

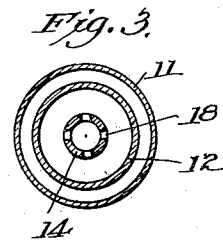
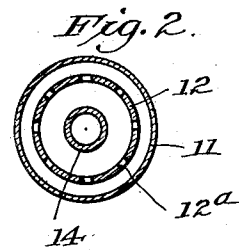
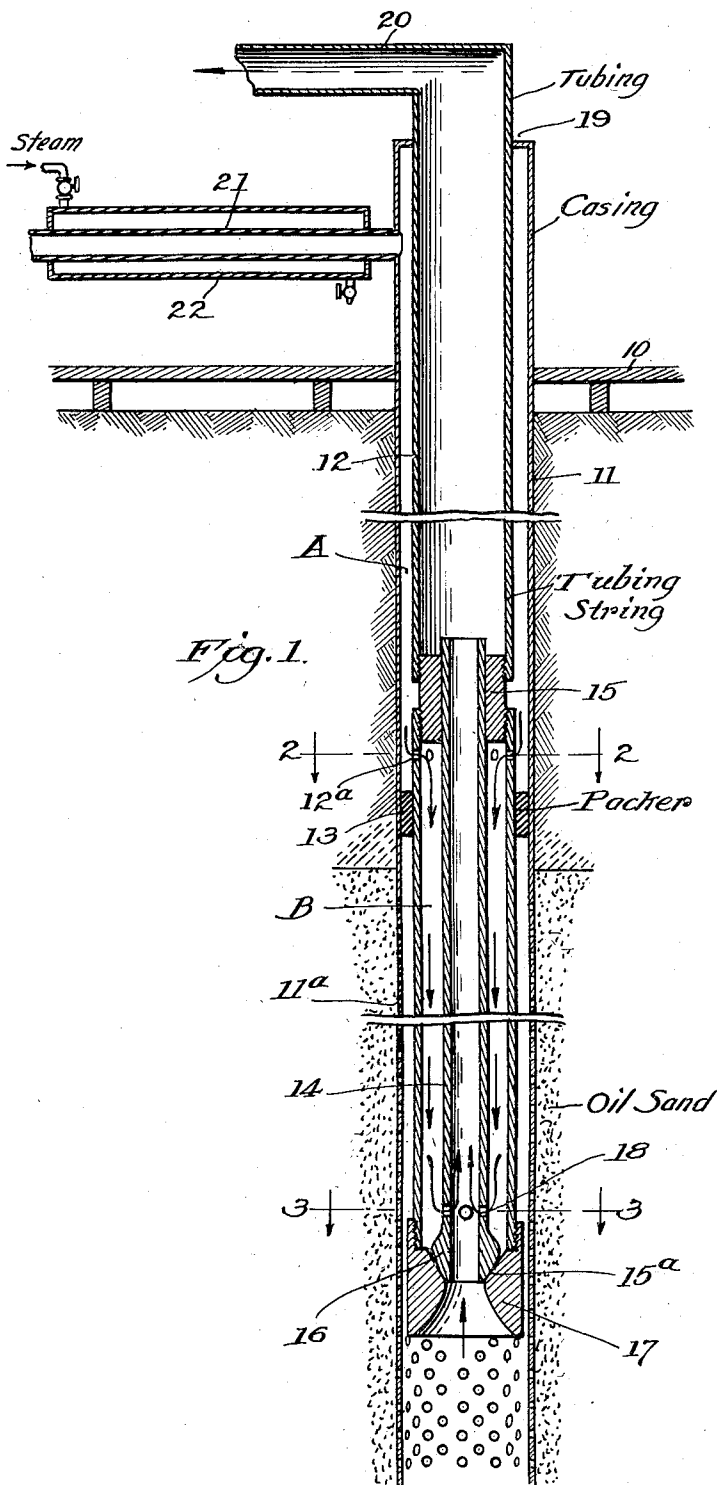
Dec. 3, 1929.

