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E. TILTON

METHOD OF CLEANING OIL WELLS

Original Filed August 12, 1922

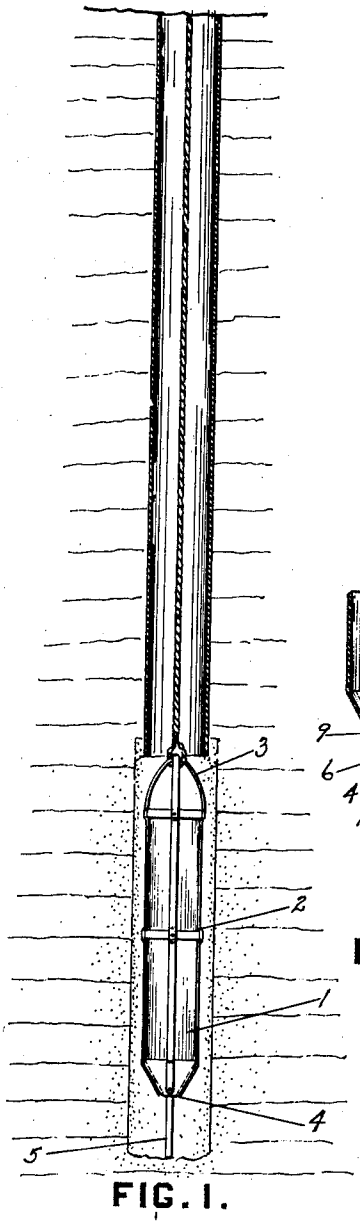


FIG. 1.

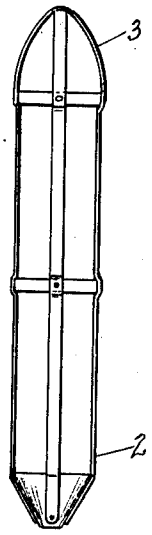


FIG. 2.

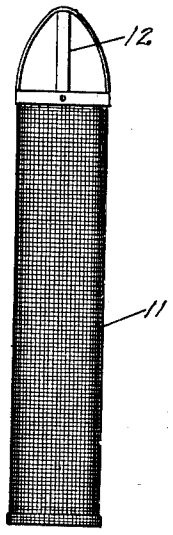


FIG. 5.

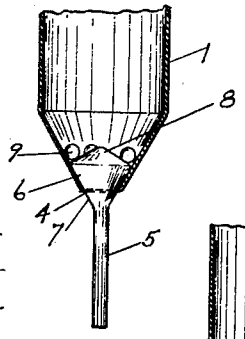


FIG. 3.

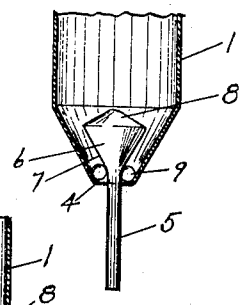


FIG. 4.

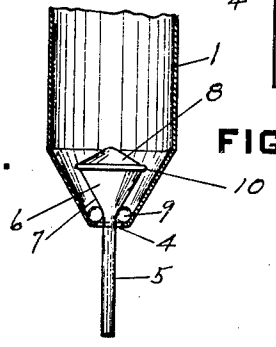


FIG. 6.

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UNITED STATES PATENT OFFICE.

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METHOD OF CLEANING OIL WELLS.

Application filed August 12, 1922, Serial No. 581,369. Renewed December 7, 1925.

This invention relates to a method of cleaning oil wells.

It is a known fact that after oil wells have been producing for a short time the production decreases; this decrease taking place rather rapidly for the first month or two, and more gradually thereafter. Several factors, such as gas pressure, porosity of the oil bearing sand, mineral precipitation, and entrance of water into the well, cause or contribute to this falling off in production. The most common cause of such falling off, however, is paraffine, a thick and gummy component of the oil which collects in the pores of the oil bearing sand adjacent the well and retards the flow of oil thereinto.

