

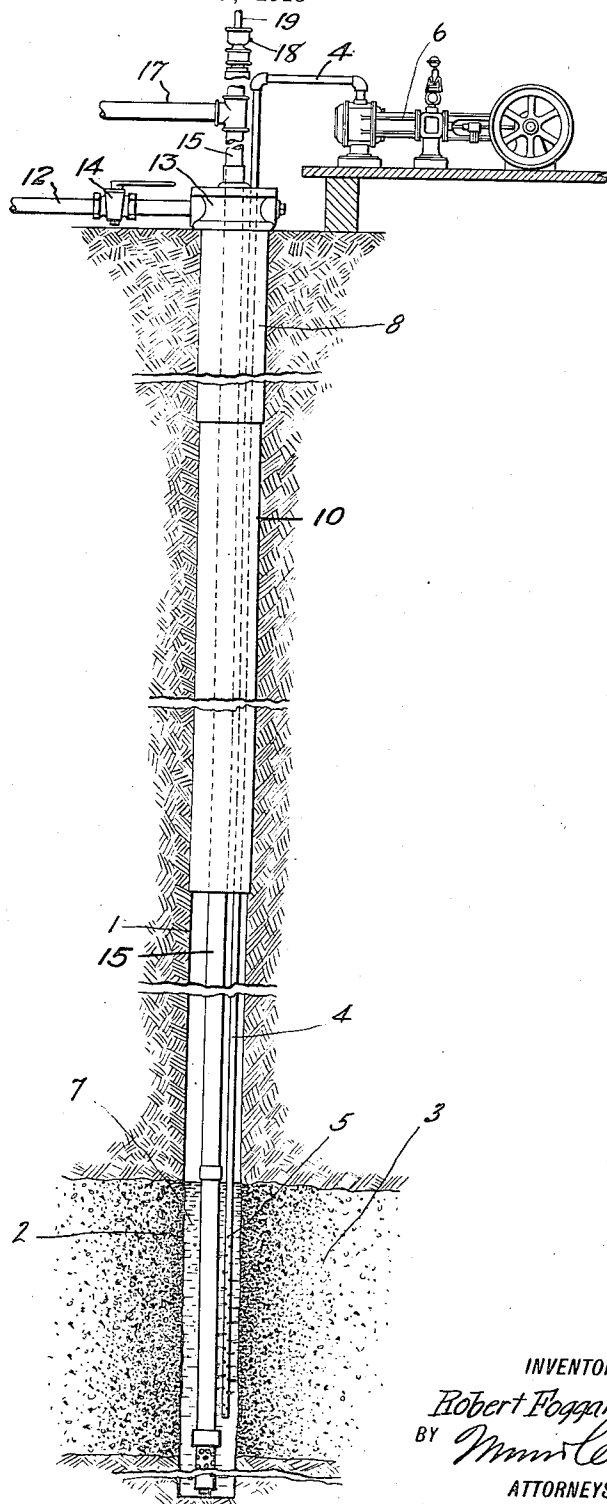
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METHOD OF CLEANING OIL WELLS

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WITNESSES

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METHOD OF CLEANING OIL WELLS.

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To all whom it may concern:

Be it known that I, ROBERT FOGGAN, a citizen of the United States, and a resident of Pleasantville, in the county of Venango and State of Pennsylvania, have invented a new and Improved Method of Cleaning Oil Wells, of which the following is a full, clear, and exact description.

This invention relates to the cleaning of those oil wells (hereinafter called non-flowing wells) which receive petroleum from the oil bearing rock under a pressure that is insufficient to deliver the petroleum to the surface of the ground and that would be insufficient to do so even though the oil column in the well tubing should be lightened by injection of air into the same. It has more particular (but not necessarily exclusive) reference to the cleaning of non-flowing wells which tap a more or less porous oil bearing sandstone or like rocky formation.

In a non-flowing well the entrance of the petroleum into the well cavity is apt to be rather slow at best; and ordinarily the well cavity would be pumped out at intervals, thus exposing periodically the surface of the oil bearing rock, coated with petroleum, to the atmosphere. Under these conditions, the petroleum tends to deposit obstructing substances, as paraffine wax, asphalt and the like, on the well walls; and (at least when the well cavity is in a more or less porous sandstone or like rocky formation) the collection of these obstructing substances, increasing with the passage of time, is apt eventually to bring about a premature abandonment of the well; unless some industrially practicable means can be found for preserving, improving or restoring the inflow of petroleum into the well cavity.

Heretofore many proposals along various lines have been made. Among other modes it has been proposed to wash the deposit off of the well walls by a solvent liquid; and washing of the well walls with such a liquid is employed in the present invention successfully and with advantage over all other modes within the prior state of the art; but in all prior plans for using a solvent liquid, such use has been associated with one or more nullifying or counteracting features, such as a high temperature, a high pressure, lack of sufficient movement of the liquid, impractical agitating devices, water in the solvent liquid, and possibly others.

