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OIL WELL HEATER

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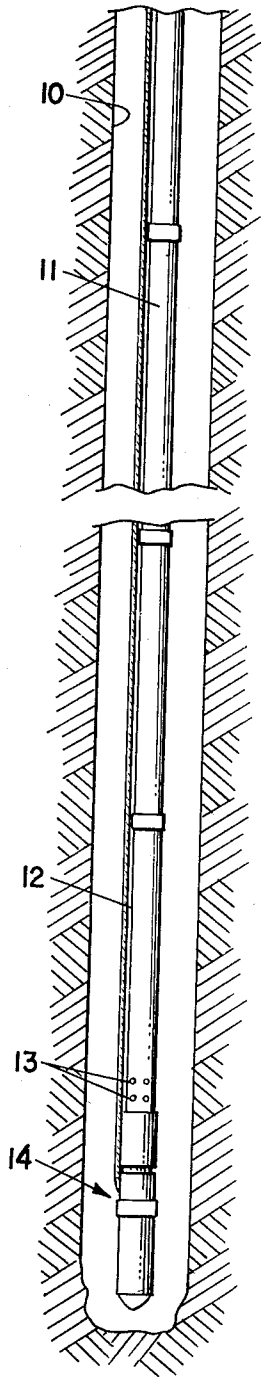


FIG. 1.

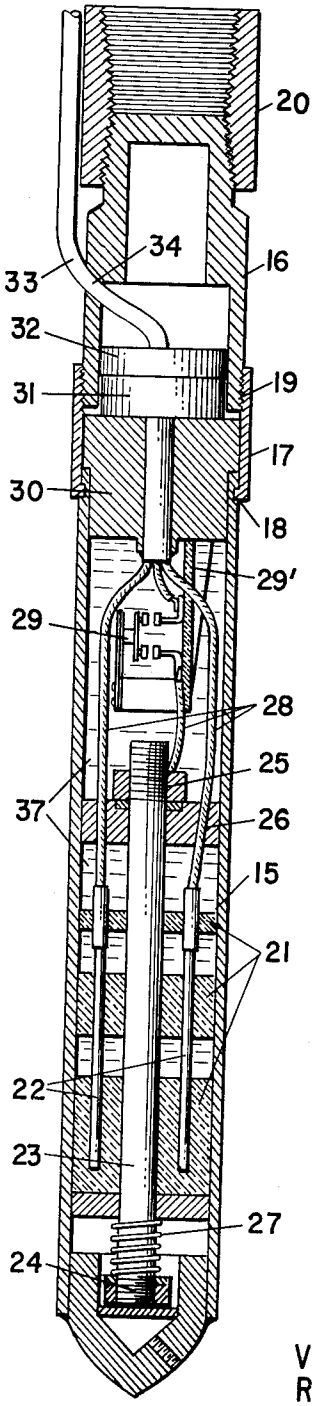


FIG. 2.

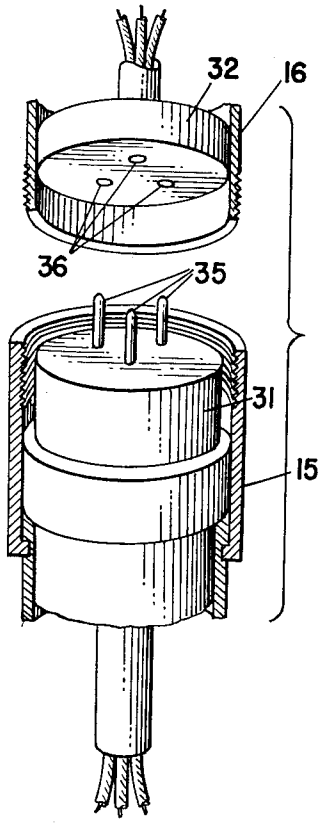


FIG. 3.

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OIL WELL HEATER

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This invention relates to oil well heaters and more particularly to an improved oil well heater for use in conjunction with pumping operations in wells of relatively small diameter.

Oil well heaters for decreasing the viscosity of oil to facilitate pumping are well known in the art. Usually, the heating elements themselves are electrically energized and thus require electrical conductors passing from the surface of the bore hole downwardly to the heater. With many present-day designs, it is not possible to use the heaters in relatively small diameter bore holes, principally because of the problems of bringing the electrical conductors out of the heating structure itself. Generally, some type of laterally projecting structure is required in order that the upper portion of the heater may be connected to the pumping pipe string and there thus results a relatively large diameter portion which prevents the use of the heater in smaller diameter holes. Further, heaters employed in wells are subject to relatively rugged treatment and in order to operate satisfactorily, it is extremely important that the electrical connections be reliable. As a consequence, a special crew of men properly trained is oftentimes required to effect the electrical connections between a suitable source of electrical energy and the heater itself.

