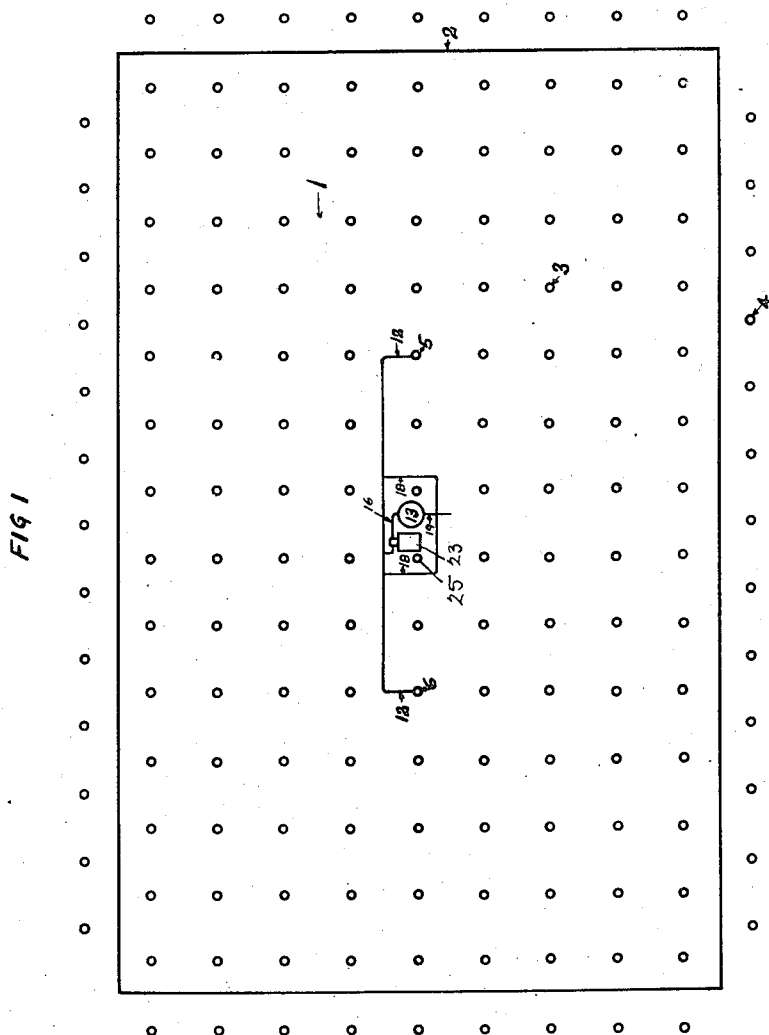


1,295,243.

