METHOD AND APPARATUS FOR HEATING OIL PUMPED FROM AN OIL WELL

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References Cited

UNITED STATES PATENTS

824,808 7/1906 Pannier 165/158
1,308,486 7/1919 Earle 165/51
1,660,230 2/1928 Monger 210/181 X
1,745,492 2/1930 Kelch et al. 165/51
2,656,925 10/1953 Johnson 210/187
2,698,055 12/1954 Williams 166/267 X
2,864,502 12/1958 May 210/72

ABSTRACT

The specification discloses an apparatus and method for breaking down the water-paraffin emulsion in oil to facilitate the separation of the water from the oil. The system includes a combustion engine for pumping the oil to the surface and a heat exchanger having a shell with a first inlet for receiving the oil and a first outlet for discharging the oil. A second inlet is formed in the heat exchanger for receiving the exhaust gases from the engine and is connected to at least one heat exchanger tube disposed within the shell, whereby the oil being passed through the shell surrounds the heat exchanger tube and absorbs the heat transferred to the tube by the flow of the exhaust gases therethrough. A second outlet in the heat exchanger communicates with the heat exchanger tube and contains an adjustable baffle for varying the speed of the flow of exhaust gases through the tube, thereby varying the amount of heat available to be transferred to the oil passing around the tube.

7 Claims, 5 Drawing Figures
METHOD AND APPARATUS FOR HEATING OIL PUMPED FROM AN OIL WELL

FIELD OF THE INVENTION

This invention relates to a method and apparatus for heating oil to facilitate the removal of water therefrom, and more particularly to the use of the heat from the exhaust of the engine of an oil well pump to heat the oil to break down the water-paraffin emulsions within the oil so that the water may be separated from the oil.

PRIOR ART

Oil pumped from an oil well generally contains impurities including paraffin and water. The water is usually trapped in an emulsion with the paraffin, thereby requiring treatment of the oil before it may be sold. It is known that heating of the oil causes the paraffin to break down and release the water; once released, the water falls to the bottom of the container and may readily be removed.

Heating the oil has generally been herebefore accomplished by the use of heating units comprising burners fed by gas obtained from the well or from a separate source. Such heating techniques present problems in small wells wherein sufficient natural gas is not available from the well to operate the burners. In such small wells with insufficient natural gas to feed the heating units, an expensive outside supply of fuel such as butane must be provided. Further, such prior gas heating techniques have sometimes been inadequate to break down the water-paraffin emulsion and a paraffin solvent must be introduced into the fluid to promote the separation of water and oil.

A need has thus arisen for a technique for economically heating the fluid pumped from an oil well to assist in the removal of water from the oil. The system should be one that can be readily movable from well to well as the pumps are moved from one well to another. Preferably, the system should be relatively maintenance-free and of a simplistic design to foster easy repairs when necessary.

SUMMARY OF THE INVENTION

The present invention is directed to a system and apparatus for essentially eliminating or reducing the problems heretofore associated with apparatus for heating oil to break down the water-paraffin emulsion for enabling removal of the water from the oil. In accordance with the present invention, heating of the oil is accomplished through utilization of the hot exhaust gases from the engine driving the well pump. The exchange of heat from the engine exhaust to the oil is accomplished through the use of a shell and tube heat exchanger. The shell of the exchanger is adapted with a first inlet for receiving the oil from the well and a first outlet for discharging the oil after heated. A second inlet is adapted to receive the hot exhaust gases from the engine and a second outlet is joined to the second inlet by at least one tube which is disposed within the shell. The heat from the exhaust is transmitted through the tube to the oil flowing around the tube within the shell of the heat exchanger.

In accordance with a further aspect of the invention, the second outlet on the heat exchanger is provided with an adjustable baffle for varying the speed of the flow of exhaust gases through the tube. By varying the flow of the exhaust gases, an operator may control the heat of the tube and thus the heat of the oil in contact with the tube.

DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and for further objects and advantages thereof, reference is now made to the following Detailed Description, taken in conjunction with the Drawings, wherein:

FIG. 1 shows a somewhat diagrammatic illustration of the present invention;
FIG. 2 is an enlarged longitudinal sectional view of the heat exchanger illustrated in FIG. 1;
FIG. 3 is an end view of the heat exchanger shown in FIG. 1;
FIG. 4 is a sectional view taken generally along the section line 4-4 in FIG. 2; and
FIG. 5 is an enlarged view of a baffle employed in the heat exchanger.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the Drawings, FIG. 1 discloses a conventional well pump schematically shown by the numeral 10 which reciprocates a rod 12 to pump oil from the well through an outlet 14. An engine 16 drives the well pump 10 in the well-known manner. Engine 16 may be any combustion type engine, with the hot exhaust gases from the engine 16 being directed to the inlet of a heat exchanger device 18. The oil from the well is pumped through the heat exchange device 18 and the oil is heated by the exhaust gases and is then pumped through a pipe 20 to a storage tank. The heating of the oil causes breakdown of the water-paraffin emulsion within the oil, such that the water separates from the oil in the storage tank. The purified oil may then be pumped from the container and the water removed.