In accordance with the present invention, a solvent liquid is introduced through the upper part of the well into the well cavity in sufficient volume to cover the places at which the petroleum enters, without filling the well above the oil bearing rock; and said liquid washes the well wall at low temperature and under low pressure, while moving about under the influence of an agitating fluid introduced below the surface of said solvent liquid.

It is advantageous to use a gaseous agitating fluid, such as atmospheric air, natural gas, artificial gas, or the like, and to allow this gaseous fluid, after it has risen to the surface of the solvent liquid, to pass away through the upper part of the well outside the well tubing up which the petroleum is pumped.

Other things being equal, the liquid that has the greatest power of dissolving the paraffine wax, asphalt or other obstructing substance or substances would best be used as the solvent liquid in the well cavity; and gasoline, benzine, kerosene or other liquid having a greater dissolving power than crude petroleum would ordinarily at least be preferred to the latter for introduction through the upper part of the well; but the use of crude petroleum in this way is not necessarily excluded. Crude petroleum has, however, the advantage over other solvent liquids, in that a suitable body of the same can be collected in the well cavity by direct flow from the oil bearing rock; and when thus collected it can be moved about under the above recited conditions for the purpose of preserving, improving or restoring the inflow of petroleum into said well cavity. This use of crude petroleum is within the scope of the invention, as expressed in one or more of the hereinafter written claims, irrespective of the manner of collecting it in the well cavity, whether by direct flow or by introduction through the upper part of the well.

The accompanying drawing is a view in vertical section and elevation of an oil well, provided with pumping appliances and also with appliances for use in cleaning the well in accordance with the present invention.

As shown, the upper portion 1 of the well passes through non-productive earth and rock and has casings 8 and 10; while its lower portion 2, with well cavity 7, is located in a more or less porous oil bearing

sand rock 3. A gas outlet pipe 12 leads from casing head 13 and includes a valve 14.

The oil raising well tubing 15 has its lower end at or near the bottom of the well and projects at the top through the casing head 13. It has oil admitting openings near its bottom, an oil discharging pipe 17 near its top, and above this latter a stuffing box 18; through which last the pump rod 19 extends, for reciprocating the plunger (not shown) of the customary oil raising pump; this pump being constituted by said plunger and a foot valve (not shown), in connection with the working barrel, which forms part of the tubing 15, and within which the plunger is reciprocated.

The pump 6 has its discharge connected with a pipe 4, which extends down into the well alongside the tubing 15, and opens into the well cavity 7 through small apertures 5 near the bottom of the well. It serves (with pipe 4) to introduce the agitating fluid into the solvent liquid in the well cavity 7, and can be dispensed with when another appropriate source of agitating fluid is available for supplying the same to pipe 4.

Petroleum from rock 3 enters the well cavity 7 either by gravity alone or by the joint agency of gravity and natural gas; and a non-flowing well may either be such at the start or may result from loss of original pressure in the oil bearing rock 3.

Petroleum is pumped up from the well cavity through the tubing 15 and delivered by pipe 17 to any desired receptacle. Gas can be let out of the well whenever desired by opening the valve 14 in pipe 12 or other appropriate outlet.

Ordinarily, in accordance with the present invention, when a falling off in production is observed, the well cavity 7 (best after being pumped out) is supplied with gasoline or other solvent liquid in sufficient volume to cover the places at which the petroleum flows in from the rock 3, without filling the well above the latter, and consequently without forming an overlaying column of liquid whose pressure would tend substantially to hold the petroleum in the rock 3.

The solvent liquid may well be introduced through the pipe 4; but, if preferred, it could be introduced otherwise, as, for example, through the tubing 15 or the free space within the well outside the tubing 15 and the pipe 4.

The temperature of the solvent liquid in the well cavity 7 should be low so as not to melt the paraffine wax, asphalt or other obstructing substance on the cavity walls. Its temperature may be that which naturally exists in the well, or the ordinary atmospheric temperature.

An agitating fluid of low temperature, best a gaseous fluid like atmospheric air, natural gas, or an artificial gas, say at ordi-

nary atmospheric temperature, is delivered by the pump 6 (or otherwise) down the pipe 4 into the solvent liquid in the well cavity so far below the surface of this liquid as to cause the latter to move over and wash the cavity walls and by its solvent action to preserve, improve or restore the inflow of the petroleum from the rock 3. A pressure producing accumulation of gas or air above the solvent liquid is avoided by opening valve 14 or other suitable outlet.

The use of a gaseous fluid for the agitation is specially advantageous because of its lifting and mixing action, as it rises through the solvent liquid, and its capacity for vaporizing and carrying with it whatever water (if any) may be encountered by it, and also because of its easy application and the fact that it removes itself from the well without back pressure so long as its egress is not obstructed.

The pressure of the air or gas in pipe 4 need not be great; and it is preferably only sufficient to cause a bubbling or agitation of the solvent liquid in the well cavity.

