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APPARATUS FOR EXPELLING OIL OR WATER FROM NATURAL GAS WELLS.

APPLICATION FILED JUNE 19, 1912.

1,153,253. Patented Sept. 14, 1915.

Fig. 1

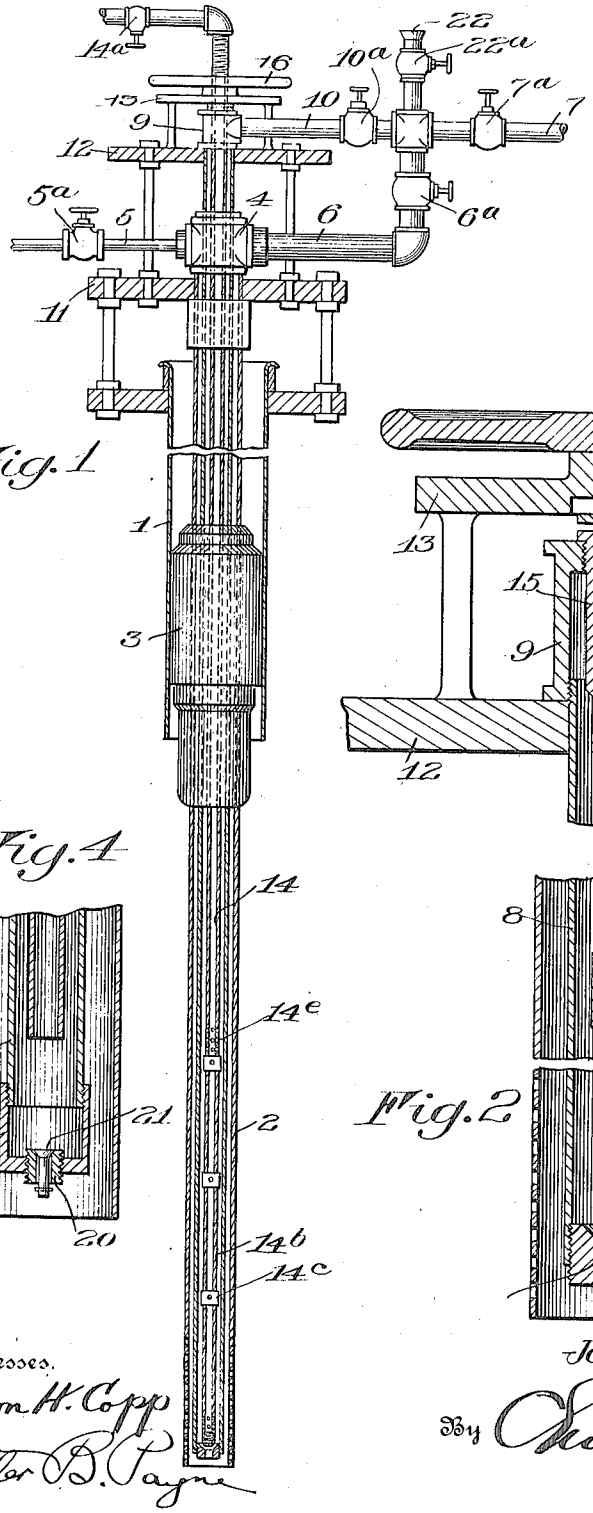


Fig. 3

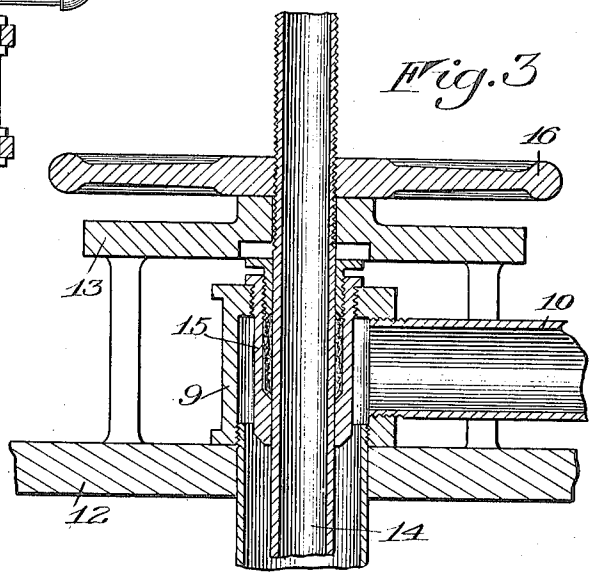
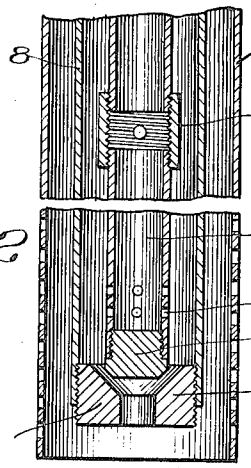


Fig. 4

Fig. 2



Witnesses.

