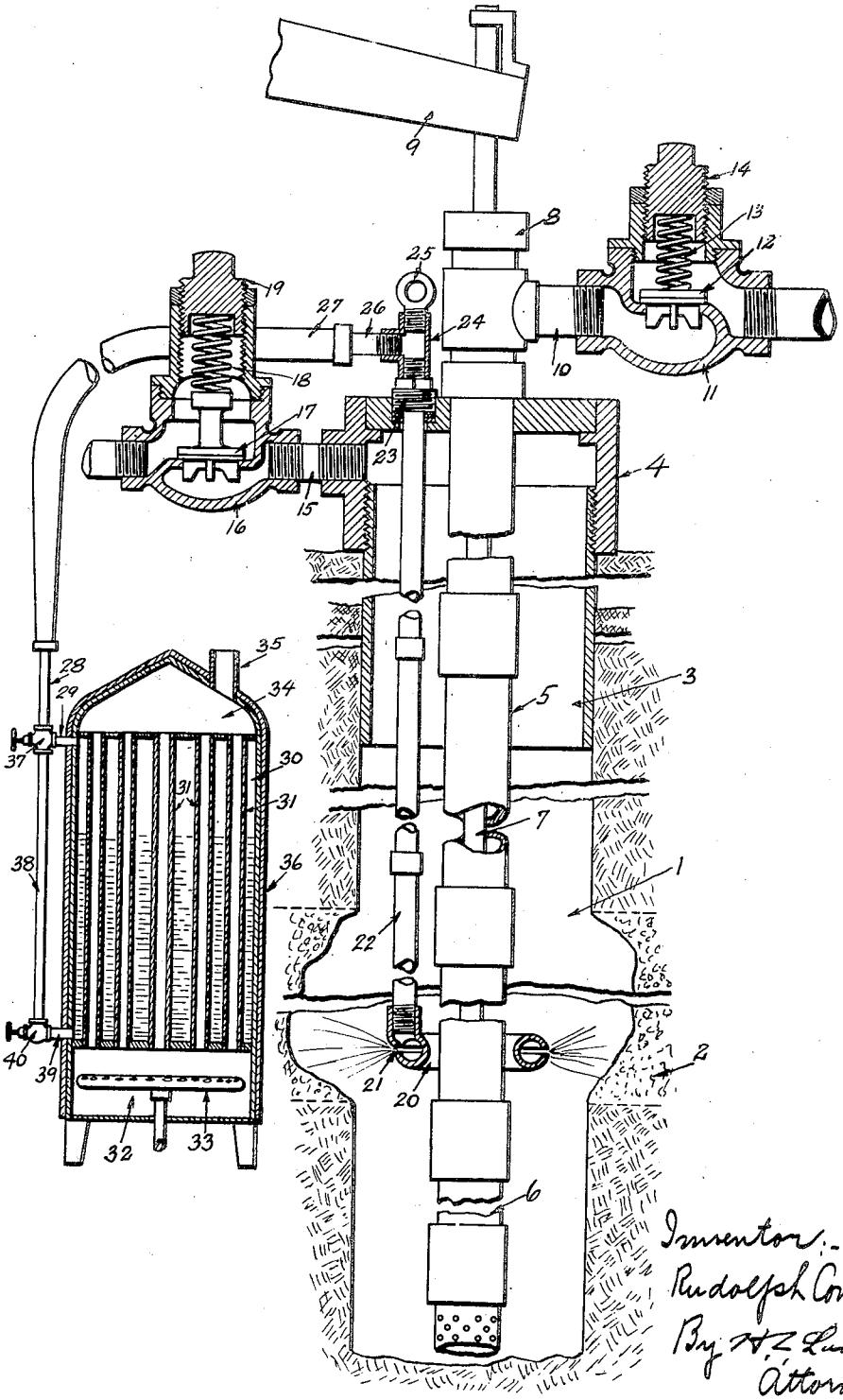
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METHOD OF TREATING OIL WELLS AND APPARATUS THEREFOR

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RUDOLPH CONRADER, OF ERIE, PENNSYLVANIA.

METHOD OF TREATING OIL WELLS AND APPARATUS THEREFOR.

