Nov. 13, 1956 T. J. DEERDOFF 2,770,307

PARAFFIN REMOVAL PROCESS FOR OIL WELLS

Filed June 1, 1954 2 Sheets-Sheet 1

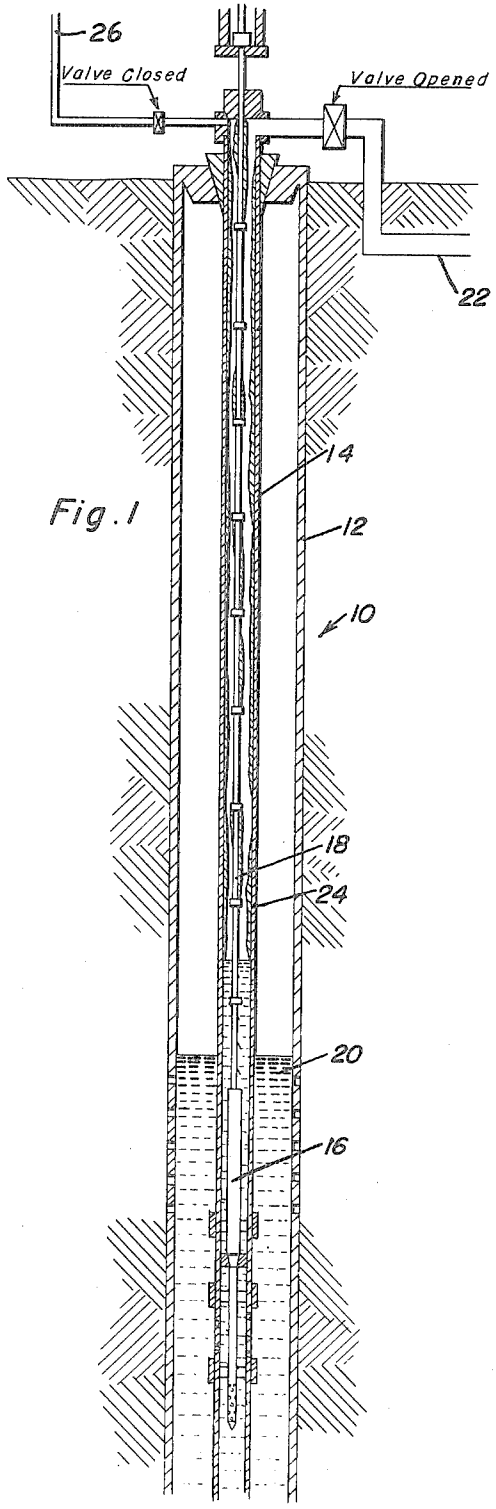


Fig. 1

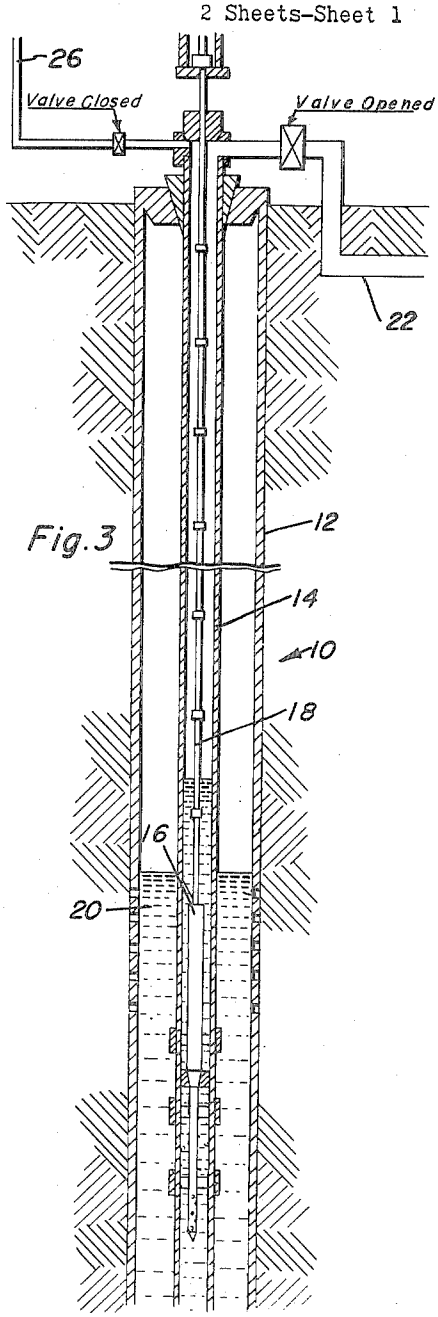


Fig. 3

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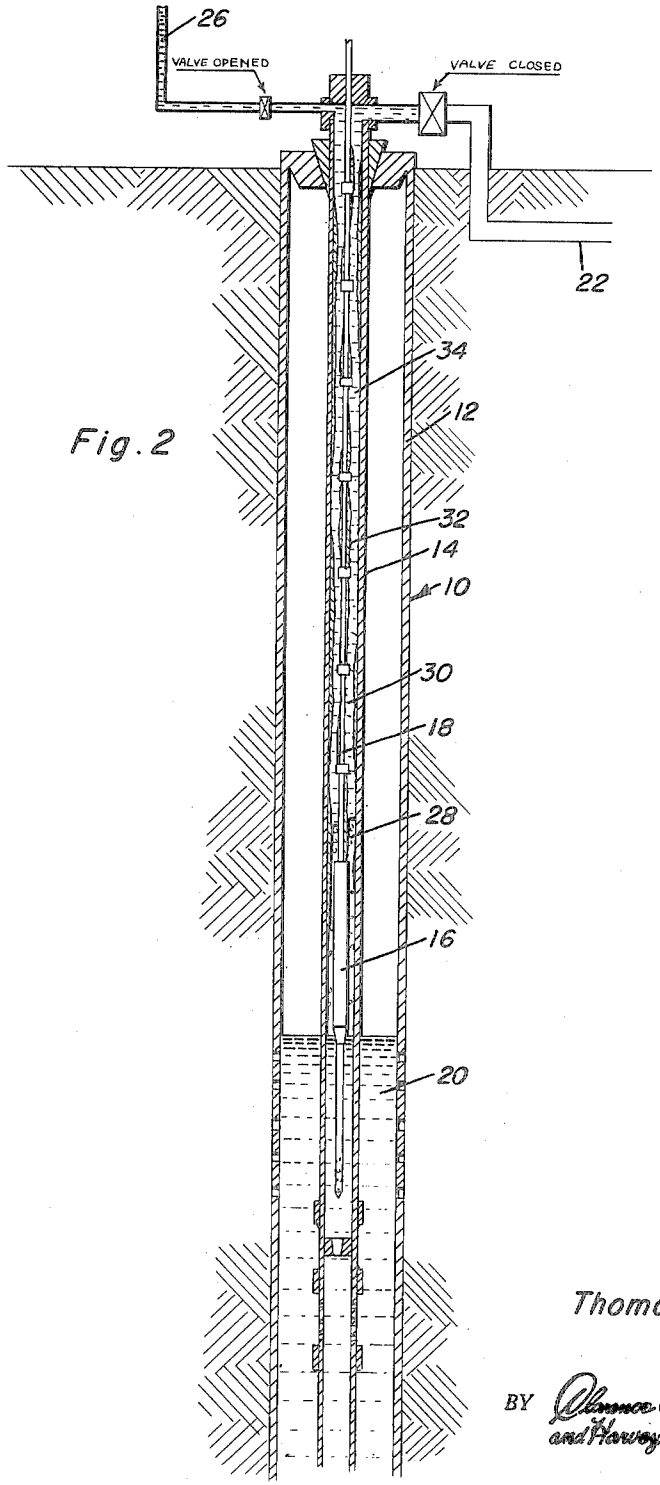


Fig. 2

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PARAFFIN REMOVAL PROCESS FOR OIL WELLS

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7 Claims. (Cl. 166—41)

The present invention relates to a method of removing paraffin deposits from the casing, tubing, and pump rods of oil wells.

The primary object of the invention is to provide a novel method of treating oil wells to remove from and prevent the further accumulation of paraffin on the well tubing and pump or sucker rods, which process necessitates no pulling of the well tubing or pump rods and which process of treatment may ordinarily be completed and the well put back in operation in a matter of from one-half to two hours.

Paraffin deposition in oil well pumping equipment presents a particularly difficult problem in the pumping of oil from wells in the minimum time and at a minimum cost since such deposition on the well casing, tubing and sucker rods is dependent upon temperature variations in the well, the physical and chemical nature of the oil from which the paraffin is deposited, the nature of the paraffin, and to a lesser extent, to the tubing size and the rate of oil flow from the well.