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APPARATUS FOR EXPELLING OIL OR WATER FROM NATURAL-GAS WELLS.

1,153,253. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed June 19, 1912. Serial No. 704,509.

To all whom it may concern:

Be it known that I, JOSEPH S. L. PURDY, of Le Roy, in the county of Genesee and State of New York, have invented certain new and useful Improvements in Apparatus for Expelling Oil or Water from Natural-Gas Wells; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference numerals marked thereon.

My present invention has for its object to provide an improved apparatus adapted particularly to be used in natural gas or oil wells for removing or expelling accumulations of liquid therein.

Generally stated, my invention comprehends placing in the bottom of a deep well a liquid collecting chamber having a valve controlled passage therein through which the liquid may pass and become entrapped and then subjecting the fluid in the chamber to a high pressure of air or gas, to cause the ejection of such liquid.

My invention also has for its further object to provide, in conjunction with the casing and tubing of a deep well, an arrangement of piping whereby the gas collected, under compression, in a gas main may be utilized to drive the liquid in the well into the impounding chamber, in the first instance and then employed to eject said liquid therefrom.

To these and other ends the invention consists in certain improvements and combinations of parts all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings: Figure 1 is a vertical sectional view showing apparatus constructed in accordance with my invention. Fig. 2 is an enlarged detail view showing the lower end of the collecting chamber, and Fig. 3 is an enlarged detail view of part of the casing head showing the means employed for operating the impounding valve. Fig. 4 is an enlarged detail view of a modified form of valve.

Similar reference numerals in the several figures indicate the same parts.

In illustrating my invention, I have shown a single well casing 1 which, it will be understood, extends from the surface of the ground to a point in the well below the lowest water vein. This casing may be the inner one of several, depending upon the nature and character and structure of the rock formations penetrated by the well, but other strings of casing have been omitted as has also the drive pipe. Within the casing 1 is the gas tube 2 which extends nearly to the bottom of the well and is preferably provided with perforations in its lower end. This gas tube extends upwardly from the mouth of the well and at a suitable point therein the space between it and the casing 1 is closed, by any suitable form of packer indicated by 3, to prevent leakage of the gas. The upper end of the gas tube is fitted with a cross 4 from one side of which extends the well line pipe 5 provided with the valve 5^a; and leading from the opposite side of the fitting 4 is the pipe 6 provided with the valve 6^a and connected to the compression line pipe 7. The latter is provided with a valve 7^a and leads from a larger distributing main, in which the gas flows under high pressure, or said pipe may lead directly from some suitable form of compression apparatus, as will be understood.

Suspended within the gas tube 2 is the liquid collecting, or impounding chamber 8, composed of a tube, somewhat smaller in diameter than the gas tube, which extends downwardly within the latter nearly to its lower end.

At its upper end the chamber 8 is closed by a T fitting 9 which is connected by the pipe 10 and the valve 10^a with the compression line 7.

The gas tube and compression chamber are secured in position above the casing head by any suitable form of supports and in the present instance I have shown the usual clamps comprising the plates 11 and 12 on which the fittings 4 and 9 respectively rest and on the upper clamping plate I have shown another support or bearing rest 13, the purpose of which will be further described hereinafter.

The ejector pipe or siphon 14 leads from the bottom of the collecting or impounding chamber and out of its upper end to any suitable point of discharge; said pipe being provided with a shut off valve 14^a. The upper end of this pipe where it projects through the T fitting 9, is made smooth so as to move freely through the gland or

stuffing box 15 provided in said fitting. The upper end of the pipe is threaded and carries the hand wheel 16 which bears against the support 13 and is employed to raise and lower the pipe 14. The lower end of the ejector is preferably composed of a plurality of short sections 14^b which are united by couplings 14^c. These couplings are provided with one or more perforations as shown and the lower end of the pipe is also provided with a plurality of perforations 14^d and at some more elevated point, as indicated by 14^e. These perforations are for the purpose of admitting gas into the liquid column while the latter is being lifted for the purpose of gasifying or aerating it.

Provision is made for retaining the liquid in the chamber 8 after it has flowed into said chamber, either naturally or has been forced therein by pressure of the gas in the well. The entrapping or impounding of the liquid may be accomplished either by an automatically operating check valve, as shown in Fig. 4, or by a manually operating valve which may be opened or closed, parts of which may be arranged as shown in Figs. 2 and 3, which I deem the preferable construction, as the movement of the valve head relatively to its seat will have a tendency to prevent the incrustation of these parts and by a slight rotary movement of the fluid discharge pipe 14, deposits of various substances may be removed. In carrying out this idea it is preferred to form the valve seat in the form of a tubular plug 17, in the bottom of the chamber 8, provided at its inner side with a conical seat with which engages the valve head 18, which also comprises a plug secured in the end of the discharge pipe 14 which latter may be elevated or lowered to open or close the valve by a rotation of the hand wheel 16. When an automatic valve is to be employed the parts thereof should be arranged somewhat as shown in Fig. 4. Here the impounding chamber indicated by 8^a is closed at its lower end by a cap 19, in the bottom of which is arranged the inwardly opening check valve comprising the plug seat 20, and the stem 21.