In addition to the foregoing, many oil well heaters in present day use tend to develop "hot spots" on their surfaces resulting in "sanding in." This is a consequence of failure of the heating device to distribute uniform heat over a relatively large exterior area. To avoid possible overheating, thermostatic switches have been proposed which will deenergize the heating elements if overheating should develop. However, it would be more satisfactory if suitable means for properly distributing the heat could be employed in conjunction with such a thermostatic switch.

There is also the problem of proper shock mounting for the heating elements themselves. These heating elements are relatively sensitive and of course are subject to expansion and contraction with changes in temperature during operation. Ineffectual mounting to accommodate such expansion and contraction as well as various shocks encountered during lowering of the heater into the bore hole can result in damage to the heater and consequent malfunctioning.

With all of the foregoing in mind, it is a primary object of this invention to provide a greatly improved oil well heater in which substantially all of the foregoing problems encountered in the prior devices are overcome.

More particularly, it is an object to provide an improved oil well heater which is designed for extremely rapid connection and disconnection of the heater elements to a source of electrical energy in a manner such that any unskilled worker in the field may readily effect the connection and thereby avoid the expense of specially skilled labor.

Another object is to provide an improved oil well heater so designed that it may readily be accommodated within relatively smaller diameter bore holes incapable of receiving many present-day heaters.

Still other objects of the invention are to provide improved heating elements in combination with other structural components which are more rugged with respect to shock, expansion, and contraction and in which more

uniform heat distribution is realized with the attendant advantages of greater efficiency and reliability.

Briefly, these and many other objects and advantages of this invention are attained by providing first and second pipe sections arranged to be coupled together in coaxial alignment by a coupling sleeve keyed to one of the pipe sections and threaded to the other. The first or lower pipe section includes suitable heating means and the second or upper pipe section serves to house electrical conductors passing through a lateral slot to minimize outside dimensions. The arrangement is such that when the pipe sections are fitted together, proper connection is effected between the conductors and the heating elements in the sections respectively, there being required no special tools or special skills in effecting a quick connection or disconnection.

The heating elements in the lower section are closed within a sealed chamber. With this arrangement, a thermally conductive liquid, such as oil, may be poured into the chamber and thereby effect improved distribution of the heat from the elements to the surfaces of the pipe section itself. The heating elements are shock mounted by means which will also accommodate conventional expansion and contraction. Finally, the preferred embodiment of the invention includes in the combination a suitable thermostatic switch for de-energizing the heating elements should excessive heat develop.

A better understanding of the preferred embodiment of the invention will be had by now referring to the accompanying schematic drawings, in which:

FIGURE 1 is an elevational view partly in cross section of a typical oil well bore hole incorporating the heater of this invention in conjunction with a string of pumping pipe;

FIGURE 2 is an enlarged cross section of the heater; and,

FIGURE 3 is an exploded perspective view of quick connect and disconnect plug members employed in the heater of FIGURE 2.

Referring first to FIGURE 1, there is shown a bore hole **10** including a string of pumping pipe **11** terminating in an oil well pump **12**. As shown, the pump **12** includes ingress openings **13** adjacent its lower end for receiving oil from the surrounding formations. Secured to the lower end of the pump **12** is the improved oil heater of this invention indicated generally by the numeral **14**.

Referring to FIGURE 2, it will be noted that the oil heater comprises first and second pipe sections **15** and **16** adapted to be coupled together in co-axial alignment by a suitable collar **17** keyed to the upper end of the lower or first section **15** as at **18** and threaded to the upper or second section **16** as at **19**. With this sleeve arrangement, it is possible to separate the sections **15** and **16** by simply rotating the sleeve **17** rather than rotating either of the pipe sections **15** or **16**. The upper end of the second pipe section **16** is threaded for reception within a suitable collar **20** in turn arranged to be threaded to the lower end of the pump **12** of FIGURE 1.

Within the lower or first section **15**, there is provided heating means including annular porcelain frame structures **21** within which are embedded straight nichrome wires or rods **22**. This structure is centered and guided by a vertical guide tube **23** threaded at **24** to the lower closed end of the pipe section **15** and secured at **25** to a suitable spider structure **26** adjacent the upper end of the heating means.

The guide tube **23** is rigidly secured with respect to the pipe section **15**. The porcelain heating support structures **21** are arranged to move short distances longitudinally along the guide rod **23**. A compression spring **27** is secured between the lower end of the pipe section **15** and the under side of the porcelain frame structure **21** so that

the frame structure is ordinarily biased upwardly against the spider structure 26. With this arrangement, any shock upon lowering of the heating structure to the bottom of a bore hole resulting from the first pipe section 15 striking the hole bottom will be absorbed to a considerable extent by compression of the spring 27. This spring 27 will also accommodate longitudinal expansion of the porcelain frame structures 21 and rods 22 as a consequence of heating thereof.

