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PARAFFIN REMOVAL

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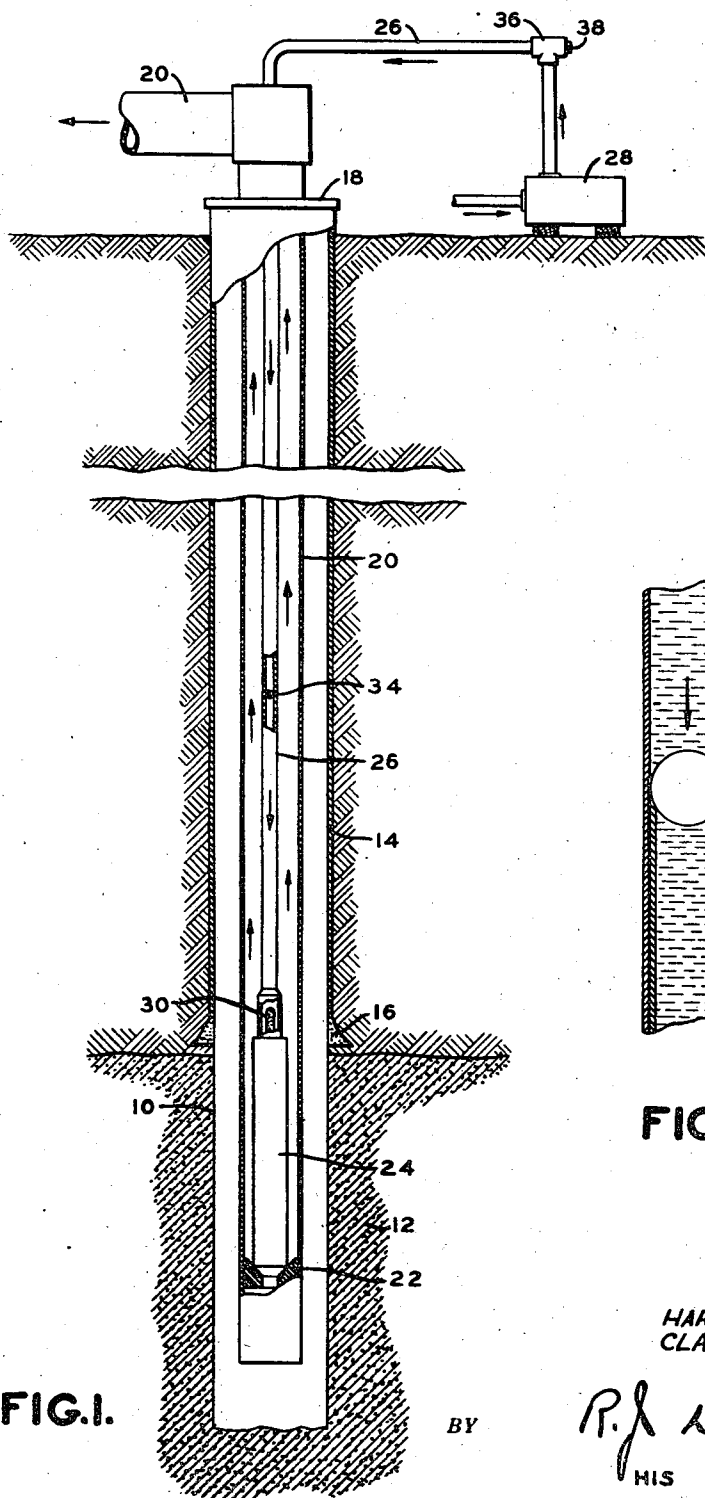


FIG. 1.

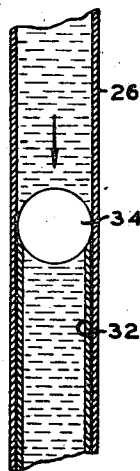


FIG. 2.

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PARAFFIN REMOVAL

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7 Claims. (Cl. 134—8)

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This invention relates to the removal of unwanted substances from the inner surface of pipe lines and more particularly to a method and an apparatus for removing wax adhering to the inner surface of a pipe line or conduit carrying oil under pressure to a fluid pressure motor. The principal object of the invention is to provide a method and means for removing a deposit of wax from the inner surface of a pipe conducting oil under pressure to a pressure motor during normal operation of the motor and without any detrimental effect either to the oil being conducted through the pipe or to the mechanism of the motor.

