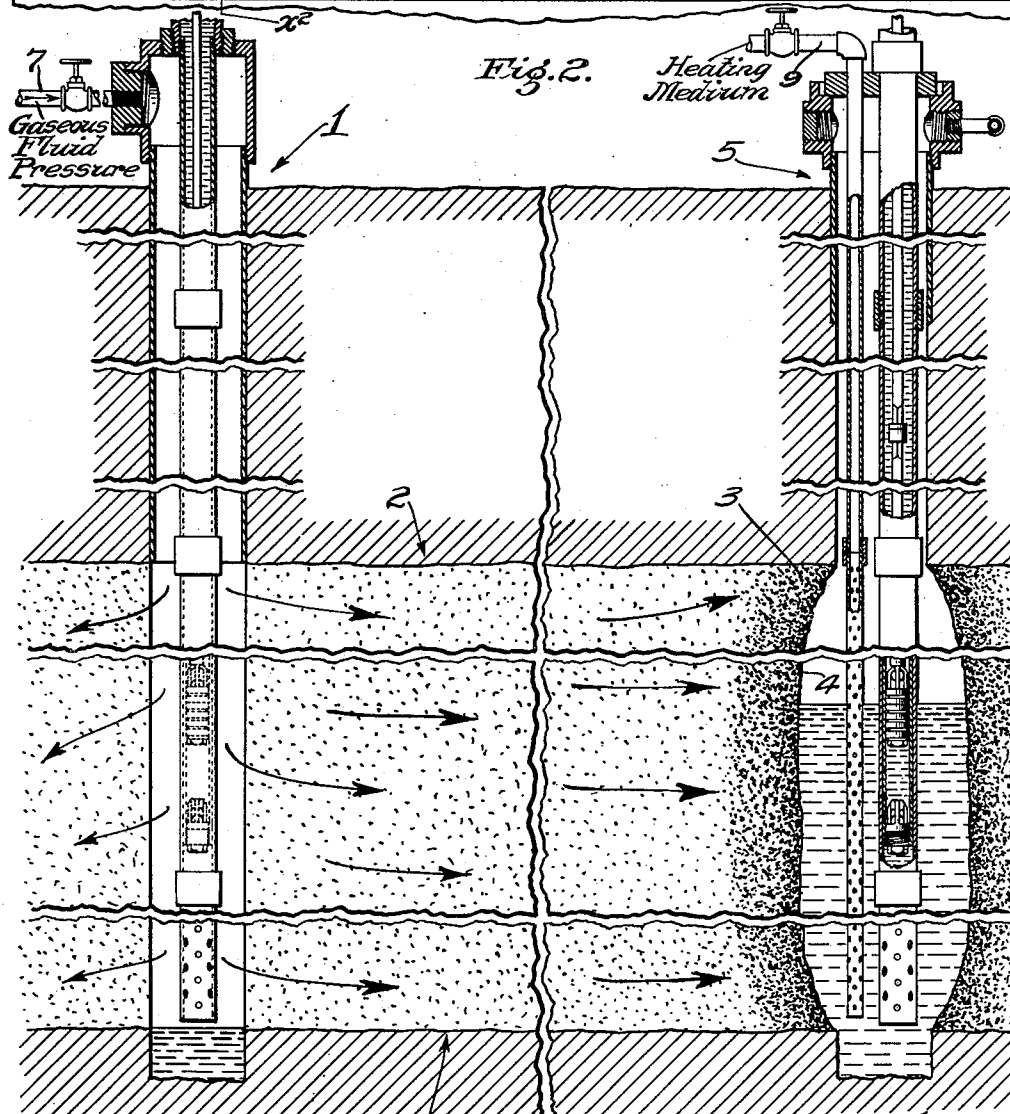
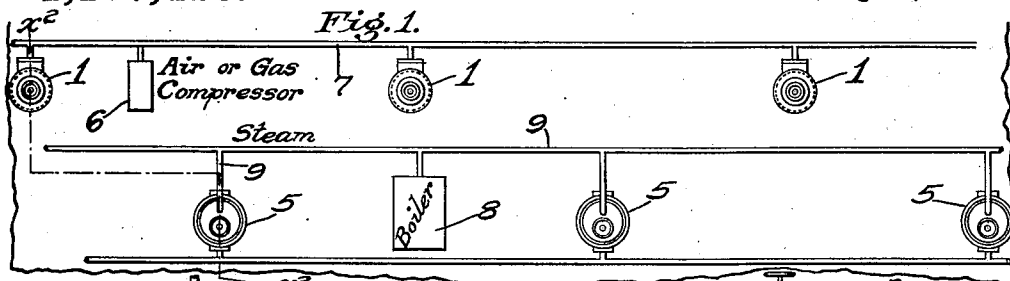