Energization of the various nichrome wires or rods 22 is accomplished by a plurality of conductors 28 passing through the spider structure 26 towards the upper end of the first pipe section 15. A thermostatic switch 29 may be interposed in at least one of the conductors as shown. This switch 29 is preferably resiliently mounted as by a suitable frame member 29' secured to an upper sealing plug 30. The conductors themselves pass centrally through the plug 30 in sealed relationship thereto to terminate in a plug member 31 at the upper end of the pipe section 15. The sealing plug 30 defines with the inner side walls of the pipe section 15 and the lower closed end thereof a sealed inner chamber accommodating the heating elements and switch 29.

Referring now to the upper portion of FIGURE 2, the second pipe section 16 serves to support a cooperating plug 32. This plug includes sockets connected to suitable conductors within a metal sheath 33 passing upwardly within the pipe section 16 to pass therefrom through a lateral slot 34 and thence upwardly past the collar 20 adjacent to the various pump pipes as shown in FIGURE 1.

Referring to the exploded view of FIGURE 3, the plug member 31 includes male prongs 35 arranged to be received within the referred to sockets shown in FIGURE 3 at 36. By this arrangement, it is a simple matter to effect the desired electrical connection. Moreover, this connection is secure and extremely reliable, inasmuch as the sleeve 17 serves to hold the pipe section 16 in axial alignment wtih the pipe section 15 after the plug members have been connected together. By employing the lateral slot structure as described, minimum lateral protuberances are presented so that the overall structure may be maintained of relatively small diameter for use in small diameter bore holes. Moreover, it will be evident that a quick electrical connection is effected simultaneously with the assembling of the pipe sections 15 and 16 together.

With reference once again to FIGURE 2, the chamber between the upper sealing plug 30 and lower end of the first pipe section 15 is filled with a suitable thermally conductive liquid such as oil 37. This oil will serve to distribute heat from the nichrome wires or rods 22 to the surfaces of the pipe section 15.

With the above description in mind, over all operation of the well heater will be evident. In use, the pipe sections 15 and 16 are assembled at the surface of the bore hole, the plug 32 being positioned over the plug 31 such that the prongs 35 will be received within the sockets 36. The sleeve 17 is then rotated to draw the plug members into tight engagement with each other and secure the pipe sections in axial alignment. The upper collar 20 may then be threaded to the lower end of the pump and the entire structure lowered into the bore hole.

Suitable electrical energy from a source at the surface of the bore hole is passed through the various conductors within the metal sheath 33, through the plug members 32 and 31, switch 29, and the various conductors 28 to the heating wires 22 within the lower pipe section 15. The resulting generated heat will be uniformly distributed as a consequence of the use of the oil 37 as described and "hot spots" thereby avoided. Oil from the surrounding formations will be correspondingly heated and the pumping thereof facilitated. The shock mounting spring 27 not only will cushion any shocks upon lowering of the oil heater as described but will also accommodate thermal expansion and contraction of the heating elements. Should undue heat develop, however, the thermostat 29 will operate to de-energize the heating elements in a conventional manner so that "sanding in" and the like will not occur.

After a particular pumping operation has been completed, or in the event servicing is required, the heater is withdrawn with the pumping pipe. Disassembly of the device is accomplished simply by rotating the collar 17 until the pipe sections 15 and 16 are separated. Separation of these sections will automatically disconnect the plug 32 from the plug 31. If any of the heating elements per se are damaged or other trouble developed an entirely new lower pipe section, the same upper pipe section 16 with the plug being used again. Thus, unnecessary delays and the like are avoided and the mentioned connecting and disconnecting can be achieved in an extremely short period of time. Preferably, three phase 220–440 volt A.-C. is employed for energization of the heating elements. However, single phase 120–220 volt sources could be used. In this latter event, only two prongs and sockets would be required.

While a preferred embodiment of the invention has been shown and described, various modifications and changes falling clearly within the scope and spirit of the invention will occur to those skilled in the art. The oil well heater is therefore not to be thought of as limited to the exact embodiment set forth merely for illustrative purposes.

What is claimed is:

1. An oil well heater comprising, in combination: upper and lower pipe sections; a sleeve keyed to one end of one of said sections and threaded to the adjacent end of the other of said sections for enabling separation of said sections; means in said lower section defining a sealed chamber; electrical heating means in said chamber; oil in said sealed chamber to distribute heat generated by said heating means uniformly to the surfaces of said lower section; electrical conductors for energizing said heating means passing from said heating means to terminate at the upper end of said lower section in a plug; and cable means adapted for connection at one end to a source of electrical energy and having its other end passing through a lateral slot opening in said upper section to terminate in a mating plug whereby said plug and mating plug may be readily connected and said sleeve then threaded to secure said sections in axial alignment.

2. An oil well heater according to claim 1 including means guiding and resiliently supporting said heating means for limited longitudinal movement in said chamber.

3. An oil well heater according to claim 2 including a thermostat switch connected in circuit with at least one of said conductors within said chamber between said heating means and said plug and responsive to a predetermined temperature for de-energizing said heating means.

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