheets-Sheet 1

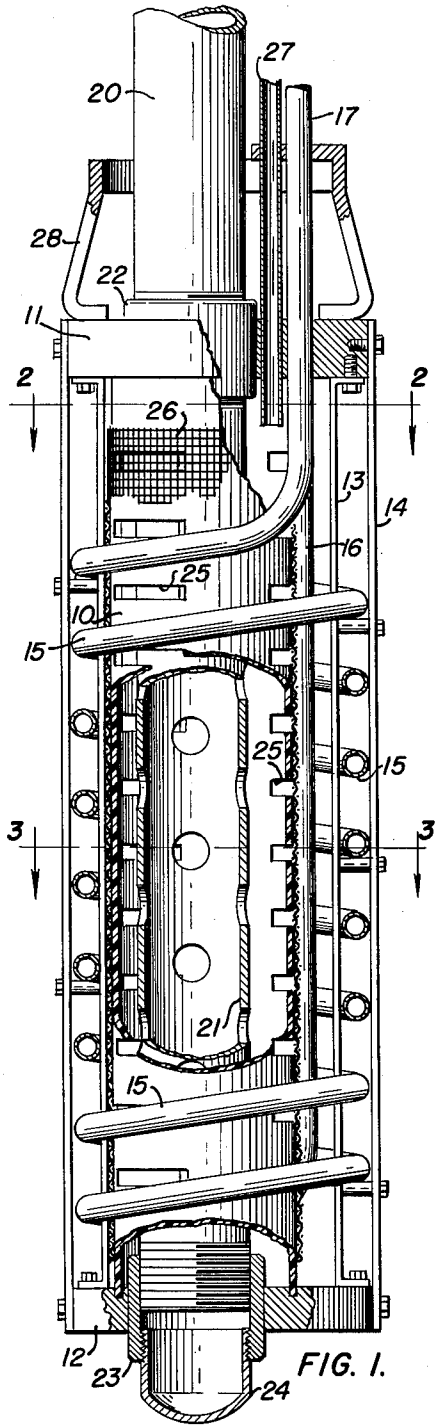


FIG. 1.

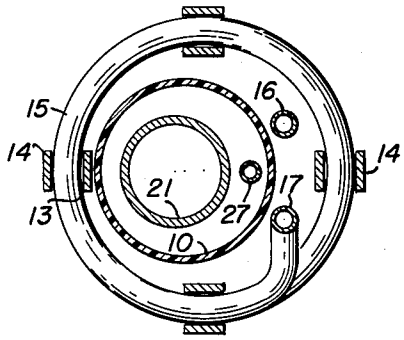


FIG. 2.

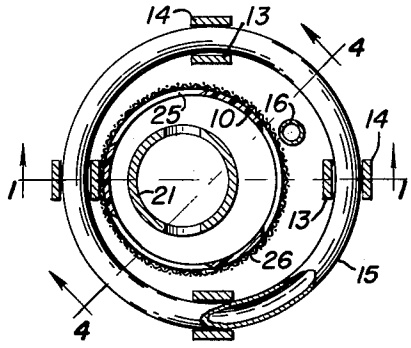


FIG. 3.

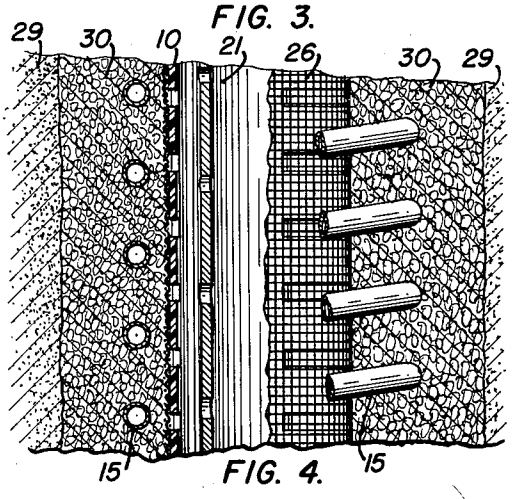


FIG. 4.

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Nov. 6, 1962 J. H. EADES 3,062,289