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METHOD OF RESTORING AND INCREASING THE PRODUCTION OF OIL AND GAS WELLS.
APPLICATION FILED MAR. 18, 1912.

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METHOD OF RESTORING AND INCREASING THE PRODUCTION OF OIL AND GAS WELLS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, IRWIN L. DUNN, a citizen of the United States, residing at Long Beach, in the county of Los Angeles and State of California, have invented a new and useful Method of Restoring and Increasing the Production of Oil and Gas Wells, of which the following is a specification.

It is well known that the production of oil and gas wells decreases with time and that finally the flow nearly or completely ceases; and various methods have been employed to increase the production, but with varying results.

This invention relates more particularly to the treatment of old oil and gas wells which have become clogged by accumulations of paraffin or other heavy hydrocarbons and the purpose is to restore production to those wells which have ceased to produce and to increase the production of those wells the production of which has been lowered by such clogging. It is understood that such wells have become entirely or partially closed by accumulations of paraffin or other heavy hydrocarbons in the formation surrounding the well. That is to say; when an oil well is drilled in a virgin territory, the natural gaseous fluid pressure or the so-called rock pressure in the formation is found to be approximately one-half pound per square inch for each foot of the depth. If such well be pumped by ordinary means so as to take the oil from the well pocket as fast as it accumulates, there will be only atmospheric pressure at the bottom of the well, to which pressure the gas must expand from the formation; and at some place within such formation, at a distance from the well, the rock pressure will be at a maximum. The expansion of gas causes a reduction of temperature and such expansion of gas and reduction of temperature will be greater in the strata immediately around the well than elsewhere. The sand rock or producing stratum acts in the nature of a filter; and, at the places where the reductions of temperature occur, frees the oil from its heavy hydrocarbons which lodge at such places, thus closing the interstices of the formation to a greater or less extent, and finally shut off the flow of oil. That is to say, the congealed heavy hydrocarbons are strained from the oil and so fill the interstices and openings in the formation that the flow of

oil and gas is nearly or wholly shut off. In order to increase the production which has thus been clogged, heat has been applied through the medium of steam or heated non-combustible gas applied inside the well to fluidify the accumulations of paraffin and other heavy hydrocarbons. But it has been found that a decrease instead of an increase in the production is liable to result from such treatment; and such treatment has not met with favor in the oil producing regions because of its unreliability and the danger of entirely losing the production.

An object of this invention is to provide a method whereby the wells may be so treated as to invariably increase the production if there is a supply of oil in the producing stratum. I apprehend that the reason for the reduced production liable to occur in wells that have been steamed or otherwise heated for the purpose of increasing their production is that the application of heat fuses the heavy hydrocarbon deposits which are originally in the form of flakey crystals and not absolutely impervious to the flow of oil and gas until fused and congealed; and, that when said deposits are fused, they form a homogenous non-porous mass, which, when congealed is practically impervious to the natural fluids contained in the formation, and that as the heat is dissipated the hydrocarbons congeal, and seal the interstices of the formation, so as to prevent the flow of gas or oil.