E. P. REYNOLDS

1,737,894

METHOD OF FLOWING OIL

Filed June 27, 1927



INVENTOR
Edward P. Reynolds,
BY *Munn & Co.*
ATTORNEYS

UNITED STATES PATENT OFFICE

EDWARD P. REYNOLDS, OF ANAHEIM, CALIFORNIA

METHOD OF FLOWING OIL

Application filed June 27, 1927. Serial No. 201,803.

This invention relates to a method of cleaning oil wells and reducing the viscosity of the oil while accelerating the flow of the oil from the well, all as a continuous and positively functioning operation.

An essential object of the invention is the provision of a method which will maintain a definite clearance of the perforations of the well casing by the step of subjecting the oil to the action of a reducing heat at the perforations so as to break down the heavier constituents of the oil which ordinarily are the cause of a clogging of said perforations and a resultant impediment to the motion of the oil from the oil bearing sand to the tubing of the well.

A further object of the invention resides in the step of subjecting the oil to the action of reducing heat before it is permitted to enter the tubing and in the step of ushering the oil through the tubing by the action of a heat current whose supplementary functional characteristic is to reduce the viscosity of the oil and prevent undue adhesion of the heavier constituents of the oil to the walls of the tubing, thus allowing an uninterrupted flow of the oil.

My invention embodies the principle of introducing air or some other suitable, non-condensable and gaseous substance at a sufficiently high temperature to the well to overcome the congealing of the paraffin, asphaltum or other heavy bodies contained in the mineral oil and in reducing the viscosity of the mineral oil to liberate the entrapped gases contained therein, thereby assisting very materially in lightening the column of the mineral oil on its upward movement from the source to the discharge from the top of the well. I am particularly concerned in these prime features and, of course, I do not wish to be limited to any details of construction of a desirable mechanical means for carrying the invention into practice. Therefore, the instrumentalities which characterize the apparatus herein disclosed are to be considered simply as a statutory prerequisite necessary to a disclosure of at least one known way of carrying the invention into practice.

Other objects and advantages of my in-

vention will more fully appear as the description proceeds.

In the drawings,

Figure 1 is a vertical section through a well showing the manner of practicing my invention;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a section on line 3—3 of Figure 1.

Reference may now be had to the drawings, wherein 10 represents the floor of a derrick and 11 the well casing which passes there-through, the latter associated with a tubing string 12. The casing 11 is perforated as usual near its lower end as at 11^a and at a point above the perforations and occupying the space between the casing and the tubing is a packer 13 which functions to provide an air- and gas-tight connection between the walls of the casing and the walls of the tubing, while holding the latter spaced from the said walls of the former. At a point above the packer 13 and formed in the tubing are perforations 12^a which open outwardly into the space A between the tubing and the casing and which open inwardly to the space B between the walls of the main body of the tubing and the walls of an inner length of supplemental tubing section 14. The string coupling 15 closes the upper end of the said space B, and, as illustrated, the lower end of the space is closed by the flared portion 16 of the supplemental tubing through its engagement in a correspondingly formed socket 15^a in the base nose 17 of the main body 14 of the tubing. At a point slightly above the nose 17 and formed in the supplemental tubing section 14 are perforations 18.

The casing 11 is closed at its upper end as at 19, and the tubing 12 passes through said closed end and, beyond the latter, it is provided with a lateral branch 20 to conduct the discharging oil to a receiving source, not shown. Below the closed upper end of the casing and connected with the latter so as to communicate with the space A is a pipe or duct 21. Around a portion of said pipe or duct is a drum 22 by means of which steam or some other heat agent can be introduced

through a suitable valved connection. At the opposite end and at the bottom of the drum 22 is a control valve which can be manually set to govern the bleeding of the steam from the drum according to the degree of temperature at which it is desired to introduce hot gas or air to the space A by way of the pipe or duct 21.

It can now be assumed that the well is functioning and that hot fluid, such as gas or air, is being discharged thereinto by virtue of the scheme above suggested. This hot fluid, which is forced into the system by pressure, is first caused to descend into the space A around the portion of the tubing 12 above the packer 13 in order to heat this portion of the tubing, and then reaches the perforations 12^a, at which point it is deflected laterally and inwardly, so that it may now descend into the space B, where it acts to heat the walls of the tubing 12 below the packer and also to heat the walls of the supplemental tubing section 14. By the action of the heat which radiates from the tubing walls throughout the intake area of the perforations of the well casing, the heavy bodies contained in the mineral oil, such as paraffin, asphaltum or the like, are subjected to the action of a reducing heat so as to overcome the congealing of these bodies and reduce the viscosity of the oil. The surrounding formation about the casing is maintained in a heated state so that the perforations in said casing are kept clear.