OIL WELL HEATER

Filed Jan. 21, 1960 2 Sheets-Sheet 2

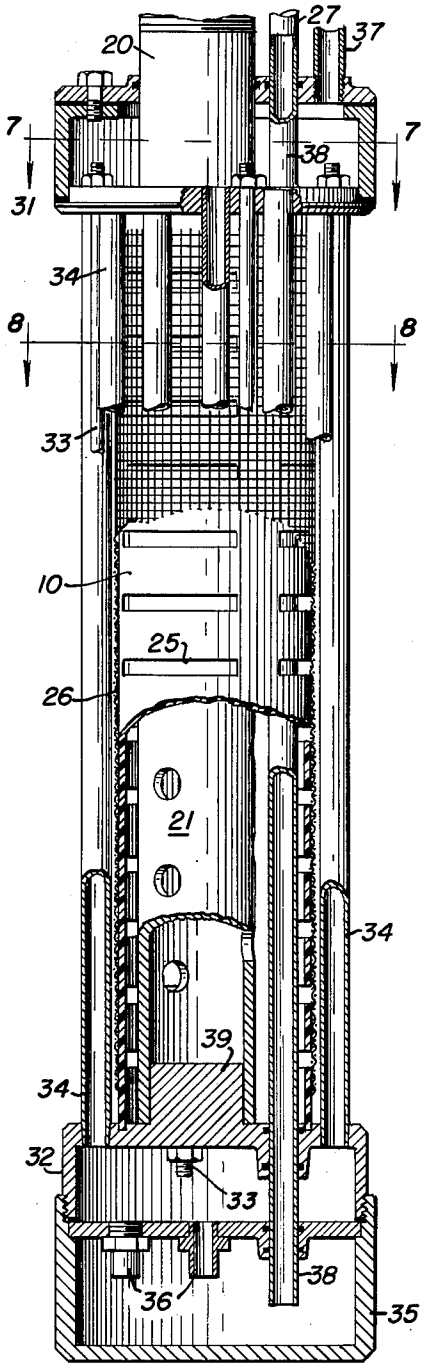


FIG. 6.

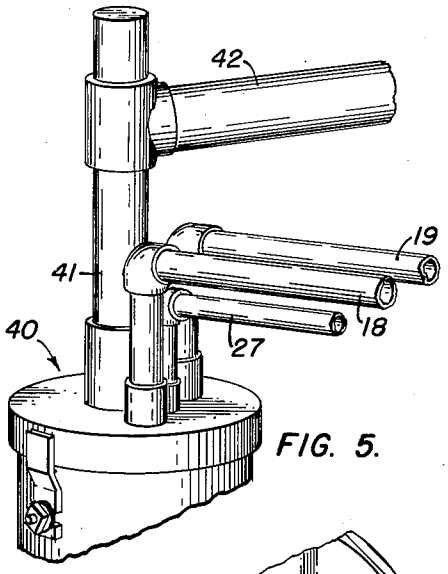


FIG. 5.

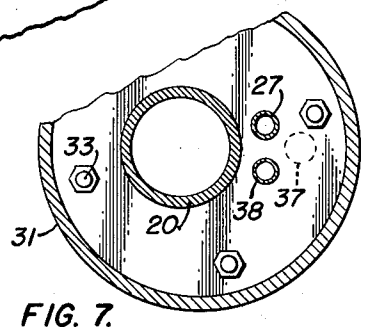


FIG. 7.

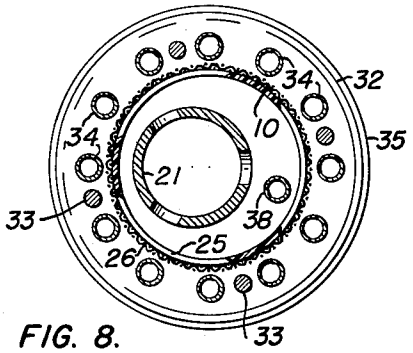


FIG. 8.

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United States Patent Office 3,062,289 Patented Nov. 6, 1962

3,062,289

OIL WELL HEATER

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Filed Jan. 21, 1960, Ser. No. 3,839
1 Claim. (Cl. 166—61)

This invention relates to heaters for oil wells and has reference to improvements in apparatus wherein heated fluids, for example steam or water, are circulated in a bore hole for transferring heat to a producing earth formation.

The present invention is for use in both primary and secondary recovery where paraffin or asphalt accumulate in the producing zone around the bore hole. Reducnig the viscosity of oil promotes flow and tends to separate entrained gas and water emulsions. Additionally, heat reduces the viscosity of paraffin and asphalts in the oil and promotes flow within the formation.

Heretofore, oil well heaters have been used with some degree of success but were inefficient in their operation because considerable heat was lost in the annulus between the casing and the tubing. Another loss of heat was by conduction in the tubing itself.

An object of the invention is to increase production in oil wells by reducing the viscosity of oil in an earth formation around a bore hole.

A particular object of the invention is to heat producing formations by conduction rather than radiation and thereby effect greater efficiency of the heater.

Another object of the invention is to provide means for at least partially insulating the heater from the well and well tubing.

Another object of the invention is to provide a well heater having direct contact means with the bore hole, yet which means may be readily removed when it becomes desirable or necessary to remove the heater from the well.

A further object of the invention is to provide means for reducing or preventing sand from entering the well tubing, together with means for repelling sand which may accumulate around the outer surface of the heater.

These and other objects will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a broken elevation and sectional view of a preferred form of the invention.

FIGURE 2 is a transverse sectional view taken on line 2—2 of FIGURE 1.

FIGURE 3 is a transverse sectional view taken on line 3—3 of FIGURE 1.

FIGURE 4 is a broken vertical sectional view taken approximately on line 4—4 of FIGURE 3 and additionally showing the present heater installed in a bore hole.

FIGURE 5 is a broken perspective view of an exemplary well head employed in connection with the invention.

FIGURE 6 is an elevation and broken sectional view of a modified form of the invention.

FIGURE 7 is a transverse sectional view taken on line 7—7 of FIGURE 6, and

FIGURE 8 is a transverse sectional view taken on line 8—8 of FIGURE 6.