An object of the invention is to so treat oil and gas wells that the clogging substances may be absolutely removed and the hydrocarbons be caused to flow to the well from which they may be pumped; and to obtain from the hydrocarbon and gas-bearing earth formation the largest possible amount of the store of hydrocarbon contained therein. This I accomplish by applying a gaseous fluid pressure within the formation adjacent to and around the well and fluidizing the paraffin and heavy hydrocarbon deposits by heat applied from within the well, the fluid pressure in the formation being thereby enabled to drive out the clogging hydrocarbon deposits while in a fluid state, into the well from which they can be removed. The operation of removal is preferably performed while such deposits are being caused to flow into the well. That is to say, the application of the fluid pressure and of the fluidifying medium are practi-

cally simultaneous with the pumping operation; it being necessary, however, in many instances, that the rock pressure be restored in the formation around the well before heat is applied to the well. As the clogging material is removed, the introduced gaseous fluid pressure in the formation will become effective to overcome the force of capillary attraction and to carry the oil from the interstices of the formation, to the well from which it may be pumped.

I am aware that an artificial pressure system has been proposed to expedite the flow of oil and maintain a constancy of oil-level within the oil pocket and that there has been suggested a method of treating petroleum wells with compressed hot air for the purpose of melting paraffin and like substances in the crevices and fissures of the rock around the well-hole, but so far as I am aware this present method is novel in that the clogging hydrocarbons are first liquidized and are then displaced and driven into the well by an artificially created pressure adjacent the well.

Reference is made to the accompanying drawings which represent a plan and a vertical section of earth formation in oil-bearing territory.

Figure 1 is a broken plan of a portion of oil-bearing territory in which oil wells have been provided. Fig. 2 is an enlarged vertical section from line x^2 , Fig. 1, showing a well through which fluid pressure may be applied to the formation and a well to which such pressure may be applied through the formation.

Arrows indicate the direction of gaseous fluid pressure against the clogging material. In carrying out this newly-invented method, gaseous fluid pressure may be applied from a well 1 which may be a newly-drilled well or one that has not become fully clogged and that is yet receptive to the gas and will admit the same to the interstices of the oil-bearing stratum 2 around and outside of the paraffin or otherwise clogged portion 3 of the oil-bearing formation immediately surrounding the pocket 4 of the well 5 to be restored, thus producing an artificial rock pressure, so that the tendency is to force the paraffin, etc., from the interstices of the rock at 3 into the well pocket 4. After such pressure has been applied, a liquidizing agent, such as superheated steam or heat-generating materials as quick-line and water, or some other heat-carrying or heat-generating medium that will melt the paraffin and other clogging hydrocarbons, and thereby liquidize the same, is applied to the paraffin, etc., from the interior of the well 5 which is to be restored. Or a liquidizing agent such as gasolene may be introduced into the free well 1 and allowed to percolate into the formation 2 and

be driven by the gaseous fluid pressure from the well 1 to the adjacent clogged wells 5.

To increase the production of a partially clogged well which will take gas, the pressure in the surrounding stratum outside of the clogged portion thereof will first be increased by pumping atmospheric air or gas into the well for a considerable time, say two or three weeks, more or less, before the application of the fluidizing medium is commenced, so that the rock pressure will force the liquidized hydrocarbons out of the stratum into the well; otherwise the liquidized material will be driven back into the formation and may there congeal, thus preventing the results aimed at.

The application of heat should be continued until the liquefaction of the paraffin or other obstructing hydrocarbons is extended back to the interstices from which the gaseous fluid pressure is exerted, so that as the paraffin or other heavy hydrocarbons become liquidized they will be forced from the interstices of the formation into the well in which a tendency to vacuum may be produced by a gas pump.

During the treatment above specified the pumping operation is carried on to remove from the well the liquid paraffin, etc., practically as fast as the same flows into the well. Otherwise the paraffin will congeal; and care is taken that the liquid paraffin is removed from the well as fast as it flows from the formation.