In the Texas-Oklahoma oil field area, wells are often drilled to a depth of 6000 feet, and over. The bottom hole temperatures of the wells in this area average somewhere in the neighborhood of 120 degrees F. Paraffin is normally held in solution at these temperatures. Under average pressure and other well conditions, paraffin begins to congeal out of the petroleum and deposit and form encrustations on the well tubing and pump rods at approximately 100 degrees F. which temperature occurs at a depth of approximately 3000 feet. The conditions, however, do vary considerably and there may be no substantial paraffin encrustation on the tubing and pump rods below a depth of around 1200 feet. But, since the temperature decreases from the bottom to the top of the well, the encrustation increases in thickness as the top of the well is approached.

The paraffin encrustation on the well tubing and pump rods in some cases completely chokes the well causing complete stoppage. More often, however, before this condition is reached, attempts are made to reduce the paraffin congestion in the tubing in order to bring the well back to full pumping capacity.

Numerous methods have heretofore evolved for treating oil wells to remove paraffin depositions on the well equipment. The treatments fall into many categories such as treating with heated steam or oil to remelt the paraffin in the solution, treating the paraffin with solvents, physical scraping of the paraffin from the affected areas, treating the formation oil with paraffin deposition inhibiting solvents, and more recently, the provision of hollow sucker or pump rods through which a portion of the oil flows at an increased rate with considerable turbulence.

Although all of these methods of treatment have some advantages, they also possess many disadvantages which are well known to those skilled in the art.

In treating a well, in accordance with my invention, attention is directed to the drawings wherein:

Figure 1 represents a cross-sectional view of a pumping oil well which is partially choked through the incident of paraffin depositions or accumulations on the sucker rods and the tubing;

Figure 2 is a cross-sectional view of the well in the initial stages of treatment in accordance with the present invention; and

Figure 3 is a cross-sectional view of the well after treatment and ready to resume pumping operations.

In the drawings, the well is designated in its entirety by the numeral **10** and is shown, as is customary, as comprising a well casing **12**, well tubing **14**, pump **16** for pumping oil from the formation through the tubing **14** and pump or sucker rods **18** for reciprocating the pump piston within the pump cylinder or working barrel **16**. As shown in the drawings, the pump is disposed within the oil formation **20** at the bottom of the well and in the ordinary operation of the well, oil is pumped up through the tubing **14** and out the flow line **22**.

As the oil is drawn up through the tubing **14**, the temperature is constantly decreasing until a temperature is reached wherein paraffin begins to congeal out of the oil and deposit or accumulate on the inner surface of the well tubing and the outer surface of the sucker rods. This deposition is designated generally at **24**.

When this condition results, as shown in Figure 1, the well tubing is choked and the normal flow of oil cannot be pumped through the tubing. Consequently, treatment of the tubing and sucker rods is necessary to restore the well to its normal pumping capacity.

In order to prepare the well for treatment in accordance with my invention, the barrel **16** is first drawn up out of its seated pumping position at least the length of the pump stroke, as indicated in Figure 2.

Then, the sucker rods **18** are reciprocated in the well tubing **14** while a plurality of layers of treating materials are successively forced down the well tubing, the materials consisting of an emulsion breaking layer, a light lubricating layer, and a heavy lubricating layer, the layers being forced down the tubing by hot oil to form a progressively increasing downwardly moving column, the layers and the oil entering the tubing through line **26** opening into the upper end of this tubing.

The proper depth in the well tubing to which the composite layers and hot oil must be forced is easily determined by the sudden pressure drop which occurs when the treating layers have reached a point in the tubing below the lowest point of paraffin accumulation thereon.

The crux of the present invention lies in the formation of the fluid column forced down the well tubing wherein the column comprises successive layers from bottom to top of a water in oil emulsion breaker **28**, lubricating or lubrication grease layers **30**, **32**, followed by hot oil **34**.