2 SHEETS—SHEET 1.

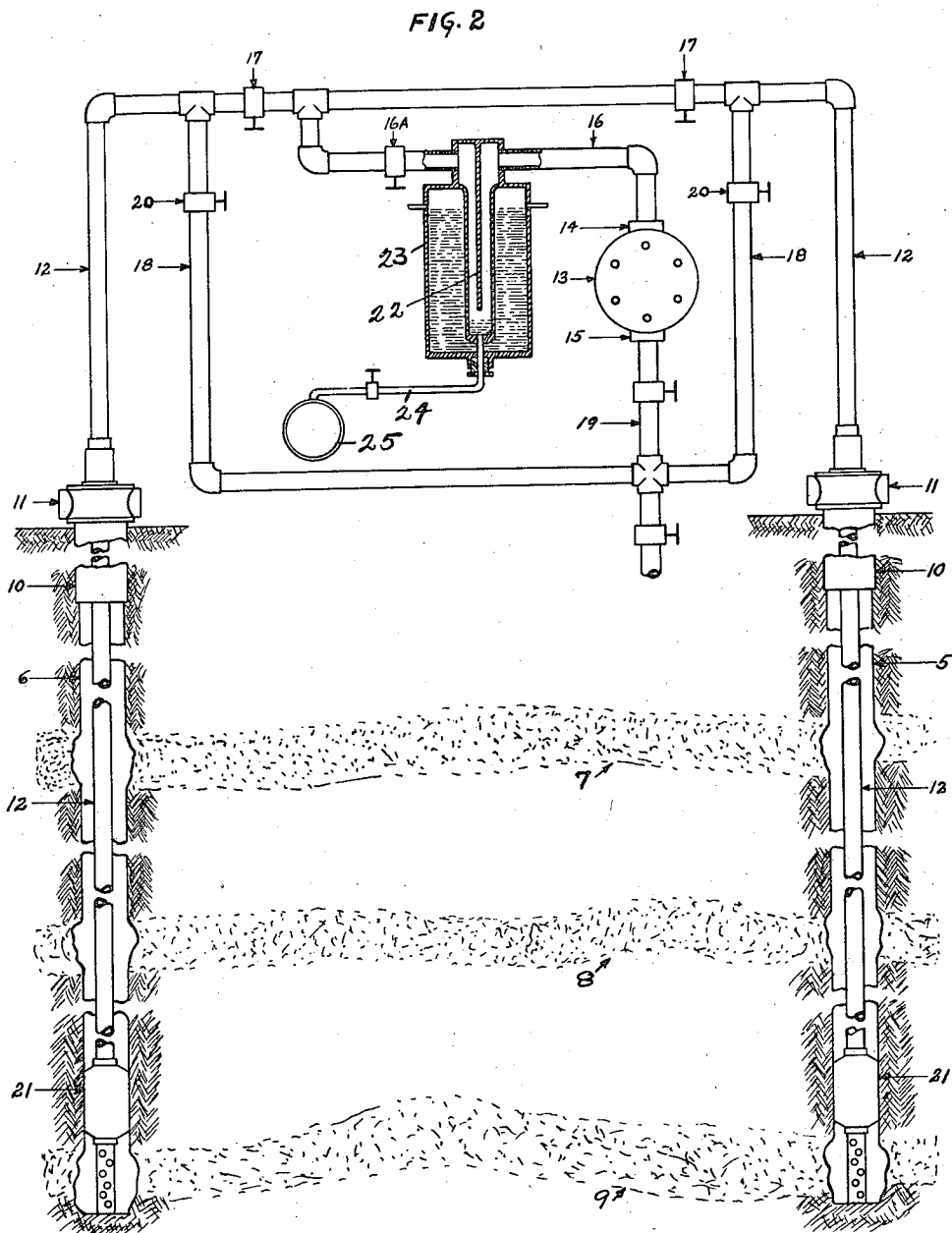


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METHOD OF OPERATING OIL WELLS.
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2 SHEETS—SHEET 2.



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METHOD OF OPERATING OIL-WELLS.

1,295,243.

Specification of Letters Patent.

Patented Feb. 25, 1919.

Application filed March 22, 1917. Serial No. 156,572.

To all whom it may concern:

Be it known that I, CHARLES A. WAITZ, a citizen of the United States, residing at Rouseville, in the county of Venango and State of Pennsylvania, have invented new and useful Improvements in Methods of Operating Oil-Wells, of which the following is a specification.

This invention relates to methods of operating oil wells and consists in certain improvements therein as will be hereinafter fully described and pointed out in the claims.

The object of the invention is to facilitate the removal of the oil from oil-bearing sands.

In the accompanying drawings I have shown a group of oil wells and mechanism for carrying out the method as follows:—

Figure 1 shows a plan view of an oil field.

Fig. 2 a vertical section of two wells in the field illustrative of the apparatus used in carrying out the method.

1 marks an oil field, the boundary line being at 2. A group of wells 3 are arranged within the boundary line 2 and a number of competing wells 4 are arranged without the boundary. Two wells 5 and 6 arranged within the group are selected for introducing pressure to the sands. These two wells preferably are about the same distance apart as they are from the boundary lines. These wells tap a plurality of sands as shown 7, 8 and 9. The wells are provided with the usual casing 10, casing heads 11 and tubing 12. It will be understood that each well of the group has or may have a casing, casing head and tubing.

In carrying out my method I place the well 6 under pressure, preferably a very high pressure, say up to five or six hundred pounds. This drives the oil away from the well 6 and toward the boundaries of the field. As the different wells in the group feel the effect of this pressure the oil is removed. When it becomes apparent that the pressure is driving the oil to a point adjacent to the wells near the boundary I reverse the operation on the well 6 and place this well under a partial vacuum, thus reversing the flow of oil through the sand and taking it up from well to well in the group. It is preferable as the pressure is exhausted from the well 6 to introduce it to another well, thus utilizing the gas instead of the air as a rule and also saving some of the

energy necessary to effect the result. I, therefore, introduce the pressure as the gas is exhausted from the well 6 into another well 5 and in placing the wells 5 and 6 it is desirable, as before stated, to have them as distant from each other as they are from the boundary and preferably a little greater distance apart so that they will cover the intervening territory in a natural manner.

