

F. SQUIRES.
METHOD OF RECOVERING OIL AND GAS.
APPLICATION FILED JAN. 12, 1917.

1,238,355.

Patented Aug. 28, 1917.

Fig. 1.

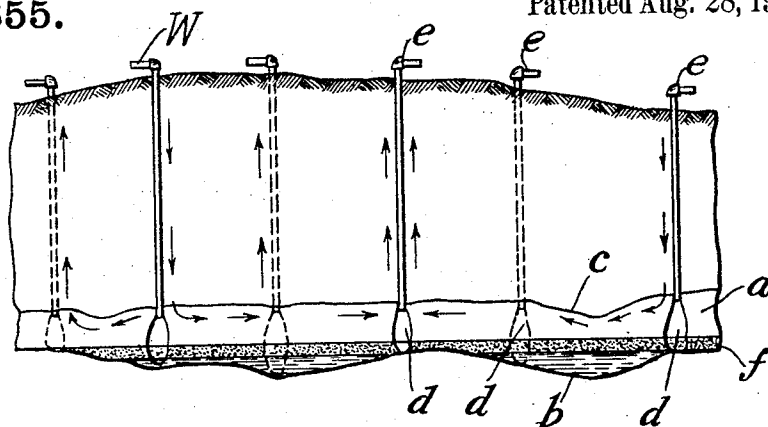


Fig. 2.

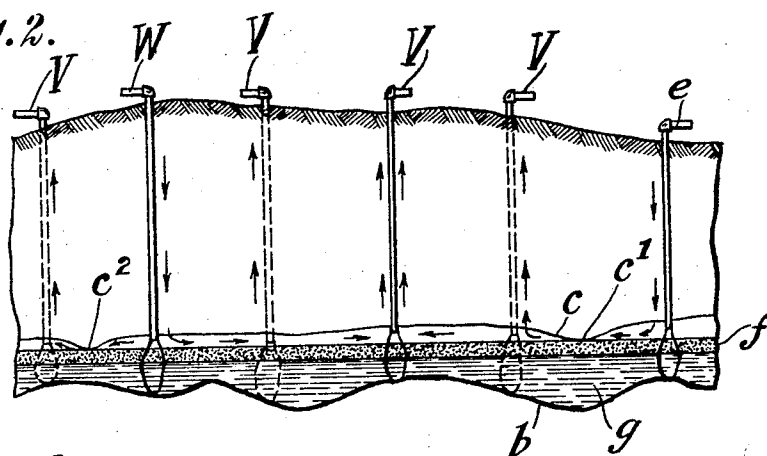
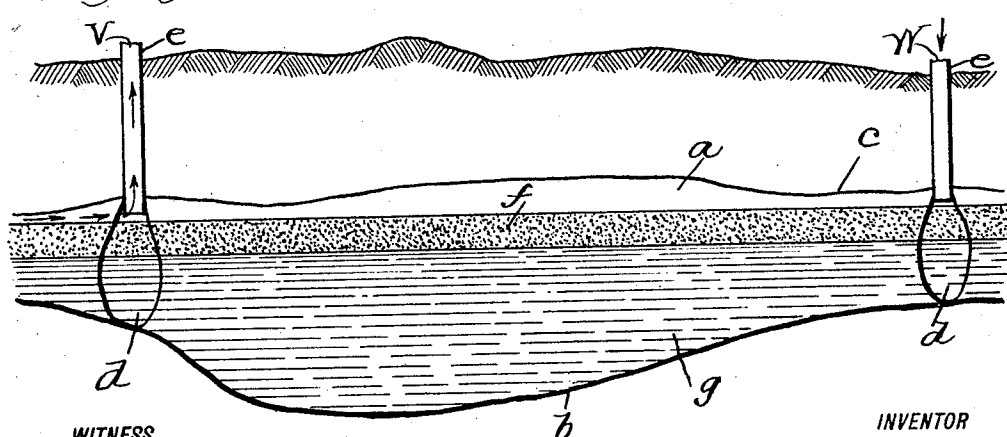


Fig. 3.



WITNESS
Geo. H. H. H.

INVENTOR
Frederick Squires
BY
W. G. H. H.
ATTORNEYS

UNITED STATES PATENT OFFICE.

FREDERICK SQUIRES, OF MARIETTA, OHIO, ASSIGNOR TO WALTER SQUIRES, OF ZANESVILLE, OHIO.

METHOD OF RECOVERING OIL AND GAS.

1,238,355.

Specification of Letters Patent.

Patented Aug. 28, 1917.

Application filed January 12, 1917. Serial No. 141,961.

To all whom it may concern:

Be it known that I, FREDERICK SQUIRES, a citizen of the United States, and a resident of Marietta, in the county of Washington and State of Ohio, have invented certain new and useful Improvements in Methods of Recovering Oil and Gas, of which the following is a specification, reference being had to the accompanying drawings, which form a part hereof.

In view of the steadily increasing consumption of petroleum and its by-products, attention is now being directed in the art to the exploitation of so-called depleted oil wells, that is, wells from which there is no longer a natural flow. Thus far, however, the only successful results which have been obtained in practice in recovering oil from such wells have been those in which pressure has been applied to the oil bearing sands or suction created at the venting wells. The present applicant in a patent issued to him on September 12th, 1916, No. 1,198,078, discloses a method of recovering oil in which water is introduced into the oil stratum for the purpose of forming a dam by which to minimize the dissipation of oil and gas in the porous sands upon application of pressure thereto. This method was termed, for convenience, the "flood" method. The present invention is somewhat allied to that shown in the patent but differs therefrom in principle in that flotation of the oil is effected by the introduction into the oil sands of an incompressible fluid. By this method, the oil is brought into such relation to the venting pressures as to be moved or "pushed along" by the air to the venting wells regardless of the initial depth of the dry sands and the character of the impervious floor of the sands. The method will be described in greater detail hereinafter in connection with its application to dry sands shown, as an example, in the accompanying drawings. In these drawings,

Figure 1 is a somewhat conventional illustration in section through an oil bearing stratum of sand drilled for the practice of the invention.