A general object of the invention is to provide a method of melting such paraffine and removing it from the well.

Various processes have been practiced for the purpose of removing the deposits of paraffine. In some of such processes steam has been forced down the tubing or casing of the well and brought into contact with the paraffine coated portion of the well, either with or without special apparatus for applying it thereto.

The disadvantages of this method are that a large proportion of the steam tends to condense during its passage to the bottom of the well, so that when the point of its application has been reached the steam is ineffective in melting the paraffine. If the steam is introduced under high pressure, it tends to drive the melted paraffine further into the pores of the sand so that production is more effectually cut off than was the case before the introduction of the steam.

Other processes which utilize the heat of chemical actions or reactions to melt the paraffine have also not been wholly satisfactory, because of the manner in which the chemicals have been introduced or applied. Previously the chemicals have been poured into the well in solution, or in a liquid state, or have been introduced at the mouth of the well in a solid state. In either case the heating effect is dissipated throughout the length of the casing or tubing and a corrosive effect is also exerted thereon. The corrosive effect is the more marked if the chemicals be dumped into the well while in a solid state, as in such case they adhere to the casing or tubing, which is always in a moist condition.

A more specific object of the invention is, therefore, to provide a method for so introducing chemicals into the lower, or producing, zone of an oil well that their full action and heating effect is exercised in such zone and none dissipated in heating the casing or tubing of the well, so that the paraffine in the producing zone is completely liquified, and for raising the paraffine above the level of the oil sand, or producing zone of the well.

In the accompanying drawings Figure 1 is a vertical section through an oil well, showing a container for introducing one or more of the active chemicals in operative position in the well; Figure 2 is an elevation of the cage for supporting the inner container or receptacle which receives and discharges the chemical or chemicals; Figure 3 is a fragmentary sectional view through the lower portion of the inner container, showing the same in closed position; Figure 4 is a fragmentary sectional view through the lower portion of such container, showing the same in open or discharging position; Figure 5 is an elevation of a container of different form for containing other chemical or chemicals; and Figure 6 is a detail elevation of the valve of the acid container, illustrating a slight modification therein.

The apparatus shown for conducting the process comprises an acid container 1, shown in Figures 1, 3 and 4 of the drawings, and an open receptacle or cage 2 for supporting the container 1. The acid container proper is an elongated receptacle, provided at its lower extremity with a valved discharge orifice 4. The valve for closing the discharge orifice 4 comprises a stem 5, extending through the orifice, and a head 6 lying within the receptacle. The head 6 of the valve comprises a conical lower portion 7 arranged to fit the wall of the container adjacent the discharge orifice 4, and an upper portion 8, which is shown as conical but which may be of any desirable rounded or tapered form.

Cooperating with the valve head 6 are a plurality of spheres 9 disposed within the container 1. When the container is lowered into operative position, the valve stem 5 comes into contact with the bottom of the well and moves upwardly within the container. When the valve head 6 moves upwardly, the spheres 9 run downwardly in the container and wedge between the conical portion 7 of the valve head and the corre-

sponding inner surface of the container adjacent the discharge orifice 4. These spheres are of sufficient diameter to prevent them from passing out through the discharge orifice around the valve stem 5, and also to prevent their upward displacement around the valve stem and past the valve head into the body of the container. If desired, however, the head portions 7 and 8 may be separated by the ridge or bead 10 shown in Figure 6 of the drawings, to additionally insure against displacement of the spheres from between the lower portion 7 of the valve head and the inner surface of the container.

The container proper, all parts of the valve, and the spheres for wedging the valve in open position, are all preferably made of lead in order that they may not be attacked by acid introduced in the container for the purpose of cleaning the well.

In cleaning an oil well by the method of my present invention; the well is first pumped as dry as possible and the pump and tubing removed. A bailer is then used to remove any loose material which has not been reached by the pump.

Water is then poured into the well, the volume of this water being preferably equal to the volume of acid which is to be introduced. The total volume of both liquids should be sufficient to bring the surface of the solution above the top of the oil bearing sand.