The said heat agent or fluid is now and with pressure behind it introduced into the bore of the supplemental tubing section by way of the perforations 18 at the very base of the tubing. This fluid now intermingles with the flowing mineral oil and ascends therewith into the portion of the tubing 12 above the packer 13, thus liberating the entrapped gases contained in the oil, and thereby materially assisting in lightening the column on its upward movement in the well. The oil is thereby treated for a second time to an action to reduce the viscosity of the oil, and aside from lightening the column and assisting the flow, I am able to prevent undue adhesion of the heavier bodies or constituents of the oil to the tubing walls.

I have set forth a scheme of routing the heat agent so as to bring about the functional action herein set forth but it shall be understood that I am not to be limited in this respect, because, broadly speaking, the invention is directed to the provision of a method characterized by the functions set forth, and it is but reasonable to infer that the described functions may be accomplished through aid of other mechanical agencies without altering these functional characteristics.

It should be further noted that by my method steam is not allowed to intermingle with the air or other suitable, non-condensable and gaseous substance, by which the

viscosity of the oil is reduced, so that products of condensation are not liable to accumulate at the bottom of a well, to which my method is applied, and therefore can not interfere with the free flow of oil into the well, as is the case with wells subjected to the action of steam for the purpose of assisting in raising the oil from the wells.

I claim as my invention:

1. The herein described method of cleaning oil wells and assisting the step of flowing the oil therefrom which consists in causing a current of a heated, non-condensable and gaseous substance to descend around the tubing of the well and into the tubing in proximity to the perforations of the well casing so as to reduce the viscosity of the oil at and above the perforations by the action of radiant heat, thereby preventing a congealing of the heavier constituents of the oil at and above the perforations, and in then deflecting said current into the tubing from a point near the bottom thereof in order to permit the current to ascend in the tubing with the flowing oil, and thereby to reduce the viscosity of the oil and accelerate the flow thereof.

2. The herein described method of assisting the flow of oil in a well, which consists in heating a non-condensable and gaseous substance, introducing a current of the heated substance under continuous pressure around the tubing of the well, then leading the current to the oil inlet area of the tubing, and finally causing the heated current to ascend in the tubing with the up-flowing oil, and to intermingle therewith.

3. The herein described method of assisting the flow of oil in a well, which consists in introducing a heated, non-condensable and gaseous substance around an upper portion of the tubing of the well, then leading the gaseous substance to the oil intake area of the tubing, and finally causing the heated substance while under continuous pressure to ascend with the oil in the tubing, thereby liberating the entrapped gases contained in the oil and lightening the column of oil while reducing the viscosity thereof, incident to a direct intermingling of the heated substance while under induced pressure with the oil.

4. The method of assisting in flowing oil from a well which consists in continuously applying a stream of a heated, non-condensable and gaseous substance under pressure around the tubing of the well and thereby causing heat to radiate to the earthy formation about the oil intake region of the perforated casing of the well, and in injecting an updraft of the heated substance laterally into the tubing at a point near the base thereof.

5. The method of lightening the column of oil in the step of flowing the oil upward in the tubing of a well, which consists in continuously forcing a stream of a hot, non-con-

densable gas around the tubing of the well and upward into the tubing from a point near the source of oil supply and in causing the gas to mix with the oil as the column moves upward in the tubing.

- 5 6. The herein described method of lightening the column of mineral oil and in reducing the viscosity of the oil from the source to a point of discharge of the oil from a well,
10 which consists in forcing under constant pressure a hot non-condensable and gaseous substance around the tubing of the well and upward into the tubing from the base thereof and in causing the gaseous substance to flow
15 upwardly in the tubing while in direct contact and intermixed with the oil.

EDWARD P. REYNOLDS.