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METHOD OF AND APPARATUS FOR STRIPPING OIL SANDS

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Fig. 1.

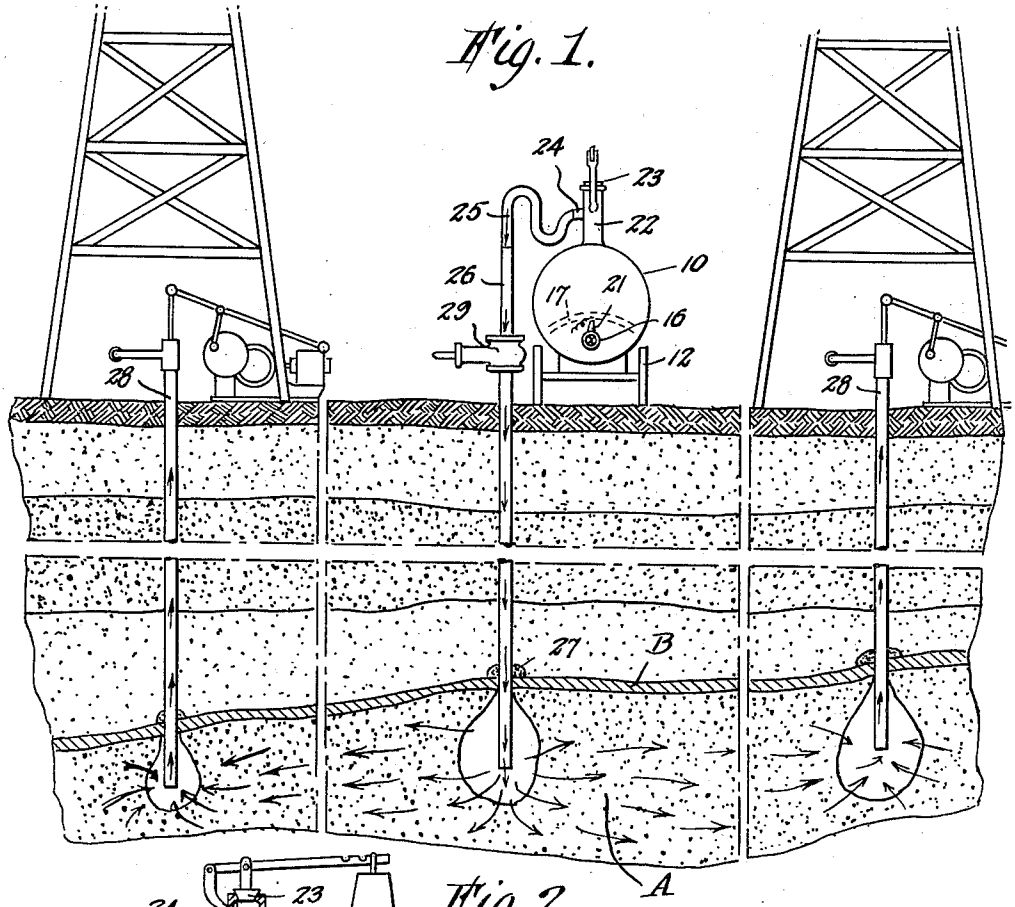
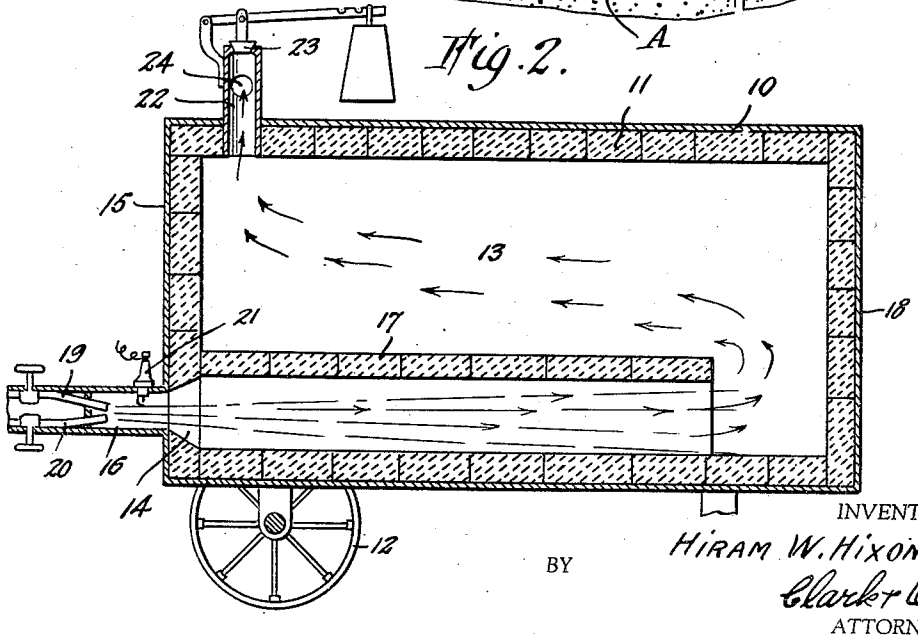



Fig. 2.




