

June 6, 1944.

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2,350,429

ELECTRO-HYDROTHERMIC OIL-WELL PROCESSOR

Filed May 17, 1941

2 Sheets-Sheet 1

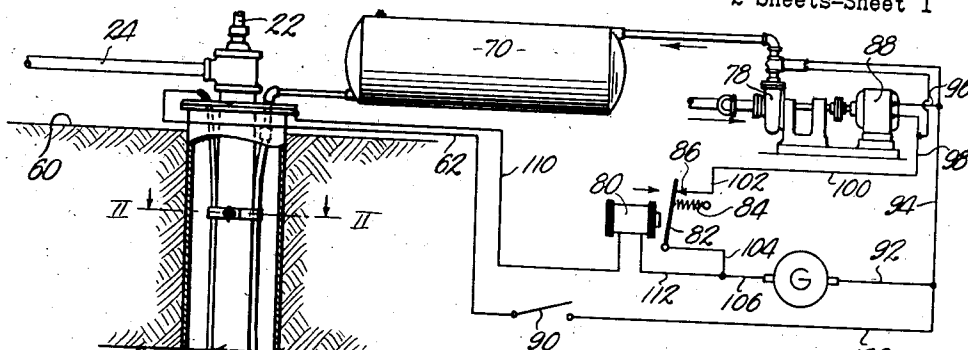


Fig. 1.

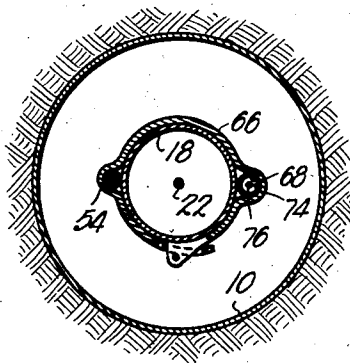


Fig. 2.

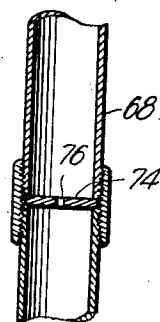
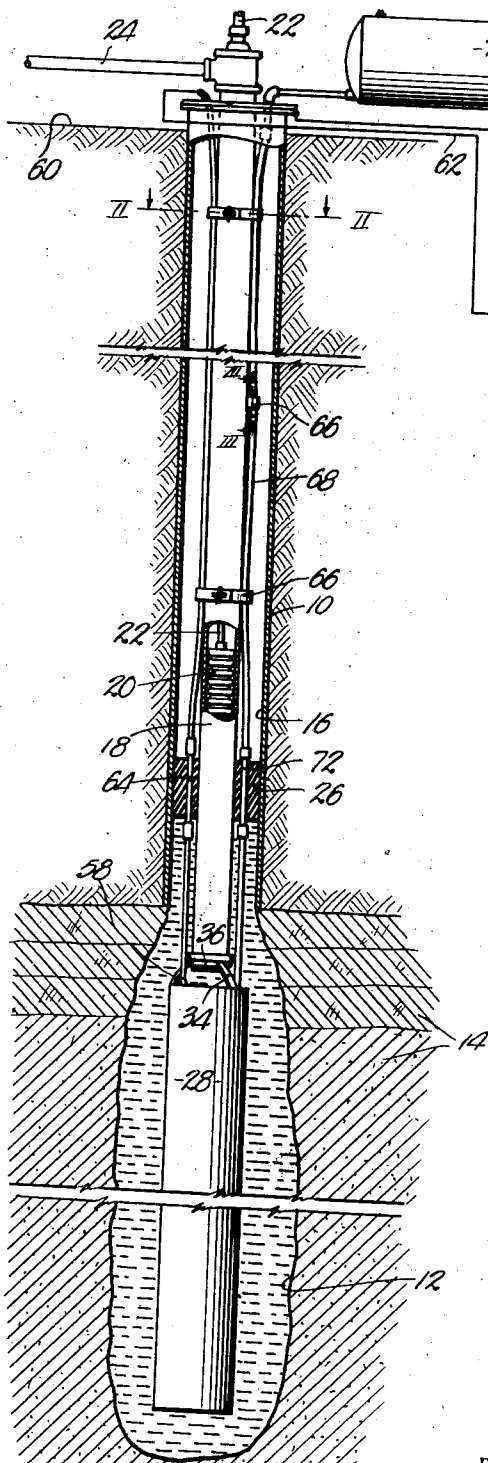


Fig. 3.