The liquidizing process is continued until the production of paraffin and other clogging hydrocarbons practically ceases, whereupon the application of the liquidizing agent is discontinued while the application of fluid pressure in the formation, and the pumping operation, are continued, so that the liquid and gaseous hydrocarbons contained in the interstices of the formation will be forced into the well and there recovered by the pumping operation or by allowing the hydrocarbon to flow from the well when such may be accomplished by the pressures available. The heating or other liquidizing operation may be conducted intermittently thereafter as deemed expedient or as its necessity may be indicated by reduced flow from time to time as clogging again occurs.

To introduce this method in a territory having numerous old wells, some centrally located wells that are receptive to the gas should be selected through which to introduce the gaseous fluid pressure; and after the oil-bearing formation has been sufficiently charged therethrough, the other wells, and also said receptive wells, if deemed advisable may be treated in such a manner either with superheated steam or some other liquidizing agent as to fluidize the stiff and heavy clogging hydrocarbons

which may then be removed as above described. In some cases the old wells may be so clogged throughout the territory as to practically prevent charging the territory
5 with gaseous fluid pressure through any of the wells; and in that case a new well may be drilled at some central location and the gaseous fluid pressure applied therethrough.

In Fig. 1 an air or gas compressor is shown at 6 connected through the pipe line 7 with a number of receptive wells 1; and a steam boiler 8 is connected through a pipe line 9 with wells 5 around which the clogging material is to be liquidized.

15 I claim:—

1. A process of removing the clogging constituents of hydrocarbons from a clogged well, which consists in first inducing a relatively high pressure outside of and against
20 the clogged area, subsequently liquefying the clogging constituents at a pressure not exceeding that outside of the clogged area, and pumping the liquefied clogging constituents from the well when they are driven
25 thereto by the outside pressure.

2. A process of removing the clogging constituents of hydrocarbons from a clogged well, which consists in first inducing a relatively high pressure outside of and against
30 the clogged area, subsequently pumping a hot fluid inside the well at a pressure not exceeding that of the pressure outside of the clogged area and continuing the application of the hot fluid until the clogging
35 constituents are liquefied, and pumping the liquefied clogging constituents from the well as fast as they are driven thereto by the outside pressure.

3. A process of removing the clogging constituents of hydrocarbons from a clogged well which consists in first pumping into the oil-producing formation adjacent the well a
40 gaseous fluid until a relatively high pressure is induced against the clogged area, subse-

quently pumping a hot gaseous fluid into 45 the well at a pressure not exceeding that outside the clogged area, and continuing the application of such heated fluid until the clogging constituents are liquefied and driven into the well by the preponderating 50 pressure outside thereof, and pumping such liquefied constituents from the well while in the liquefied state.

4. A process of removing the clogging constituents of hydrocarbons from a clogged 55 well, consisting in forcing a solvent toward and through the clogging material from a point outside the well.

5. A process of removing the clogging constituents of hydrocarbons from a clogged 60 well, consisting in supplying a light hydrocarbon to the rock surrounding the well and applying gaseous pressure thereto to drive the hydrocarbon through the clogging material into the well. 65

6. A process of removing paraffin and the like from a clogged well which consists in supplying the rock near but outside of the well with gasoline, forcing gaseous pressure against the gasoline and driving it 70 through the clogging matter into the well.

7. A process of removing the clogging constituents of hydrocarbons from a clogged well which consists in first introducing a light hydrocarbon liquid into the rock sur- 75 rounding the well, then applying pressure to said hydrocarbon and finally supplying heated fluids to the interior of the well whereby the clogging material will be softened and the hydrocarbon driven there- 80 through into the well.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 11th day of March 1912.

IRWIN L. DUNN.

In presence of—

JAMES R. TOWNSEND,
L. BELLE RICE.