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## METHOD OF AND APPARATUS FOR STRIPPING OIL SANDS

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6 Claims. (Cl. 166—21)

This invention has to do with the recovery of oil remaining in oil pockets after the usual pumping methods have ceased to produce a sufficient yield to justify the expense of further operation under such methods.

It is a well established fact that only approximately one-third of the oil contained in an average oil pocket is recovered under the ordinary methods due to the fact that the remaining two-thirds adheres to the sands after the natural gas pressure has driven the more loosely held oil to the well where it is forced out in the gusher stage and later pumped out when the gas has been depleted.

The present invention comprehends an improved method of any apparatus for recovering oil remaining in an oil pocket after the yield from the usual methods has ceased to prove profitable.

More particularly the invention resides in on improved method of stripping oil sands in which heated fluid products of combustion under pressure are introduced to an oil pocket and permitted to accumulate therein so as to build up a pressure within the pocket and for heating and thereby lowering the viscosity of the oil adhering to the oil sands so that the pressure thus accumulated will drive the oil which is freed from the sands to one or more wells tapped into the oil pockets through which its removal is effected.

The invention is further directed to an improved apparatus for producing the heated fluid products of combustion and for introducing the same under pressure to the oil pocket.

With the above recited and other objects in view the invention is set forth in the following specification and illustrated in the accompanying drawing in which:

Fig. 1 is a diagrammatic view illustrating the apparatus employed for carrying out the method.

Fig. 2 is an enlarged longitudinal sectional view through the apparatus for generating the heated fluid products of combustion and for introducing the same under pressure to the oil pocket.

In carrying out the method, use is made of a plant for generating heated fluid products of combustion and introducing the same under pressure to a subterranean oil pocket A from which the loosely held oil has been removed by the ordinary methods.

The apparatus consists of a steel cylinder 10 lined with silica brick or an equivalent fire and heat resistant lining 11, the cylinder being of sufficient strength to withstand a pressure of approximately two hundred pounds per square inch. The cylinder is preferably mounted on wheels 12 to render the same portable whereby it may be readily moved to the location desired. The cylinder defines a chamber 13 which is provided with an inlet 14 in one end wall 15 thereof with which a burner tube 16 communicates and from which inlet a baffle arch 17 extends towards and is spaced from the opposite end wall 18 of the chamber.

The burner tube 16 has located therein and directed towards the inlet 14 a pair of injector nozzles 19 and 20, one for air under pressure and the other for a gaseous fuel, which are introduced under a pressure of approximately one hundred and fifty pounds per square inch, the fuel being adapted to be ignited as it enters the inlet 14 by one or more spark plugs 21. The jet of flame thus produced is directed longitudinally of the chamber 13 from the inlet 14 towards the end wall 18 and the products of combustion caused by the burning of said fuel are adapted to be discharged through an outlet 22 at the upper portion of the chamber adjacent the end wall 15. By arranging the inlet 14 and the outlet 22 adjacent one end of the chamber and interposing the baffle arch 17 therebetween, the commingling of the fuel mixture with the burned gases or products of combustion is prevented. The outlet 22 is provided with a safety valve 23 and a discharge pipe 24 which is connected by an expansion coupling 25 with the upper end of a well casing 26, said coupling being utilized to compensate for expansion of the well casing which occurs due to the heat of the products of combustion passing therethrough.

The gas used for the fuel is filtered or treated so as to insure the removal therefrom of any dust, soot or other particles of foreign matter which would tend to clog the interstices between the oil bearing sands, and all of the products of combustion which are thus produced within the chamber 13 are forced under the pressure developed downwardly through the well casing 26 into the oil pocket A. The lower portion of the casing will be thoroughly cemented as at 27 at the point where it extends through the cap or covering stratum B of the oil pocket so as to prevent leakage and to insure the introduction of all of the heated products of combustion which are forced into the pocket A and through the oil bearing sands.