FIG. 2 shows a sectional view of the device 18, wherein hot exhaust gases from the engine 16 are applied to an inlet 22 and are conducted by three exchange tubes 24, 26 and 28 to an outlet 30. Outlet 30 opens to the atmosphere and includes a baffle 32 which may be adjusted in order to vary the amount of heat provided by the device to the oil. The heat exchange unit 18 is enclosed within an insulating skin 29 which serves to retain the heat from the hot exhaust gases for more efficient heating of the oil. The untreated oil from pump 10 is carried from the pump head through pipe 14 to an inlet 34 on device 18. The untreated oil passes into shell 38 and around the tubes 24, 25 26 28 to absorb the heat therefrom. The heated oil then passes out through the outlet 36 for transmission to the storage tank.

As shown in FIG. 4, the pipes 24, 26 and 28 are symmetrically disposed within the shell 38. Of course, additional tubes of various shapes and positioned in various locations within the heat exchanger may be utilized within the present system. The heat exchange unit is made of a material such as stainless steel, which is capable of resisting repeated and continuous exposure to the high temperatures encountered by the unit.

FIG. 5 shows an enlarged view of baffle 32 located within the outlet 30. Baffle 32 is of the butterfly valve type the adjustment of which varies the flow of exhaust gases through pipes 24, 26 and 28. By varying the flow of the exhaust, the temperature of the tubes may be
controlled, thus controlling the temperature of the oil passing over the tubes.

While in the above described embodiment of the invention, the engine exhaust is directed through the heat exchanger tubes and the oil is passed into the heat exchanger shell and allowed to flow around the tubes, it is readily apparent that the routing of the oil and the exhaust gases may be interchanged such that the oil is made to flow through the tubes and the exhaust gases are made to flow around the tubes to heat the oil therein.

The present invention eliminates the expense and inconvenience of supplying expensive fuel and equipment for heating the oil and the need for a paraffin solvent. Utilization of the exhaust from the pump engine as a means of heating the oil eliminates the need for a separate burner unit, as well as the need for a fuel source to feed the burner. It has also been found that due to the degree of heat available through this method, the need for a paraffin solvent is in many cases also eliminated while still achieving the degree of purity necessary to sell the oil.

The present invention is particularly suitable for taking advantage of the high temperature of the oil upon emergence from the ground. The mobility of the present invention and the proximity of the pump engine to the mouth of the well allow the earliest possible heating of the oil upon removal from the well.

Although the well heater unit shown in the Drawings comprises the preferred embodiment of the present invention, it will be understood that numerous other embodiments can be employed in the practice of the invention. For example, various heat exchanger designs may be employed to successfully utilize the heat from the exhaust of the engines to heat the oil flowing from the pump.

Although specific embodiments of the invention are illustrated in the Drawings and described herein, it will be understood that the invention is not limited to the embodiments disclosed but is capable of rearrangement, modification and substitution of parts and elements without departing from the spirit of the invention.

What is claimed is:

1. A method of breaking down water-paraffin emulsion in oil comprising:
   - moving oil from a well with a motor which emits heated exhaust gases;
   - passing the exhaust gases from the motor through a plurality of confined paths in a heat exchanger;
   - passing all of the oil pumped from the well around said confined paths in said heat exchanger in order to heat the oil to an extent that the water-paraffin emulsion is broken.

2. An apparatus for breaking down the water-paraffin emulsion in oil as the oil is removed from an oil well comprising:
   - an oil well pump motor which emits heated exhaust gases as said motor pumps the oil from the well;
   - a shell having an inlet for receiving all of the oil pumped from the well and an outlet for discharging the oil;
   - at least one tube member disposed within said shell with both ends of said tube protruding through said shell and with the first end of said tube being adapted to receive the exhaust gases from the motor whereby all of the oil pumped from the well is heated by the exhaust gases to an extent that the water-paraffin emulsion is broken.

3. The apparatus according to claim 2 wherein the second end of said tube contains an adjustable baffle for varying the flow of exhaust gases through said tube whereby the heat transferred to said tube is regulated.

4. The apparatus according to claim 3 wherein said shell is enclosed within an insulating skin.

5. Apparatus for heating oil to break down water-paraffin emulsion to enable removal of water from the oil comprising:
   - a combustion engine for pumping the oil;
   - a heat exchanger having a shell with a first inlet for receiving all of the oil pumped from the well and a first outlet for discharging the oil;
   - said shell further having a second inlet adapted to receive the exhaust gases from said engine and a second outlet joined to said second inlet by at least one tube disposed within said shell;
   - means for feeding the exhaust gases from said engine to said second inlet;
   - means connected to the outlet of said oil well pump for directing all of the oil pumped from the well into said first inlet, whereby all of the oil pumped from the well, when passed through said shell, surrounds said tube and absorbs the heat transferred to said tube by the flow of exhaust gases thereafter.

6. The apparatus for heating oil to break down water-paraffin emulsion according to claim 5 wherein said second outlet on said heat exchanger contains an adjustable baffle for varying flow of exhaust gases through said tube to thereby vary the heat transferred to said tube.

7. A method of breaking down water-paraffin emulsion in oil comprising:
   - moving oil from a well with a motor which emits heated exhaust gases;
   - passing the exhaust gases from the motor through a heat exchanger;
   - passing all of the oil pumped from the well through said heat exchanger in order to heat the oil to an extent that the water-paraffin emulsion is broken;
   - varying the flow of exhaust gases through said heat exchanger to thereby vary the heat transferred from the gases to said heat exchanger.