For the emulsion layer, almost any known demulsification agent for preventing, breaking, or resolving emulsions of the water in oil type may be utilized. Such demulsification agents, usually comprising a saponifiable oil and an alkali, exist in a wide variety and are well known in the art, several different agents being represented in Patents Nos. 1,454,616, 1,858,156, 1,976,602, 2,522,523, these patents being comparatively representative of the demulsification agents now in use. The ordinary use for these demulsification agents is, of course, to separate the water from water-in-oil emulsions after oil has been pumped from the well. However, I have found extremely beneficial and unique results accrue in the treatment of the oil wells themselves with such demulsification agents in the removal of paraffin encrustations or accumulations from the well tubing and sucker

rods. Although it is not certain exactly what occurs with the use of the demulsification agent, in this deparaffinizing treatment, the agent appears to remove the salt brine from the paraffin, tubing and sucker rods to prepare the tubing and sucker rods for the coating of these members by the lubricating layer.

The lubrication layer consists of two separate and distinct portions, a light lubrication layer and a heavy lubrication layer. The light lubrication layer is formed by cutting chassis grease from its normal consistency to a Saybolt viscosity of approximately 50–70 at 100 degrees F. This light lubrication layer prepares the tubing and sucker rods for the heavy lubrication layer which follows.

The heavy lubrication layer is in the form of a heavy chassis lubricating grease, having a Saybolt viscosity approaching 500 or above at 210 degrees F. and immediately follows the light lubrication layer into the well tubing. The entire mass is forced through the tubing by hot oil, preferably around 140 degrees F. which melts the paraffin from the sucker rods and the tubing wall.

Ordinarily, if only hot oil is utilized to melt the paraffin from the tubing and sucker rods, the treatment is short lived indeed, since immediately upon expulsion of the hot oil from the tubing, paraffin again begins to accumulate on the tubing and sucker rods, necessitating frequent treatment and affording generally inadequate results.

However, when this hot oil is utilized with the heavy and light lubrication layers and the demulsification plug in a batch treatment of the well, the paraffin is not only completely removed, but a lubrication coating of the heavy grease and oil of the lubrication layers is formed on the walls of the sucker rods and the tubing which prevents the accumulation or encrustation of paraffin thereon for extremely long periods of time. The uniformity and duration of the coating is believed to result from the emulsified salt brine removal from the well equipment by the demulsification plug.

This treatment has been utilized with outstanding success in the treatment of pumping oil wells for the removal of paraffin from the well equipment, the treatment taking anywhere from one-half to two hours, the well being restored to normal operation immediately following the treatment.

Example 1

Well No. 2, situated on the Hamill-Hooper lease in Hockley County, Texas, had been treated with various paraffin removal treatments approximately every thirty days for the removal of paraffin therefrom and it became completely stuck if permitted to run sixty days or longer without such treatment.

On November 13, 1953, this well was treated in accordance with my invention to a depth of 1100 feet. The treatment took approximately half an hour and immediately after this treatment the well continued to produce by pumping in the usual and customary manner. Eighty days after treatment, approximately 40 joints of the sucker rod were pulled and the tubing and rod were found to be clean and completely free of paraffin. The well was producing from a pay zone situated 4894 feet below the surface of the ground and the fluid level in the casing and the tubing was approximately 3800 to 3900 feet below the surface of the ground.

Example 2

Sun Oil Company well No. 6 located on the Gann Lease B situated in Hockley County, Texas, was treated in accordance with the present invention on January 11, 1954. At that time it was producing from a zone approximately 4896 feet below the surface of the ground and the fluid level in the casing and tubing was about 2800 feet below the surface of the ground. This well was treated to a depth of 900 feet at which time it was paraffined to a depth of approximately 1100 feet. Apparently the treatment was sufficient to slip on through the well tubing because the well was checked on February 6, 1954 and found to be completely clear of paraffin.

Example 3

David Parsons well No. 3 of Sun Oil Company in Hockley County, Texas, was treated in accordance with the invention in December, 1952. At that time the well was producing from a zine approximately 4996 feet below the surface of the ground. The fluid level in the casing and tubing at that time was approximately 4196 feet below the surface of the ground and the well was paraffined to a depth of approximately 1400 feet; the treatment was carried out throughout the 1400 feet. Prior to this treatment, the well had been treated by other methods approximately every thirty days in order to avoid becoming completely choked. After treatment in accordance with the invention, the well was checked at thirty day intervals for sixteen consecutive months before there was any adherence of paraffin noted on the sucker rods. It was not until the end of approximately eighteen months without further treatment that the well became completely choked with paraffin.