Fig. 2 is a view similar generally to Fig. 1 showing the same stratum after the introduction of water.

Fig. 3 is a sectional view on a somewhat larger scale showing particularly the de-

sired relation between the water, the oil and the air, effected by the improved method.

As this description proceeds, it will be evident that the invention is not to be limited in its application to oil bearing sands of any particular dimensions, formation or outline but that it will be found generally useful in fields of large and irregular form as well as those fields in which the oil streaks are relatively narrow and well defined. In the accompanying drawings, for instance, the stratum drilled is shown in section so that so far as the practice of the improved method is concerned, it makes no difference as to what form this stratum may assume in plan. Further, while the floor of this stratum has been illustrated as of irregular cross-sectional form, as will usually be the case, the invention will be found equally effective where this floor is of more uniform character.

Referring to the drawings, the porous oil bearing sands *a* have been indicated as having an impervious floor *b* and an impervious roof *c*, of rock, by which the pressures applied to the stratum will be confined. The usual shot wells *d* are drilled to the sands and pipes *e* are placed in the wells for the transfer of fluids, as required. As will be understood, in its early stages, oil and gas would be vented under natural pressure from the sands *a* until this pressure fell below atmospheric pressure. The inert gas and oil remaining in the stratum might then be recovered, within limits, by the application of air pressure to some of the wells *e* and, perhaps, the creation of suction at the remaining venting wells. As this recovery continued, however, it is evident that the level of the oil indicated by the character *f*, in the sands, would gradually fall until a practically unrestricted passage would be afforded the air through the porous sands. At this stage the air might pick up some of the hydrocarbon gas within the sands but the flow of liquid oil would cease. It is this condition in so-called depleted oil wells which the present invention seeks to meet. It will be evident that if the passage of air through the dry sands were impeded by the oil itself, the oil would be picked up or pushed along by the air to the venting wells. To bring about this desired relation between

the oil and the air, water is introduced into the oil sands through one of the wells W and this water, under pressure slowly percolates through the sands and, by reason of its higher specific gravity, displaces the oil f and settles to the floor of the oil bearing stratum. This condition is shown in Fig. 2 wherein the water is designated by the reference character g . The displacement of the oil may be made more complete by introducing an alkali into the water and by raising the temperature of the water. An electric current will also aid the washing process. As the oil is floated it is brought directly into the path of the air introduced through some of the wells e and is picked up or pushed along by this air to the venting wells V. This venting may be further increased by applying suction to the venting wells V, the only necessary condition being that a pressure differential within the oil sands be created in any desirable manner.

As described thus far, it is evident that the flotation method is effective no matter what the character of the streak may be. Its most effective application, however, will probably be in those sands where the roof c is of irregular formation so that the oil f is raised to a point where it actually engages the lowermost sections, as c^1 , c^2 , and air pockets are formed. These air pockets will increase the effectiveness of the air pressures since seals will be formed wherever the roof dips into the oil.

Another condition under which the improved method will serve as the only feasible means of recovering the oil will be where, as illustrated, the floor b is of irregular shape so that the oil collects in the depressions therein. Under such circumstances it is quite certain that the oil in these depressions cannot be disturbed or forced therefrom by any pressures now available in the art so some means must be employed for moving the oil from these depressions in order that the venting pressures may act thereon. By the flotation herein described and as brought out clearly in Fig. 3, the water introduced into the sands enters these depressions in the floor and displaces the oil thereby raising it into the path of the venting pressures and insuring its removal.

It is obvious that the gas in the sands

will be driven out at the venting wells in the volume of the water admitted to the sand. This method also will produce gas by evaporation from the oil of hydrocarbons into the pressure medium. The agitation of the oil by contact with the water causes evaporation and the moving air over the oil will provide a carrying medium for evaporation just as wind aids the evaporation of water. This process may be improved by lowering the pressures around the venting wells by means of suction, quick evaporation being assisted by low pressure. The gas produced by these means will be rich in gasoline which may be recovered therefrom.

As pointed out hereinbefore, the improved method will be found of general application to oil fields. Further, the invention is not to be limited to the character of the pressure impressed on the oil. For instance, atmospheric pressure may be admitted at the pressure well and suction created at the venting well or, a positive pressure may be applied at one point and the venting well be left under atmospheric pressure or have suction applied thereto. The scope of the invention will appear more definitely from the appended claims.

I claim as my invention:

1. The method of recovering oil and gas from a porous oil bearing stratum which consists in raising the oil from depressions by the introduction into the sands of a liquid of greater specific gravity than oil to a point where the oil lies in the free course of the stratum but does not fill it and then applying to said sands a separate venting medium of less specific gravity than the oil to flow along the oil and pick up and push the oil and gas to the venting well.

2. The method of recovering oil and gas from a porous oil bearing stratum which consists in raising the oil from depressions by the introduction into the sands of water under pressure to a point where the oil lies in the free course of the stratum but does not fill it and then applying air to said sands under pressure, the air flowing along the oil and picking it up and pushing the oil and gas to the venting well.

This specification signed this 6th day of January, A. D., 1917.

FREDERICK SQUIRES.