One or more pumping well casings 28 are tapped into the oil pocket A and it will be found

by continuously introducing the heated fluid products of combustion under pressure through the well casing 26 to the pocket A that a pressure will be built up within the pocket. The products of combustion consist of carbon dioxide, carbon monoxide, nitrogen and steam and the steam which condenses into hot water as it contacts with the oil bearing sands will be maintained in a heated condition by the incoming products of combustion. The hot water and the heat of the gases function as a medium for lowering the viscosity of the oil adhering to the oil bearing sands to free the same therefrom while the carbon dioxide, carbon monoxide and nitrogen gases will accumulate within the pocket and develop a pressure which operates to drive the oil freed from the sand to the pumping wells for removal therethrough. Inasmuch as the heat of the products of combustion as they are forced through the charging casing 26 is approximately one thousand degrees, it will be readily appreciated that the temperature within the pocket will be gradually raised and maintained so that the heated gases and hot water will eventually strip and remove from the oil bearing sands practically all of the oil adhering thereto. It will, of course, be appreciated that the combustion chamber will be required to be in operation for a considerable length of time before the effect would be apparent at the pumping wells and likewise the expansion of the hot gases will continue to function subsequent to the disconnection and removal of the apparatus to a new location upon closing of an inlet valve 29 adjacent the upper end of the casing 26.

What is claimed is:

1. A method of stripping the oil remaining in a subterranean oil pocket consisting in continuously forcing gas and air under pressure into a closed combustion chamber located above ground, continuously burning within said chamber the gas and air mixture in jet formation to produce heated fluid products of combustion, conveying said products of combustion by the pressure thus developed therein from the combustion chamber to the oil pocket to effect by the heat thereof the freeing of the oil from the oil bearing sand and to cause by the pressure thereof the driving of the freed oil towards one or more pumping wells tapped into the pocket and then removing the oil through said pumping wells.

2. A method of stripping oil remaining in a subterranean oil pocket consisting in continuously forcing gas and air under pressure into a closed combustion chamber located above ground, continuously burning within said combustion chamber the gas and air mixture in jet formation to produce heated fluid products of combustion composed of carbon dioxide, carbon monoxide, nitrogen and steam, conveying said products of combustion by the pressure thus developed therein from the combustion chamber to the oil pocket to effect a lowering of the viscosity of the oil and freeing of the same from the oil bearing sands by the condensation of the steam into hot water and by the heat of the gases, and to build up a pressure in said pocket to drive the oil thus freed towards a pumping well tapped into said pocket, and pumping the oil through said pumping well to remove the same.

3. A method of stripping oil remaining in a subterranean oil pocket consisting in continuously burning a gas in jet formation in a closed combustion chamber located above ground to continuously produce heated fluid productions of combustion including carbon dioxide, carbon monoxide, nitrogen and steam, and introducing the same under the continuous pressure thus developed within the combustion chamber to the oil pocket to lower the viscosity of the oil and free the same by the heat of the gas and the condensation of the steam contacting with the oil bearing sands, and to drive the oil thus freed towards a pumping well tapped into said pocket for removal of said oil therethrough by the pressure introduced to and built up within said pocket.

4. A method of stripping the oil remaining in a subterranean oil pocket consisting in continuously forcing gas and air under pressure of approximately one hundred and fifty pounds per square inch in a closed combustion chamber located above ground, continuously burning within said combustion chamber said gas and air mixture in jet form so as to continuously produce heated fluid products of combustion having a temperature of approximately 1000° F., conveying said products of combustion by the pressure thus developed to the oil pocket at a pressure in excess of the back pressure of said oil pocket so as to effect by the heat thereof the freeing of the oil from the oil bearing sands and to cause by said pressure the driving of the freed oil towards one or more pumping wells tapped into the pocket and then removing the oil through said pumping wells.

5. An apparatus for stripping subterranean oil pockets of the oil remaining therein, including a combustion chamber having an inlet, means for continuously introducing into said combustion chamber through said inlet a gaseous fuel and air under pressure, means for igniting said fuel and air mixture to produce a continuously burning jet, said combustion chamber having an outlet for discharging the products of combustion of said fuel and air mixture jet, and a conduit communicating with and extending from said outlet to said oil pocket.

6. An apparatus for stripping subterranean oil pockets of oil remaining therein, including a combustion chamber having an inlet adjacent one end thereof, means for continuously introducing into said combustion chamber through said inlet a gaseous fuel and air under pressure, means for igniting said fuel and air mixture to produce a continuously burning jet, said combustion chamber having an outlet adjacent said end for discahrging the products of combustion of said fuel and air mixture jet from said chamber, a baffle interposed between said inlet and outlet and extending towards and spaced from the opposite end of said chamber, a conduit extending from the ground surface to and communicating at its lower end with said oil pocket, and an expansion coupling establishing communication between the upper end of said conduit and said combustion chamber discharge outlet for compensating for expansion of said conduit.

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