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2 Sheets-Sheet 2

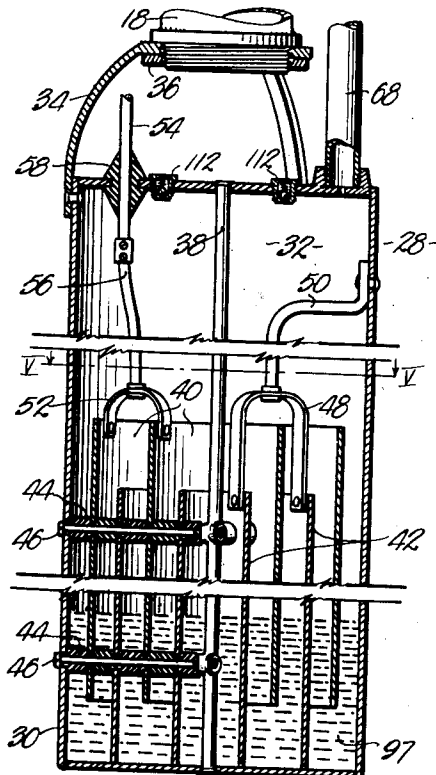


Fig. 4.

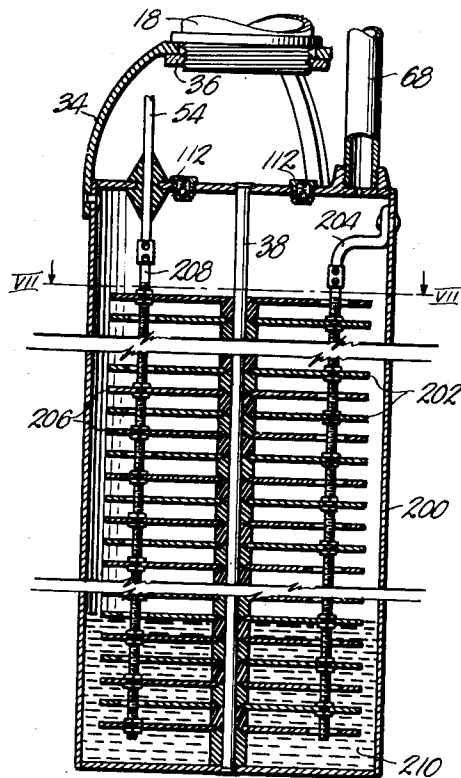


Fig. 6.

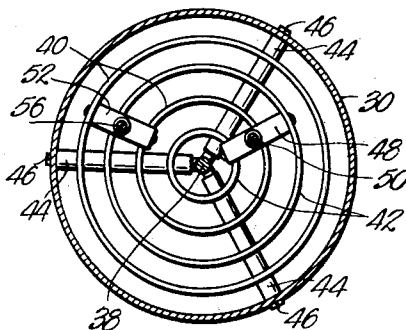


Fig. 5.

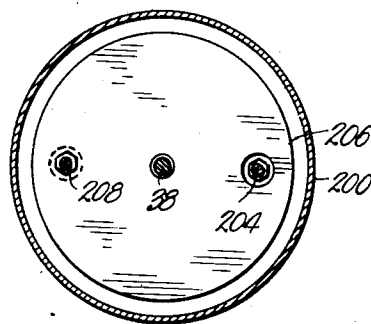


Fig. 7.

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UNITED STATES PATENT OFFICE

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ELECTROHYDROTHERMIC OIL-WELL
PROCESSOR

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Application May 17, 1941, Serial No. 393,991

1 Claim. (Cl. 219—33)

This invention relates to the art of treating oil wells for the purpose of rejuvenating the same by melting solidified substances, such as tar, wax, paraffin and heavier oils, to the end that the same will flow toward a collecting point where they may be lifted to the ground surface by pumps or similar equipment.

One of the primary aims of this invention is the provision of an oil-well processor of the electro-hydrothermic type wherein electrical elements are arranged to combine with a dielectric of water or other suitable liquid, to adequately generate heat and steam in a boiler of a special type, that is disposed in the oil well being treated.

A yet further aim of this invention is to provide an oil-well processor of the aforementioned character having a high pressure boiler constructed for attachment to the end of a pump barrel and provided with a liquid supply line and means for furnishing electrical energy to specially arranged, spaced apart plates within the boiler, all to the end that a predetermined steam pressure may be built up for the purpose of radiating heat and melting solids or semi-solids that may be retarding the flow of oil from structure into which the well has been drilled.

