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CHEMICALLY HEATED PARAFFIN KNIFE

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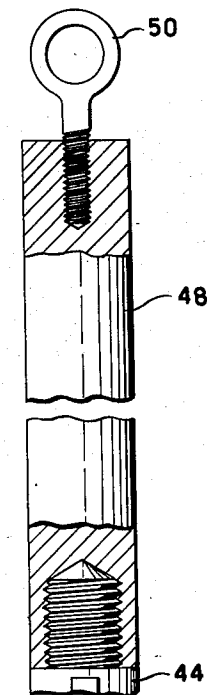
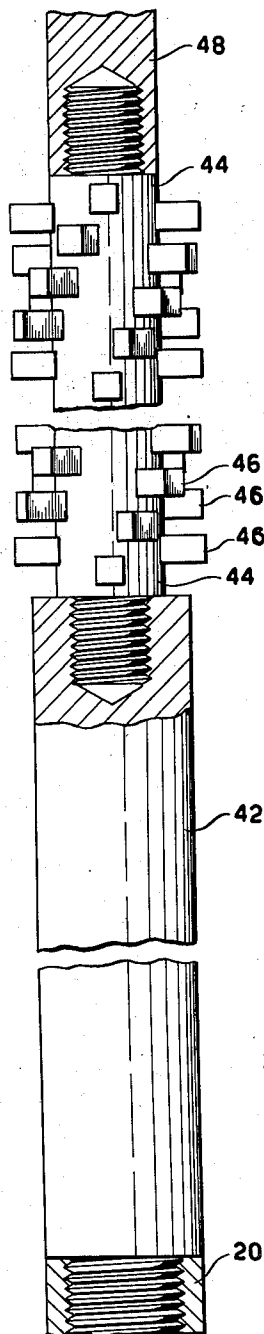
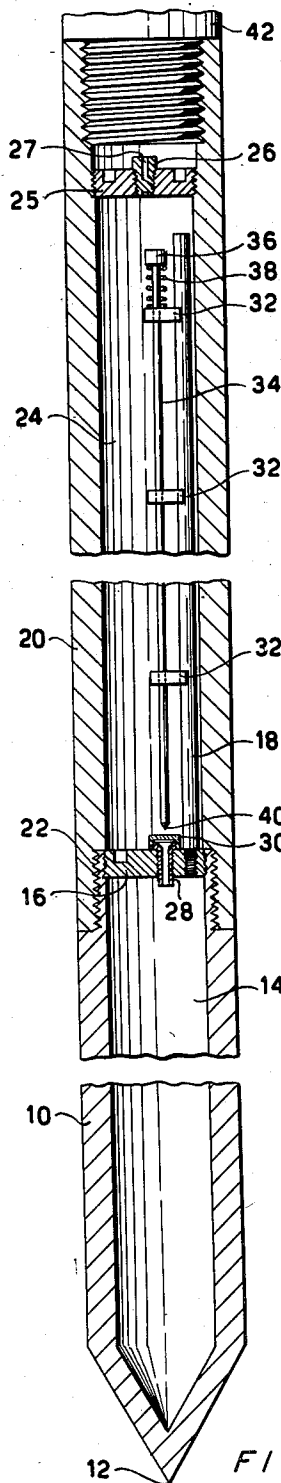


FIG. 1C.

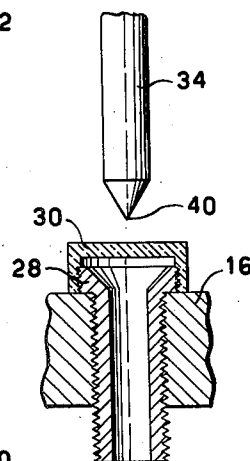


FIG. 2.

FIG. 1B.

FIG. 1A.

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CHEMICALLY HEATED PARAFFIN KNIFE

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1 Claim. (Cl. 166—17)

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This invention relates to an apparatus for removing the paraffin which accumulates on the wall of the tubing carrying crude oil up through a well bore hole.

It frequently occurs in the process of recovering oil from underground deposits, that the well bore hole will pass through water bearing strata whose temperatures are relatively low compared with the relatively high temperatures of the oil within the underground deposits which occur at considerable depths within the earth. Thus, when the oil is carried upward through the tubing which is lowered into the well, the oil is chilled as it passes over the cool wall of the tubing in the region of the water bearing strata and some of the paraffin which is carried by the crude oil solidifies and adheres to the tubing wall. This deposit of paraffin may accumulate to a thickness which reduces the opening through the tubing to such a degree that the flow of oil through the pipe is materially reduced and, therefore, it becomes necessary to clean out the deposit to permit normal flow of oil to be reestablished.

It is an object of this invention to provide a weighted apparatus, which when lowered into the bore hole tubing on a wire line, will clean out such deposits.

It is a further object of this invention to provide a weighted apparatus which, when the weight is insufficient to force the apparatus through the paraffin deposit, is capable of generating sufficient heat to soften the paraffin, thereby facilitating the removal of the deposit.

These and other objects of the invention will become apparent from the following description read in conjunction with the accompanying drawings, in which:

Figure 1A shows a longitudinal section of the lowermost portion of the apparatus which contains the heat generating materials;

Figure 1B shows the intermediate portion of the apparatus which carries the cleaning knives;

Figure 1C shows the uppermost portion of the apparatus which includes a weighted sinker bar and a lifting eye; and

Figure 2 shows an enlarged section of a portion of the apparatus shown in Figure 1A.