The form of the invention shown in FIGURES 1 through 4 includes a tubular insulator **10** of a suitable thermal setting synthetic resin, such as Bakelite, overhanging upper and lower disk-like closures **11** and **12**, and inner and outer vertical connecting bars **13** and **14**. A heating element in the form of a coil **15** is positioned around the inner frame bars **13** and the insulator **10**, the ends of which coil have vertical extensions **16** and **17**

which are connected with pipes **18** and **19** (shown only in FIGURE 5) extending to the earth's surface where they are connected with means circulating hot water therethrough. The vertical extension **16** connected with the lower end of the coil **15** is herein designated as the supply lead, but circulation in either direction is effective and within the scope of the invention.

The well tubing **20** has a lower perforated extension **21** within the tubular insulator **10**, and which perforated extension is connected with the well tubing by means of a collar **22** located in an opening in the upper closure **11**. Similarly, the lower end of the perforated extension **21** is connected with a fitting **23** in the lower closure **12**, and which fitting has a cap **24** in the lower end thereof.

The tubular insulator **10** has multiple horizontal slots **25** for admitting well fluids, and there is a screen wire strainer **26** around the insulator to prevent sand from passing through the referred to slots. It is to be understood that the slots **25** comprise the preferred construction but that other configurations of openings may be employed. In the upper closure **11** there is a fluid pressure supply pipe **27** which extends into the insulator **10**, and the upper end of which pipe has means connecting the same with the earth's surface and a supply of fluid pressure which is applied when necessary for reasons hereinafter set forth.

Other details shown include a suitable bracket **28** atop the upper closure **11** for engaging the extending portions of the supply lead **16**, return portion **17** of the coil **15** and the pressure supply pipe **27**. The ends of the insulator **10** are received in grooves, not numbered, in opposing faces of the closures **11** and **12** and the vertical bars **13** and **14** are secured in their described positions by screws, not numbered. Preferably, the tubular insulator **10** is asymmetrical with reference to the axis of the coil **15** so as to accommodate the lead **16** and return portion **17** so that the latter will not contact the well bore when installing or removing the described construction.

As shown in FIGURE 4, the described heater is installed in open hole of a producing formation **29** and gravel **30** is filled around the coil **15** and against the screen **26**. Thus, heat from the coil **15** is transferred to the formation **29** through the gravel **30**.

If sand migrates to and clogs the screen **26** fluid pressure is applied through the pressure supply pipe **27** to force the sand back and open the screen. When it becomes necessary or desirable to remove the heater from the well bore liquid pressure of considerable force is applied through the pressure supply pipe **27** forcing the gravel **30** up the well annulus, and while the gravel is suspended the heater is raised at least to a distance higher than the gravel when the latter is settled in the bore hole.

While the form of the invention illustrated in FIGURES 1 through 4 is intended primarily for operation with heated liquid, the form of the invention illustrated in FIGURES 6 through 8 is intended for operation with steam. The latter form of the invention includes the described slots **25** therein, screen **26** therearound and perforated extension **21** connected with the lower end of the well tubing **20**. Instead of the upper and lower closures **11** and **12** there are upper and lower steam chambers **31** and **32** which are secured in spaced relation by means of vertical rods **33** connected therebetween. The heating elements are vertical tubes **34** connected in communication between the upper and lower steam chambers **31** and **32** and outwardly of the insulator **10** and screen **26**. Beneath the lower steam chamber **32** there is a sump **35** which houses steam traps **36** mounted in the bottom of said lower chamber. The steam supply line **37** is connected in communication with the upper end of the

upper steam chamber **31**, whereas the steam return line **38** extends from the interior of the sump **35** upwardly the insulator **10** and through the upper steam chamber **31**. As in the first described form of the invention, there is a pressure supply pipe **27** in communication with the interior of the insulator **10** for removing sand from the screen **26** and for loosening the gravel **30** when removing the heater from the well. The closure at the lower end of the perforated extension **21** is a projecting boss **39** on the upper surface of the lower steam chamber **32**. The operation of the last described form of the invention is substantially the same as described in connection with the first form of the invention.

The well head **40** illustrated in FIGURE 5 is exemplary and it is to be understood that various commercially available well heads may be used in conjunction with the present well heater. The well head **40** shown includes a vertical nipple **41** and a laterally connected oil flow line **42**. The laterally extending fluid supply and return lines **18** and **19**, and the pressure supply line **27** have the same reference numerals as those described in the foregoing.

The invention is not limited to the constructions herein shown and described, but may be made in various ways within the scope of the appended claims.

What is claimed is:

Apparatus for heating production formations in oil wells having a string of tubing therein, said apparatus comprising a vertical perforated tube connected with the lower end of said tubing, a tubular insulator around said perforated tube, closures at the end of insulator and at the lower end of said perforated tube, means admitting the flow of fluids through the cylindrical wall of said insulator, a hollow heating element means around said insulator, means circulating heated fluid through said heating element means, and an applied permeable mass between and in contact with said heating element means and said production formation.

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