The reciprocation of the sucker rods during the forcing of the paraffin removing ingredients down the well tubing causes sufficient agitation of the demulsification plug to thoroughly separate all the salt water brine disbursed in the oil and paraffin clinging to the tubing and sucker rods to prepare the tubing and rods for a proper lubrication coating while at the same time mixing the heavy and light lubrication layers with one another and with the hot oil to form a continuous coating on the tubing and the sucker rods, which coating prevents the redeposition or accumulation of paraffin on these members during the normal pumping operation of the well, allowing paraffin ordinarily separating from the oil during pumping to slip through the tubing and around the sucker rods without deposition. The effect of this treatment is twofold in that the paraffin is not only removed from the tubing and sucker rods, but the tubing and sucker rods are prepared for the reception of a lasting, substantially uniform lubrication coating formed by the heavy lubricant and the light lubricant of the lubrication plug mixing with the hot oil and uniformly coating the tubing. This coating prevents the accumulation of paraffin on the tubing or sucker rods even though this paraffin does congeal out of the crude oil as it is pumped through the well since no adhering surface is left on which the paraffin may cling.

Were it not for the use of the demulsification agent initially in the treating process, the tubing and sucker rods would not be sufficiently prepared for the reception of a more or less uniform lubrication coating thereon, the coating being instead spotty and nonuniform causing the quick accumulation of paraffin on the insufficiently lubricated areas, which areas would occur from the higher incidence of salt water eroded bare areas along the tubing and sucker rods which ordinarily occur through the customary operation of the well and furnish footholds for the paraffin deposition.

From the foregoing description, the process and its application will be readily apparent to those skilled in the art.

What is claimed as new is as follows:

1. A method of removing deposited paraffin encrustation from the well tubing and pump rods of pumping oil wells which comprises sequentially forcing layers of an emulsion breaker, a lubricating grease and hot oil down the well tubing thereby removing the encrusted paraffin from the well tubing and pump rods and depositing a lubricant coating on the well tubing, agitating the mass formed by the successive layers during their passage down the well tubing by reciprocating the pump rods.

2. A method of removing deposited paraffin encrustation from the well tubing and pump rods of pumping oil

wells which comprises sequentially forcing an emulsion breaker, a heavy lubricant and hot oil down the well tubing thereby removing the encrusted paraffin from the well tubing and pump rods, and coating the pump rods and tubing with a lubrication film preventing redeposition of paraffin thereon.

3. A method for removing deposited paraffin encrustation from the well tubing and pumping rods of pumping oil wells which comprises sequentially forcing a water-in-oil demulsification material, a heavy lubricating material, and a paraffin solvent miscible with the lubricating material into the well tubing.

4. A process for removing paraffin depositions from oil well tubing and inhibiting further paraffin deposition of such tubing comprising the steps of forcing a water-in-oil demulsification agent down the well tubing, then forcing a heavy lubricant down the well tubing, and forcing hot oil down the tubing, agitating the mixture during its passage down the tubing to remove paraffin depositions from the tubing, then removing the mixture from the tubing by releasing the forcing pressure and thereby causing a substantially uniform deposition of a lubrication coating on the well tubing.

5. A process for removing paraffin depositions from the tubing and sucker rods of pumping oil wells which comprises lifting the working barrel from its pumping seat in the tubing, forcing a progressively increasing downwardly moving fluid column down the well tubing comprising successive layers of a water-in-oil demulsification agent, a thick, viscous lubricating grease and hot oil, longitudinally reciprocating the sucker rods while forcing the mixture down the tubing to blend the oil and grease

layers with one another, discontinuing the introduction of the fluid when the fluid column is of a length equal to the depth of the paraffin deposition in the tubing, then discharging the fluid column through the top of the tubing.

6. A process for simultaneously removing paraffin depositions from the tubing and sucker rods of pumping oil wells and treating the tubing and sucker rods for prevention of further paraffin deposition, the process comprising forcing down the well tubing a progressively increasing downwardly moving fluid column comprising successive layers from the bottom of the column to the top of a water-in-oil demulsification agent, a thick viscous lubricant, and hot oil, breaking water-in-oil emulsions in the oil clinging to the sucker rods and tubing with the demulsification agent and melting deposited paraffin on the tubing and sucker rods into the hot oil, discontinuing the introduction of the fluid when the fluid column is of a length equal to the depth of paraffin deposition in the tubing, then withdrawing the fluid column through the top of the tubing causing the deposition of a substantially uniform lubricant coating on the tubing and sucker rods.

7. The process of claim 6 wherein the lubricant coating is free from water-in-oil emulsions and is more viscous than the oil normally pumped from the well.

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