The gas or air which passes up and out of the well may be discharged into the atmosphere and lost; or it may be otherwise disposed of, as, for example, by conveyance to a suitable tank. Preferably, if the same is saved or is conveyed for any purpose to a considerable distance, it is pumped from the well so as to avoid unnecessary pressure on the solvent liquid in the well cavity.

After the well has been cleaned the solvent liquid can be pumped up and recovered for use again in the well or for such other disposition, as may be preferred.

It is believed that in some wells at least a dissolving and washing off of the deposit can usefully be effected, or the formation of such deposit be usefully checked, by means of a body of crude petroleum collected in the well cavity, either by introduction through the upper part of the well (as above described for gasoline), or by direct inflow from the oil bearing rock 3, and used under the above mentioned conditions.

What I claim is:

1. The method of renovating non-flowing oil wells, consisting in forcing a fluid into a liquid solvent in a well below the surface of the solvent at a temperature suitably below the melting point of the substances deposited on the well walls and allowing it to escape so as to agitate the solvent and cause it to move over the walls of the well and wash off the deposit thereon.

2. The method of renovating non-flowing oil wells, consisting in supplying a solvent for the deposit on the walls of the oil bearing stratum of the well and then agitating said solvent at a temperature suitably below the melting point of the substances composing said deposit by the introduction of a

fluid under pressure into the solvent to agitate the latter and cause it to move over the walls of the well to dissolve and wash off said deposit.

5 3. The method of renovating non-flowing oil wells, consisting in supplying to the well adjacent to the oil bearing stratum a quantity of liquid superior to crude petroleum as a solvent for the deposit on the well wall and agitating said solvent liquid at a temperature suitably below the melting point of the substances composing said deposit by the introduction of gaseous fluid so as to cause said liquid to dissolve and wash off the deposit on the well wall in said oil bearing stratum.

4. The method of cleaning a non-flowing well, to preserve, improve or restore the inflow of petroleum from the oil bearing rock into the well cavity, in view of the tendency of the entering petroleum to deposit obstructing substances on the walls of said well cavity, which method consists (first) in introducing into the well cavity, through the upper part of the well, a liquid that is superior to crude petroleum as a solvent of said substances, in sufficient volume to cover the places at which petroleum enters from said oil bearing rock, without forming an overlying pressure producing column of solvent liquid, and (second) in causing the solvent liquid in said well cavity to wash the walls of the latter under low pressure and at a temperature suitably below the melting point of said obstructing substances, while moving about under the influence of an agitating fluid introduced below the surface of said solvent liquid, substantially as described.

5. The method of cleaning a non-flowing oil well, to preserve, improve or restore the inflow of petroleum from the oil bearing rock into the well cavity, in view of the tendency of the entering petroleum to deposit obstructing substances on the walls of said well cavity, which method consists (first) in introducing into the well cavity, through the upper part of the well, a liquid that is superior to crude petroleum as a solvent of said substances, in sufficient volume to cover the places at which petroleum enters from said oil bearing rock, without forming an overlying pressure producing column of solvent liquid, and (second) in causing the solvent liquid in said well cavity to wash the walls of the latter under low pressure and at

a temperature suitably below the melting point of said obstructing substances, while moving about under the influence of an agitating fluid in gaseous form introduced below the surface of said solvent liquid and allowed freely to escape up through the well outside the oil raising tubing, after rising to the surface of said solvent liquid, substantially as described.

6. The method of cleaning a non-flowing oil well, to preserve, improve or restore the inflow of petroleum from the oil bearing rock into the well cavity, in view of the tendency of the entering petroleum to deposit obstructing substances on the walls of said well cavity, which method consists (first) in collecting in said well cavity a liquid that is a solvent of said substances in sufficient volume to cover the places at which petroleum enters from said oil bearing rock, without forming an overlying pressure producing column of solvent liquid, and (second) in causing the solvent liquid in said well cavity to wash the walls of the latter under low pressure and at a temperature suitably below the melting point of said obstructing substances, while moving about under the influence of an agitating fluid introduced below the surface of said solvent liquid, substantially as described.

7. The method of cleaning a non-flowing oil well, to preserve, improve or restore the inflow of petroleum from the oil bearing rock into the well cavity, in view of the tendency of the entering petroleum to deposit obstructing substances on the walls of said well cavity, which method consists (first) in collecting in said well cavity a liquid that is a solvent of said substances in sufficient volume to cover the places at which petroleum enters from said oil bearing rock, without forming an overlying pressure producing column of solvent liquid, and (second) in causing the solvent liquid in said well cavity to wash the walls of the latter under low pressure and at a temperature suitably below the melting point of said obstructing substances, while moving about under the influence of an agitating fluid in gaseous form introduced below the surface of said solvent liquid and allowed freely to escape up through the well outside the oil raising tubing, after rising to the surface of said solvent liquid, substantially as described.

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