In certain well pumping operations a hydraulic production device comprising a fluid pressure motor connected directly to a pump is placed in the producing zone of a well and the motor is actuated by means of the pressure of a liquid such as oil, conducted from a pump at the surface through a small diameter pipe line or conduit to the motor in the well. The pressure of the fluid being pumped down to the motor causes the motor to drive the pump so as to raise the oil from the formation to the surface through a production tubing string. The pipe carrying the oil under pressure to the motor in the well usually has an internal diameter of about three-quarters of an inch, and it has been found that paraffin frequently accumulates and adheres to the inner surface of this pipe or power tubing thereby decreasing the efficiency of the system. This is particularly true during hot weather. Various attempts have been made to develop a satisfactory method for removing the paraffin from the pipe but these have generally proved unsatisfactory. To remove the power tubing from the well and clean it, as by scraping, requires that the well be shut down for some time and this naturally is an expensive operation. Any insoluble body which might be forced through the tubing to scrape the paraffin from the inner surface of the pipe would, of course, cause damage to the motor of the production unit or at least would plug the tubing so that the motor and pump could not be operated.

In accordance with the present invention a method has been devised whereby the paraffin deposit can be easily removed from the power tubing without disassembling the tubing or the production unit and without causing any damage to the mechanism of the motor or well pump. A solid body, preferably a sphere, of a substance such as a normally solid hydrocarbon conforming generally in size and shape to the inner contour of the power tubing is placed in the tubing at the

surface and is pumped downwardly with the oil under pressure. It has been found that a substance of this kind will be dissolved or disintegrated slowly due to the action of the oil during its passage through the tubing. In case the body reaches the motor before it has been completely dissolved it will be held at the intake strainer of the motor and the flow of pressure oil around and past the body will then dissolve it very quickly. The dissolved body then passes with the pressure oil through the motor and passes with the oil exhausted from the motor back to the surface along with the oil being pumped from the producing formation.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Figure 1 is a vertical elevation partly in section through a well being pumped by means of a hydraulic production unit; and

Figure 2 is a vertical sectional elevation through a portion of the power tubing showing one of the bodies being forced through the tubing to remove the paraffin which has accumulated therein.

Figure 1 shows a well hole 10 drilled into the producing formation 12 and provided with a casing 14 cemented as at 16. A casing head 18 closes the top of the well and a string of production tubing 20 is shown within the hole. A pump anchor 22 is disposed at the lower end of the production string 20 and secured to this anchor is a production unit 24 which usually comprises a well pump and a fluid pressure motor, the latter being adapted to be actuated by oil pumped downwardly through a power tubing string 26 from a suitable pump 28 at the surface. The well pump is driven directly by the fluid pressure motor to pump formation oil to the surface through the production string 20.

The operation of the apparatus so far described is well known. Oil under pressure from the pump 28 passes through the string of power tubing 26, which usually has an internal diameter of about three-quarters of an inch, and downwardly to the motor of the production unit 24. A strainer or screen 30 is provided at the upper end of the unit 24 to prevent sand or other foreign substances which might be carried in the oil from entering the motor of the production unit. After passing through the motor of the production unit, the oil is exhausted into the lower end of the production string 20 and flows upwardly to the surface with the oil from the formation 12.

As is shown more clearly in Figure 2, a deposit of paraffin wax 32 frequently adheres to the inner

surface of the power tubing 26 and because of the small diameter of this tubing a fairly thin layer of paraffin may be sufficient to cut down materially the efficiency of the apparatus. In order to remove this deposit of paraffin from the inner walls of the power tubing a body 34, preferably spherical, of a normally solid hydrocarbon is placed in the line of power tubing at the surface and is forced downwardly with the oil under pressure on its way to the production unit 24. The body 34 may be placed in the power tubing in any suitable manner. A T pipe-fitting 36 is shown as connected in the power tubing line and one end of this T may be provided with a plug 38 which may be removed so that the ball 34 can be placed in the tubing line. As the ball 34 passes through the tubing 26 the paraffin 32 is scraped from the walls and passes downwardly and through the fluid pressure motor of the production unit 24.

It has been found that a ball of naphthalene, such as a commercial moth ball, which has a diameter of about five-eighths of an inch serves very satisfactorily for this purpose. The naphthalene ball will dissolve or disintegrate gradually in the presence of the oil within the power tubing, and it has been found that in normal operation the ball will finally disintegrate at about the time it reaches the strainer 30. If the ball has not disintegrated at that time, it will lodge against the strainer 30 and the disintegration will then take place much more rapidly due to the turbulence of the oil flowing past the ball. In case of a deep hole where it is necessary for the ball to pass through a relatively long string of power tubing, or if for any other reason it is found that the ball disintegrates or dissolves to a material extent before it reaches the strainer 30, a slug of oil saturated with naphthalene may be placed in the tubing 26 directly behind the ball and the dissolving action of the oil on the naphthalene ball will thus be retarded to any desired degree.