In operation the ejection of liquid from the bottom of the well may embrace two steps; first: introducing the gas or fluid pressure into the well cavity to drive the liquid into the impounding chamber; second: directing the gas pressure into the chamber to expel the liquid therefrom. When an automatic valve is employed in the bottom of the impounding chamber, these steps may be carried out successively, but where the manually operating valve is used, it will be necessary, after the first step has been performed, to close the valve. It will be preferable to allow the valve to normally stand in an open position; that is, with the head 18 retracted away from its seat, as shown in Fig. 2, so that the liquid accumulating in the bottom of the well may seek its natural level in both the casing 2 and chamber 8. At this time the valves 6^a, 10^a and 14^a are of course closed. The valve 5^a may or may not be closed depending as to whether or not the gas is being drawn off the well. In performing the first step in the operation of ejecting liquid from the well, valve 5^a is closed to shut in the gas in the tube 2 and the release pressure valve 14^a is opened to vent the impounding chamber 8. The valve 10^a being closed, valves 6^a and 7^a can now be opened and connect the compression line 7 through the by-pass 6 with the gas tube 2. The pressure thus introduced into the well will cause the liquid accumulated therein to be forced upwardly in the collecting or impounding chamber through the valve at its lower end until the column of liquid reaches a forced level, then the hand wheel 16 is rotated to close the valve head 18 against its seat 17, when the valve 6^a is closed. To expel the liquid from the chamber 8, the valve 10^a is opened whereupon the gas under pressure forces the liquid in the tubing 8 upwardly, ejecting it through the discharge pipe 14. As the level of the liquid in the chamber 8 descends, it successively uncovers the apertures 14^e and the perforation in the couplings 14^c, permitting a small quantity of the gas at each of these points to escape into the outlet pipe for the purpose of breaking up and lightening the liquid column, so that only comparatively small gas pressure is required to eject the liquid.

The chemical action and the deposit of mineral substances in solution in the liquids in a well may sometimes be utilized or arrested by suitable solvents and in order to facilitate the introduction of these into the well I provide at the point between the valves 7^a and 10^a an inlet 22 having a valve 22^a through which these solvents, either in a liquid or powdered state, may be introduced. The location of this inlet at the point suggested is desirable as the operator may at will introduce the solvents either in the tube or the chamber 8, according to which of the valves 6^a or 10^a is opened.

It is well understood that as a result of long use or overuse, the rock pressure of the gas in a field of wells gradually grows less and in time they will require the employment of some means for occasionally removing accumulations of petroleum, salt water or other mineral water, long before the actual usefulness of the well has expired. The use of sucker rods or pumping lines and their working barrels is primarily objectionable on account of their slowness in operation but a greater objection to their use exists on account of the corrosion of such fittings by the chemical action of the brine

solutions in the well, which frequently renders them inoperative. At such times the well must be opened and the pump casing removed. In the event the latter becomes broken on account of the effects of corrosion, a large volume of gas is necessarily lost and great expense suffered until the lost parts are fished out of the well. These difficulties are overcome by the use of apparatus embodying my invention by reason of the fact that solvents may be introduced through the by-pass as occasion requires, to counteract the corrosive effect of the brine, thus obviating the loss of gas or the expense of periodically pulling the tubing. A further advantage to be noted in connection with the use of the liquid collecting chamber is that a comparatively low gas pressure may be used to eject the liquid and further, the liquid may be collected in the chamber without introducing into the well cavity an extremely high pressure with the possible injurious effect of driving back into the productive sand such gas or liquid as would naturally tend to flow therefrom.

In the operation of a field, or a plurality of gas wells equipped with apparatus embodying my invention, a single compression apparatus may be used, should this be necessary in addition to the pressure in the supply main, the fluid pressure reservoir of which would be connected with each of the several wells and where these are in proximity to each other, the necessary valves may all be located at one convenient point.

I claim as my invention:

1. The combination with a well casing, a liquid impounding chamber therein, an ejection tube arranged with its lower end projecting into said chamber, a valve seat arranged on one of said parts and a coöperating valve head on the other part, of means for effecting relative longitudinal movement between the chamber and tube to move said valve seat and head toward and from each other, a source of fluid pressure supply and valve controlled passages connecting it with the well chamber and the impounding chamber.

2. The combination with a well casing, a fluid impounding chamber therein, an ejection tube within the latter having its outer end projecting therefrom and means for moving said tube longitudinally of the chamber, of two coöperating valve members on the chamber and tube for controlling the admission of fluid into said chamber, a source of fluid pressure supply and means for admitting it alternately into the well and chamber to drive liquid from the well into the chamber and to expel it therefrom through said tube.

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