The container 1 is then filled with concentrated sulphuric acid and is lowered into the well. When the container has been lowered to the bottom of the well, the valve stem 5 comes into contact therewith to open discharge orifice 4. The spheres 8 act as previously described to hold the valve in open position, and the container is then raised above the level of the liquid in the well and held in such position for a length of time sufficient for the discharge of the acid from the container.

When sufficient time for the discharge of the acid has been allowed, the liquid may be agitated by raising and lowering the container a short distance to thoroughly commingle the water and acid and to increase the effect upon the paraffine in the well. The acid is allowed to remain in this condition for a short time in order that the heat generated by the chemical combination of the acid and the water may have full opportunity to form a hot solution and highly heat the paraffine in the well, melting some proportion thereof.

If desired, potassium dichromate may be added to the acid. The function of the dichromate is to dissolve the final film of greasy material adhering to mineral matter in the well. It is therefore of importance when the deposits, or the oil bearing sand itself, consist largely of a mineral substance, such as limestone or calcium carbonate, which is attacked by sulphuric acid. In such case the potassium dichromate by removing such film prevents the acid full opportunity to dissolve the deposits or to clean and enlarge the interstices or pores of the oil sand.

When the effect of the acid alone has been largely spent, the next step in the process usually is resorted to in order to insure a complete melting of the paraffine. In conducting this step the cage 2, containing the receptacle 1, is first removed from the well. A second receptacle 11, is then filled with a suitable chemical for reacting with the sulphuric acid, preferably with sodium hydroxide (caustic soda). The receptacle or exciter 11 is formed of close wire mesh, and has a bail 12 for lowering it into the well. This exciter 11 is filled with flake sodium hydroxide, and when lowered into the producing zone may be agitated by raising and lowering it a short distance in order to expedite the reaction between the sodium hydroxide and the sulphuric acid. This, however, is generally unnecessary because the sodium hydroxide enters into solution and reacts with the sulphuric acid with great rapidity; creating an intense heat and thoroughly melting any paraffine remaining in a solid state after the previous steps of the process. The exciter 11 may be raised, refilled, and again lowered to the operative zone as often as may be necessary to secure complete neutralization of the sulphuric acid.

The mixture is then allowed to remain in the well a sufficient length of time to permit the melted paraffine to rise to the surface of the liquid.

The paraffine is then bailed out while still in a melted condition; and may be saved, if desired, either in a still liquid form or solidified by emptying it into cold water.

The solution remaining in the well is then also bailed out, and the well is cleaned by flushing it with water which may be bailed or pumped out. As the acid has been completely neutralized, the well may be emptied without injury to the pump or other equipment used.

It will be noted that the method described above results in completely and efficiently melting the paraffine, without any inefficiency resulting from the dissipation of heat wasted in heating the casing or corrosion of the casing due to the adhesion of a chemical thereto. It will be noted further that it is unnecessary in conducting this method to use crude oil to act as a solvent of the paraffine, or that, or any other additional substance, to act as a seal for localizing the heat of the chemical action within the producing zone of the well. This is because the paraffine itself, as it is melted and floats

to the surface of the liquid, serves as a seal to localize the heat of the chemical action. In general the heat produced by the entry of the acid into solution serves to melt a sufficient quantity of the paraffine to form a slight initial seal, thus insuring the useful application of substantially all the heat generated by the subsequent reaction. The heating effect is also cumulative, the action of the first chemical serving to preheat the liquid so that the heat produced by the reaction following the introduction of the second chemical is higher than if introduced into a cold liquid or solution. In order to secure this effect the second chemical must obviously be introduced before the heat generated by the first action has been dissipated.

If the well is known to contain a relatively slight deposit of paraffine, the acid treatment alone will frequently prove sufficient to completely melt the same. In general, however, it is desirable to follow up this first step with the more intense heating secured by applying the sodium hydroxide to the zone from which the paraffine is to be removed.