Application filed March 28, 1921, Serial No. 456,410. Renewed June 21, 1924.

To all whom it may concern:

Be it known that I, RUDOLPH CONRADER, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvannia, have invented new and useful Improvements in the Method of Treating Oil Wells and Apparatus Therefor, of which the following is a specification.

Oil as it exists in the rock is ordinarily under pressure, this pressure being what is commonly termed the "rock pressure". As this pressure is released through the opening of the well the more volatile constituents of the oil pass off as gas, thus leaving the residue incapable of retaining any solution of heavier constituents of the oil, such as paraffin, the result being that the paraffin accumulates on the well surfaces at the usual cavity leading from the oil bearing sands and this accumulation gradually retards the flow of oil and reduces the oil production. Different attempts have been made to remove these obstructions as by steaming the well and by heating the well various ways but in such attempts the well has been left open and the heating has vaporized the more volatile constituents of the oil precipitating some of the heavier portions and in many instances aggravating the difficulty which the operation is designed to correct. With the present methed the well is heated but is retained under pressure so as to retain the more volatile constituents of the oil in liquid form even at the higher temperature and the heating is preferably accomplished by a fluid which in itself is a solvent of the heavier constituents of the oil, a convenient fluid for this purpose being kerosene.

An apparatus forming the subject matter of the invention and suitable for carrying out the method is illustrated in the accompanying drawings.

1 marks the well, 2 the oil bearing sand, the usual cavity being formed in the sand, 3 the casing, 4 the casing head, 5 the tubing, 6 the pump, 7 the sucker rod, 8 a gland, or stuffing box through which the sucker rod works, 9 a walking beam for operating the sucker rod, and 10 a discharge pipe leading from the tubing. These parts are of ordinary construction.

A pressure valve 11 is applied to the outlet 10. The disc 12 of the valve 11 is loaded by a spring 13, the tension on the spring being adjusted by a nut 14. Any back pressure desired may be exerted on the well by adjusting the spring to prevent the opening of the disc prior to such pressure.

The gas outlet from the casing is through a pipe 15 which is provided with a pressure valve 16, the pressure valve 16 having a disc 17, loaded by a spring 18, the pressure of the spring being adjusted by the nut 19. Here again any back pressure may be given to the gas desired by adjusting the spring. The more important of these back pressure valves so far as my invention is concerned resides in the valve 16 although the pressure valve 11 should be adjusted to prevent the separation of the more volatile constituents of the oil as it is lifted through the tubing so that the paraffin may be carried in solution and delivered from the well.

A steaming nozzle, or ring 20 is arranged around the tubing 5 and has the annular nozzle slot 21 directed against the onter surface of the well. A pipe 22 leads from the nozzle 20 through a stuffing box or gland 23 in the casing head cap. The pipe terminates in a T 24. A ring 25 is formed on the plug closing the upper end of the T and provides a means by which the nozzle may be raised and lowered in the well to cover the different surfaces to be treated. A pipe 26 leads from the T to a flexible tubing 27. The flexible tubing is connected with a pipe 28 leading by a lateral pipe 29 to a boiler 30. The boiler is of the vertical type having the usual flues 31 leading from a furnace 32, the usual source of heat being through gas by means of a burner 33 The flues lead to the usual box 34 and a pipe 35 leads from this box. The boiler has the insulating jacket 36. A valve 37 controls the lateral pipe 29 and the pipe 28 has an extension 38 with a lateral pipe 39 leading to the bottom of the boiler, this being controlled by a valve 40.

In carrying out the method kerosene is furnished in the boiler and heated to a vaporizing temperature. The vapor from the kerosene is conducted through the pipes described to the nozzle 20 and delivered against the walls of the well, thus melting the heavy constituents of the oil which seal the oil sands. The hot vapor as it liquefies in cooling acts as a solvent for these heavier constituents. The well is preferably pumped so as to expose the oil sand but the oil in the well may be heated through the nozzle if desired the nozzle agitating the oil so as to assist in taking up the heavier constituents as paraffin. As the material in the well is melted or dissolved it is carried out by way of the pump, pressure being retained to prevent the precipitation of the heavier constituents at the pressure used. Preferably the pipe pressure on the well is just below the rock pressure so that there will be a continued inflow to the well. On the other hand the temperature is placed just below the vaporizing temperature of some of the lighter constituents of the oil which it is feasible to maintain in liquid state. It will be understood that these different constituents vaporize at quite definite temperatures. While it may be impossible to retain the most volatile constituent a temperature may be maintained which will retain the most available light constituent under the conditions of temperature and rock pressure.