A yet further aim of this invention is to provide an electro-hydrothermic oil-well processor comprising an uniquely constructed high pressure boiler designed to be suspended within the oil well near that portion of the earth, from which it is necessary to withdraw solidified, meltable substances before proper flow occurs, which boiler has a feed line of special character leading thereto from a source of liquid supply, preferably at the ground surface.

This invention has for an even further object, to provide means for fracturing bubbles that have been formed in the interstices of the oil structure through employment of heat. Such bubbles are usually formed of petroleum and water, and heat applied thereto causes gasification of light ends of the bubble constituents which establishes a pressure of sufficient magnitude to burst the same.

It is further intended to provide equipment in the nature of an oil-well heater capable of liquefying objectionable solids in the oil sand and earth's strata in order that they may be pumped to the surface through the conventional barrel which is kept free from paraffin because of the relatively low temperatures established in the liquefied solids that are capable of melting any paraffin that may collect in the pump barrel.

Minor objects of the invention will appear during the course of the following specification, referring to the accompanying drawings, wherein:

Fig. 1 is a condensed vertical longitudinal sectional view through an oil well of conventional

type, showing the processor, made in accordance with this invention, in the operative position.

Fig. 2 is a cross sectional view taken on line II—II of Fig. 1.

Fig. 3 is an enlarged fragmentary detailed sectional view taken on line III—III of Fig. 1.

Fig. 4 is a condensed longitudinal sectional view through the boiler forming a part of the processor.

Fig. 5 is a cross sectional view through the boiler taken on line V—V of Fig. 4, looking in the direction of the arrows.

Fig. 6 is a fragmentary longitudinal sectional view through the boiler, made in accordance with a modified form of the invention; and

Fig. 7 is a cross sectional view through the type of boiler illustrated in Fig. 6, taken on line VII—VII of said figure.

It is well-known in the art that oil wells become sluggish and fail to flow to the desired degree, due to a clogging of the oil sand structure or strata by solidified material such as wax, tar and heavy oils that fill the spaces adjacent to the well and thereby seal the valuable oil and liquid against normal passage to the bottom of the well from whence it may be pumped. The idea of applying heat to the oil structure at any point along the length of the oil well is not basically new, but the means whereby heat has heretofore been applied, have not been efficient and have been expensive to operate, construct and maintain. A temperature ranging from 300° to 375° should be established and held for a period of time in order that melting of the aforesaid solids might occur.

The step forward of employing a high pressure boiler having specially constructed and arranged parts, completely accomplishes the objects of this invention and in its preferred form, is made as illustrated in Figs. 1 to 5 inclusive.

Oil well 10 usually terminates in a shot hole 12 formed in the oil sand or strata 14, and from this hole the liquid is usually pumped.

Casing 16 lines well 10 throughout the major portion of its length and a pump barrel 18 has a piston 20 therein operated by a sucker rod 22. Conduit 24 extends from the top of pump barrel 18 to a point where the oil from well 10 is used.

A packing 26 circumscribes pump barrel 18 to close the space between barrel 18 and casing 16 while the oil passes upwardly only through pump barrel 18.

The high pressure boiler, generally designated by the numeral 28, is made as shown in Fig. 4. Its outer case 30 completely encloses a chamber 32 within which steam and heat are generated due to the disposition of the hereinafter described, specially disposed electrical elements.

Case 30 has a ball 34 at one end in screw-threaded engagement with the lower end of

pump barrel 18. After bail 34 is moved to position, lock nut 36 is applied.

A central rod 38 extending through case 30 serves as a support for a number of concentric annular plates 40, the lower edges of which are spaced above the bottom end of case 30. Between these plates 40 are positioned a plurality of similar annular plates 42 that overlap plates 40 for at least a portion of their length. All of these plates are held in spaced relation by sleeves 44 of insulating material threaded upon radial bolts 46 that have their inner ends attached to rod 38 and their outer ends in engagement with the annular side wall of case 30.

Plates 42 are joined by a yoke or connector of conducting material 48, grounded by bar 50 to the metallic side wall of boiler 28. Plates 40 are joined by yoke 52, made of conducting material and in connection with the lower end of cable 54 through the medium of member 56.

Cable 54 passes through the upper end of case 30 and a bushing 58 is employed to prevent leakage at the point where cable 54 passes through the boiler wall. This cable extends to the ground surface 60 where it is joined to a source of electrical supply, such as generator G by wire 62. Cable 56 extends through packer 26 and in actual practice, packer 26 should have a link 64 built thereinto, to the outwardly projecting ends of which, the ends of severed cable 54 are attached.