Referring to the figures, the apparatus includes a lowermost member 10 pointed at its lower end 12 and containing a chamber 14 which is sealed at its upper end by the threaded plug 16. Member 10 is joined to a member 20 by the screw threads 22. The member 20 contains the interior chamber 24 the upper end of which is sealed by the threaded plug 25. The plug 25 con-

tains the threaded tapered plug 26 which contains the bore 27.

Threaded into the plug member 16 is the tubular member 18 providing a passage between two chambers. Also threaded into the plug member 16 is the orifice member 28 which is sealed by the cap 30. Mounted on the tubular member 18 are the guide members 32, through which extends the piercing rod 34, which has affixed to its upper end the weight member 36 supported by the spring 38. The lower end of the piercing rod 34 is formed to a point 40 and is held in alignment with the center of the cap 30 by the guides 32.

With the exception of the cap 30 all of the parts thus far described are formed of cast steel or other suitable chemical resistant material. The cap 30 is composed of wax, plastic or other soft chemical resistant material.

Member 42 is threaded into the upper end of member 20 and forms a spacer between the member 20 and the member 44 which is threaded into the upper end of member 42 and carries the cleaning knives 46. The cleaning knives 46 are mounted on member 40 in a staggered arrangement so as to allow the scrapings to pass upwardly between the knife elements while the entire periphery of the inner wall of the pipe line is being scraped. Threaded to the upper end of knife carrying member 44 is a weighted member or sinker bar 48 provided to urge the assembly downward through the deposit. Threaded into the upper end of the sinker bar is lifting eye 50 provided for the attachment of a cable for raising and lowering the assembly into the tubing.

When the apparatus is assembled prior to being lowered into a bore hole tubing the chambers 14 and 24 are charged with suitable chemicals. One such combination would be to charge the chamber 14 with moist generally solid sodium hydroxide and to charge the chamber 24 with concentrated sulfuric acid. The chamber 24 should be filled to a level conveniently below the upper end of tube 18 so that with the agitation and inclination resulting from normal handling of the apparatus the sulfuric acid will not enter the upper end of the tube. The chamber 14 should be filled only part-way to allow space for the addition of the chemical from the chamber 24 which flows into the lower chamber 14 as will be hereinafter explained.

The length of the spacer member 42 and the weight of the sinker bar 48 are generally selected in accordance with the length and hardness of the paraffin deposit within the tubing. The nature of the deposit is generally dependent upon

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the thickness and temperature of the water bearing strata chilling the pipe line and the nature of the oil in that particular location.

This entire assembly is then lowered into the bore hole tubing on a wire line and when the assembly becomes engaged in a paraffin deposit, through which it can not press by its own weight, the entire assembly is "spudded" i. e., raised and allowed to drop against the paraffin obstruction. This impact against the obstruction causes the weight member 36 to carry the rod 34 downward compressing the spring 38 and causing the point 40 to pierce the soft cap 30 covering the orifice member 28. The action of the spring will then raise the rod 34 out of the hole which it has formed in the cap 30 allowing the sulfuric acid or other suitable material contained within chamber 24 to flow downward through the orifice member 28 into chamber 14 and contact the sodium hydroxide or other material contained therein. The orifice member 28 may be selected with an orifice of a diameter such as to allow any desired rate of flow of material from the upper chamber 14 into the lower chamber 24 as may be determined by the particular chemicals employed and by the desired rate of heat generation. The gases and heated air produced by the chemical action within chamber 14 pass upward through the tubular member 18 into the chamber 24, thereby equalizing the pressures in the two chambers and allowing the material in the upper chamber to flow downward into the lower chamber as the chemical action proceeds at a rate dependent upon the diameter of the orifice in member 28.

The chemical action, resulting from the combination of sulfuric acid with the sodium hydroxide or other materials which may be employed, will heat the members 10 and 20 thereby softening the paraffin deposit and allowing the members 10 and 20 to pass downwardly through the obstructed portion of the pipe line followed by the cleaning knives 46 which clear the remainder of the paraffin from the wall of the tubing. The spacer member 42 is selected to be of such a length that the paraffin has cooled sufficiently to prevent the blades from becoming congested with a plastic mass of paraffin, and yet to accomplish their cutting or scraping before the paraffin becomes too cold and solid.

After the completion of a paraffin removal op-

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eration, the apparatus is withdrawn from the well and member 42 is detached from member 20, and tapered plug 26 is loosened to allow a slow discharge of the pressure within the chambers 24 and 14 through the bore 27 within plug 26. After the pressure has been relieved, the members 10 and 20 may be separated and drained, and a new cap 30 applied over orifice member 28. The chambers may then be recharged in preparation for a new operation of the apparatus.

While for convenience the present invention has been described as applied to paraffin removal in the bore hole tubing in an oil well, it will be apparent that the invention may be employed for the removal of paraffin and many other forms of deposits which may accumulate in pipe lines in other types of apparatus.

What I claim and desire to protect by Letters Patent is:

Apparatus for heating and removing a paraffin deposit from the inside wall of a pipe line comprising a member enclosing a first chamber containing a first chemical material, a second chamber containing a second chemical material, means responsive to impact effecting a communication between said chambers permitting the passage of the first chemical from the first mentioned chamber into the second mentioned chamber, the two chemical materials being such that heat is generated by their reaction, and cutting means, including radially extending knives in staggered arrangement, joined to said member by a spacer member.

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