While steam may be used as the heating fluid I prefer kerosene because while kerosene has a vaporizing point at atmospheric pressure slightly below water this vaporizing point rises more rapidly than water as the pressure goes up so that with the pressures which are within the rock pressure vapor at considerably higher temperature than may be obtained with water at such pressure becomes available. Further the vapor from the oil is effective on the heavier constituents in the well and after it liquefies acts as a solvent, thus facilitating the removal.

After the vapor has been delivered for a period as may be desired, the valve 40 being closed and the valve 37 opened for this purpose, it may be desirable to discharge the liquid from the boiler directly to the well and this may be accomplished by opening the valve 40 and closing the valve 29. Under these conditions the vapor pressure of the boiler will discharge the liquid to the well.

The annular nozzle slot 21 assures the covering of every part of the wall of the cavity as the nozzle is raised and lowered without turning the nozzle.

What I claim as new is:—

1. The method of treating oil wells which consists in maintaining the well under pressure but below the rock pressure; and heating the well cavity.

2. The method of treating oil wells which consists in maintaining the well under pressure approximating the rock pressure but below such pressure; and heating the well cavity.

3. The method of treating oil wells which consists in maintaining the well under pressure; and heating the well cavity to a temperature which at the pressure will retain some but not all of the lighter constituents of the oil in a liquid state.

4. The method of treating oil wells which consists in maintaining the well at approximately but below the rock pressure; and heating the well cavity to a temperature at which the pressure will retain some of the lighter constituents of the oil in the liquid.

5. The method of treating oil wells which consists in maintaining the well under pressure; and heating the well cavity by the introduction of a hot fluid, said fluid being a solvent of the heavier constituents of the oil.

6. The method of treating oil wells which consists in maintaining the well under pressure; and heating the well cavity by the introduction of a vapor from kerosene.

7. The method of treating oil wells which consists in maintaining the well under pressure; heating the well cavity; and pumping the liquid from the well while maintaining a back pressure on the liquid being pumped.

8. In an apparatus for treating oil wells, the combination of means for heating the well cavity; a casing and a pressure valve on the casing retaining gas pressure on the well proportionate to the heat.

9. In an apparatus for treating oil wells, the combination of means for heating the well cavity; a pressure valve retaining gas pressure on the well; a pump; and a pressure valve retaining a back spring actuated pressure on the liquid being pumped.

10. In an apparatus for treating oil wells, the combination of a nozzle; means for introducing a hot fluid through the nozzle; means for varying the level of the nozzle; and means for retaining the well under pressure.

11. In an apparatus for treating oil wells, the combination of a nozzle; means for introducing a hot fluid through the nozzle; means for varying the level of the nozzle; means for retaining the well under pressure; and means for pumping the well.

12. In an apparatus for treating oil wells, the combination of means for introducing a hot fluid to the well; devices for retaining a well under pressure; a boiler; a connection from the upper part of the boiler to said means; a connection from the lower part of the boiler to said means; and valves controlling said connections.

13. The method of treating oil wells which consists in heating the well cavity by the introduction of a vapor from kerosene.

14. The method of treating oil wells which consists in heating the well cavity by the introduction of vapor from kerosene followed by the introduction of hot liquid kerosene.

15. In an apparatus for treating oil wells, the combination of an annular nozzle having a continuous annular nozzle slot; and means for delivering heated fluid to the nozzle.

16. In an apparatus for treating oil wells, the combination of an annular nozzle having a continuous annular nozzle slot; means for delivering heated fluid to the nozzle; and means for varying the elevation of the nozzle.

In testimony whereof I have hereunto set my hand.

RUDOLPH CONRADER.