Clamps 66 in the nature of those detailed in Fig. 2, are mounted on pump barrel 18 at points spaced along its length and in addition to operably supporting cable 54, these clamps 66 embrace supply pipe 68 through which water or other suitable liquid is fed to boiler 28 from a tank 70, preferably located at the ground surface. Like cable 54, pipe 68 has a section 72 thereof, previously built into packer 26 in order that assembly at the point of use may be facilitated.

Due to the unusually great length of supply pipe 68 and the tremendous pressure that would be normally established therein, the same is supplied with a number of partitions 74 through each of which an orifice 76 is formed. One of these partitions 74 should be at the point of connection between pipe 68 and boiler 28. The static pressure which would ordinarily be built up by an uninterrupted column of water in pipe 68 will be overcome through the employment of these partitions. As water is taken into boiler 28 from the lowermost or adjacent section of pipe 68, that section is gradually filled by water migrating thereinto from the section next above and so on. The weight of the column of water in the entire length of pipe 68 is not impressed upon boiler 28.

Water or other suitable liquid is fed automatically to boiler 28 and the level thereof maintained therein, due to the hereinafter described electric circuit which controls pump 78 supplying tank 70.

Plates 40 and 42 must be made of non-corrosive metal and the same act as electrode plates in which the electrolyte is water or other liquid. Since the water or liquid used is a poor electrolyte, a constant leakage between the plates of the boiler will result in a generation of heat and steam. The current consumed depends upon the level of the liquid and spacing of plates 40 and 42.

When the water reaches a predetermined low level the current to electro-magnetic coil 80 will be lowered to such an extent that armature 82 will be drawn by spring 84 into engagement with 75

contact point 86 to close the circuit supplying energy to motor 88 that operates pump 78. When armature 82 is in the position shown in Fig. 1, the pump 78 will operate to force water into tank 70 from whence it will flow by the action of gravity through supply pipe 68 to boiler 28. The circuit supplying current to motor 88 may be traced as follows:

From generator G through wire 92, wire 94, wire 96, wire 98, wire 100, wire 102, contact point 86, armature 82, wire 104 and wire 106 back to generator G.

So long as switch 90 is closed, energy will be supplied to the boiler 28 from generator G and the circuit may be traced as follows:

From generator G through wire 92, wire 108, closed switch 90, wire 62, cable 54, plates 40 and 42, through liquid 97, thence to ground and to casing 16; from casing 16 through wire 110, coil 80, wire 112 and wire 106 back to generator G.

When a sufficient amount of water, for example, has been allowed to pass into boiler 28, coil 80 will be energized and overcome the tension of spring 84, whereupon armature 82 will be withdrawn from contact point 86 and the circuit to motor 88 from generator G will be opened. Pump 78 will cease its operation until the level of liquid 96 in boiler 28 is again at a predetermined low level.

When the pressure within boiler 28 rises to a predetermined point, pop valves 112 will operate to release the pressure and steam causing the same. These valves are equipped with springs, the tension of which may be varied if desired, in order that the predetermined pressure may be established at will.

A modified form of the invention is shown in Figs. 6 and 7. In this instance, boiler 200 is joined by supply pipe 68 and cable 54 in precisely the same manner as aforementioned. Pump barrel 18 carries boiler 200. The plates within boiler 200, in the modified form, are differently disposed in that they are horizontal and spaced apart.

Alternate plates 202 are joined to the case of boiler 200 by bar 204. Plates 206 are directly attached to cable 54 by tie-rod 208. Obviously, the liquid 210 within boiler 200 serves as the dielectric and heat will be generated within the boiler as described with respect to the form shown in Fig. 4.

Obviously, the broad concepts of this invention might be embodied in processors having physical characteristics other than those specifically illustrated and described and therefore, it is desirable to be limited only by the scope of the appended claim.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

In a processor for an oil well having a pump barrel extending thereinto, a boiler; means for attaching the boiler to the lower end of the barrel; electrode plate in the boiler; an electrolyte submerging at least a part of the electrode plate; a source of electrical energy; conductors joining the said source and the electrode plates; and a supply pipe for the liquid in connection with the boiler extending to the latter from the ground surface, said supply pipe having a series of transverse partitions therein each provided with an orifice appreciably smaller in diameter than the inside diameter of the said pipe.

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