When a maximum heating effect is attained, the oil bearing sand is cleaned and heated for an appreciable distance outward from the well itself. The heating in this outer zone serves to stimulate the flow of oil from the surrounding sand into the well. Such extended heating obviously occurs chiefly after the introduction of the sodium hydroxide and after the formation of an efficient seal by the flotation of melted paraffine.

While the method has been described above as particularly intended for the removal of paraffine from oil wells, it will be understood that it also removes other deposits which tend to cut down production and which may be liquefied by heat or the interaction of the chemicals, as for example the deposit commonly known as "B. S." tar, asphalt or the like.

It is to be understood that an important feature of the invention resides in the method of application of the chemicals, wholly apart from the specific chemicals employed or their general classification. In this connection it is sufficient if the chemicals be such that their action or reaction should, under the conditions, produce sufficient heat to melt the deposits.

It is also to be understood that the method of the invention is applicable to the cleaning of tanks, tubes and similar containers, and that the appended claims are to be considered as referring to such application of the method as well as to the more specific purpose of the invention.

What I claim:

1. The method of freeing an oil well of paraffine and other deposits, which consists in removing naturally occurring liquids from the well, introducing water thereinto, discharging directly into the producing zone of the well an acid capable of forming a true solution with the water with a generation of heat sufficient to melt a portion of the paraffine and a water soluble dichromate to dissolve a portion thereof, and removing the melted and dissolved paraffine from the well.

2. The method of freeing an oil well of paraffine and other deposits which consists in removing naturally occurring liquids from the well, introducing water thereinto, discharging directly into the producing zone of the well an acid capable of forming a true solution with the water with a generation of heat sufficient to melt a portion of the paraffine, introducing directly into the producing zone of the well a strong water soluble base in solid form to cause a further generation of heat by reaction with the acid solution, and removing the melted paraffine from the well.

3. The method of freeing an oil well of paraffine and other deposits which consists in removing naturally occurring liquids from the well, introducing water thereinto, discharging directly into the producing zone of the well an acid capable of forming a true solution with the water with a generation of heat sufficient to melt a portion of the paraffine and a water soluble dichromate to dissolve a portion thereof, introducing directly into the producing zone of the well a strong water soluble base in solid form to cause a further generation of heat by reaction with the acid solution, and removing the melted paraffine from the well.

4. The method of freeing an oil well of paraffine and other deposits which consists in removing naturally occurring liquids from the well, introducing water thereinto, discharging directly into the producing zone of the well an acid capable of forming a true solution with the water with a generation of heat sufficient to melt a portion of the paraffine, before total dissipation of heat thus generated introducing directly into the producing zone of the well a strong water soluble base in solid form to cause a further generation of heat by reaction with the acid solution, and removing this melted paraffine from the well.

5. The method of freeing an oil well of paraffine and other deposits which consists in removing naturally occurring liquids from the well, introducing water thereinto, discharging directly into the producing zone of the well acid capable of forming a true solution with the water with a generation of heat sufficient to melt a portion of the paraffine and a water soluble dichromate to dissolve a portion thereof, before total dissipation of the heat generated by the dissolution of the acid introducing directly into the

producing zone of the well a strong water soluble base in solid form to cause a further generation of heat by reaction with the acid solution, and removing this melted paraffine from the well.

6. The method of freeing an oil well of paraffine and other deposits which consists in removing naturally occurring liquids from the well, introducing water thereinto, discharging directly into the producing zone of the well an acid capable of forming a true solution with the water with a generation of heat sufficient to melt a portion of the paraffine, permitting the formation of a seal over the solution by flotation of the melted paraffine, before total dissipation of the heat generated by the dissolution of the acid introducing directly into the producing zone of the well a strong water soluble base in solid form to cause a further generation of heat by reaction with the acid solution, and removing the melted paraffine from the well.

In testimony whereof, I hereunto set my hand.

ELVIN TILTON.