In order to carry out this pressure scheme I provide the compressor 13 with the discharge 14 and intake 15. I connect the pipes 12 with the discharge 14 by a pipe 16. I supply the bypass 18 which is connected with the intake 15 by a pipe 19. I provide the valves 17—17 at each side of the pipe 16 and the valves 20—20 in the bypass at each side of the pipe 19. By closing one of the valves 17 and one of the valves 20, as for instance the right-hand valve 17 and the left-hand valve 20, the gas drawn in from one well is discharged to the other well and by reversing the position of the valves 17 and 20; that is, closing one valve 17 and opening the other, or closing one valve 20 and opening the other, the action of the compressor on the wells may be reversed.

It frequently happens that the different sands in oil wells offer varying resistance to the flow of air and oil through them. If the air or gas is introduced to a well in which the sands are all connected to the well the pressure will be dissipated through the sand offering the least resistance. This may be the sand having the least amount of oil and consequently this result should be avoided. To obviate this I provide a packer 21 on the tubing 12. By placing this packer over the lower sand, pressure may be put on the lower sand alone. After the oil is taken from the lower sand this may be cemented or plugged, the packer put above the next sand, as shown the sand 8 and the oil taken from it. In carrying out this, it is desirable to not only pack off the well to which pressure is introduced but also the adjacent wells in the group. After the pressure has crowded the oil beyond the wells immediately adjacent the air may escape through the connection afforded by said wells into the sands having least resistance so that the result will not be fully achieved. It is desirable, therefore, not only to pack off the well to which pressure is immediately supplied but also the wells as they extend out through the group. This same action, pack-

ing off, is desirable in the well which is placed under a partial vacuum but, of course, the necessity for it is not so great with such a well as with the well to which the high pressure is applied.

I prefer to open the sands prior to the introduction of the air by introducing an explosive material in the vicinity of a sand which is being operated upon. In doing this I utilize the ordinary torpedo for this purpose.

I also prefer to introduce benzin to the well to clear the sand of paraffin.

It will be understood that pressure is put on the well 6 and then the pressure exhausted as the oil reaches the outer wells of the group so as to reverse the flow of oil and that this operation is repeated so that the oil is forced back and forth through the sand until it is exhausted beyond a point where it is profitable to remove it.

I prefer to use natural gas as the medium for exerting pressure on the wells and where this is done the gas introduced to the well exerts the pressure and then when the operation is reversed this gas is removed. The gas so forced into the sand strata, particularly in view of the fact that it is under pressure, takes up a certain amount of the more volatile parts of the oil so that when removed it carries with it these parts, such as gasoline, which gasoline may be separated from the gas and the gas again used for exerting pressure on the well. To accomplish this in the accompanying structure, I have provided the gasoline separator 22. This is simply a U-bend surrounded by a chilling medium 23, usually a brine or other liquid ordinarily used in connection with ice machines. The gasoline which accumulates is drawn off through the pipe 24 and stored in the tank 25. In order that the gas in the separator 22 may be under sufficient pressure to readily separate the gasoline, I provide a valve 16^a. This may be a differential valve which permits the passage of gas only when the pressure back of it reaches a certain volume or an ordinary valve so nearly closed in view of the volume of gas as to maintain the pressure.

It may be desirable to transfer the gas from one well to another so as to equalize the pressure, thus saving pumping. This may be done in the present instance by clos-

ing the valve 16^a and the valve 20 and opening both the valves 17—17. Under these conditions the gas in the different wells will equalize.

Where the wells actually under operation do not supply sufficient gas it may be desirable to utilize gas from outside sources.

What I claim as new is:—

1. The method of operating a group of oil wells which consists in alternately subjecting the oil sand tapped by said wells to pressure and a partial vacuum from one general location and removing the oil from the wells having the lesser pressure.

2. The method of operating a group of oil wells which consists in exerting pressure upon a well within the group until the pressure begins to move the oil past the outer wells of the group and then subjecting the sand from a point within the group to a partial vacuum to reverse the flow of oil.

3. The method of operating a group of oil wells which consists in torpedoing the wells to loosen the sand therein, then alternately subjecting the oil sand tapped by said wells to pressure and a partial vacuum from one general location and removing the oil from the wells having the lesser pressure.

4. The method of operating a group of oil wells which consists in forming a partial vacuum in the first well, putting a second well under pressure, then alternating the pressure in these wells, first equalizing the pressure by directly connecting the wells, and removing the oil from the well having the lesser pressure.

5. The method of operating a group of oil wells which consists in alternately subjecting the oil sand tapped by said wells to gas pressure and a partial vacuum, removing the oil from the well having the lesser pressure, and removing the gasoline from the gas utilized in the operation.

6. The method of operating an oil well which consists in alternately subjecting an oil sand tapped by said well to pressure and a partial vacuum, and removing the oil accumulated in said well while under a partial vacuum.

In testimony whereof I have hereunto set my hand.

CHARLES A. WAITZ.