Although it is preferred to use balls of naphthalene, solid balls of other compounds having substantially equivalent solubility characteristics may also be used; among these other compounds are acenaphthene, phenanthrene, anthracene, and triphenylmethane. Despite the fact that it is preferred to use a polycyclic aromatic hydrocarbon, bodies of certain normally solid non-hydrocarbons, such as sulfur, can be used also. These materials do not cause any detrimental contamination of the oil since the concentration is so low.

It will be seen that a method has been devised by means of which a deposit of paraffin can be quickly and easily removed from the inner surface of the power tubing during the actual well pumping operation, and, consequently, it is not necessary to shut down the pump and to remove the power tubing so that it can be cleaned. Naturally, no oil-insoluble substance can be used for cleaning a pipe line of this type since there is no way for such an insoluble body to get out of the power tubing before it reaches the fluid pressure motor driving the well pump. Although with the apparatus as shown it would be necessary to stop the operation of the pump 28 for a few seconds so that the ball 34 can be inserted in the T 36, any suitable trap device, such, for instance, as is disclosed in the U. S. Letters Patent to Strasburg 1,808,870, granted June 9, 1931, could be used in place of the T so that the ball can be placed in the flowing stream of oil

without stopping the operation of the pump 28 and without losing any of the oil.

Although the invention has been described with reference to the cleaning of the power tubing of an oil well production unit, it is believed obvious that the same method can be used in cleaning surface pipe lines such, for instance, as the line leading from a well head to a run-down tank. Again, the invention is not limited to the removing of paraffin from an oil conducting pipe or conduit. In any case, where a relatively soft deposit of a substance is built up on the inner surface of a fluid conducting pipe, a solid body formed of a material gradually soluble in the fluid being conducted could be used to scrape the substance from the walls of the pipe. The nature of the cleaning or scraping body will depend, of course, on the material which is to be scraped from the pipe walls, the type of fluid being conducted through the pipe, and the length of time the body will remain in contact with the fluid.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, but only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. The method of removing paraffin adhering to the inner surface of an oil conducting conduit which comprises forcing through said conduit with the oil a solid body of naphthalene slightly smaller than the inner diameter of said conduit, said body of naphthalene being gradually dissolved during its passage through the conduit.
2. The method of removing wax adhering to the inner surface of an oil conducting conduit which comprises forcing through said conduit with the oil an inflexible body of a normally solid, completely oil-soluble hydrocarbon conforming generally in size and shape to the inner contour of said conduit, and immediately following said body with a slug of a fluid capable of retarding the dissolving action of the oil on said body.
3. The method of removing wax adhering to the inner surface of an oil conducting conduit which comprises forcing through said conduit with the oil a solid body of naphthalene slightly smaller than the inner diameter of said conduit, and following said body in its passage through the conduit with a slug of oil saturated with naphthalene.
4. The method of removing wax adhering to the inner surface of a conduit conducting oil under pressure to a fluid pressure motor which comprises forcing through said conduit with the oil a solid body of a polycyclic, aromatic hydrocarbon, said body being slightly smaller than the inner diameter of said conduit and capable of being gradually completely dissolved by the oil during passage through the conduit to said motor.
5. The method of removing wax adhering to the inner surface of a conduit conducting oil under pressure to the in-take strainer of a fluid pressure motor which comprises forcing through said conduit with the oil a spherical body slightly smaller than the inner diameter of said conduit and capable of being dissolved by the action of the oil substantially by the time the body reaches said in-take strainer.
6. A device for cleaning the inner surface of an oil conduit comprising a body formed of a solid

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polycyclic aromatic hydrocarbon, said body being slightly smaller in diameter than the inner diameter of said conduit, and means for forcing said body through the conduit with said oil to scrape the inner surface of the conduit.

7. A device for cleaning the inner surface of an oil conduit comprising a spherical body of naphthalene slightly smaller in diameter than

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the inner diameter of said conduit, and means for forcing said body through the conduit with said oil to scrape the inner surface of the conduit, the arrangement being such that the body will be disintegrated by the action of the oil during passage through the conduit.

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