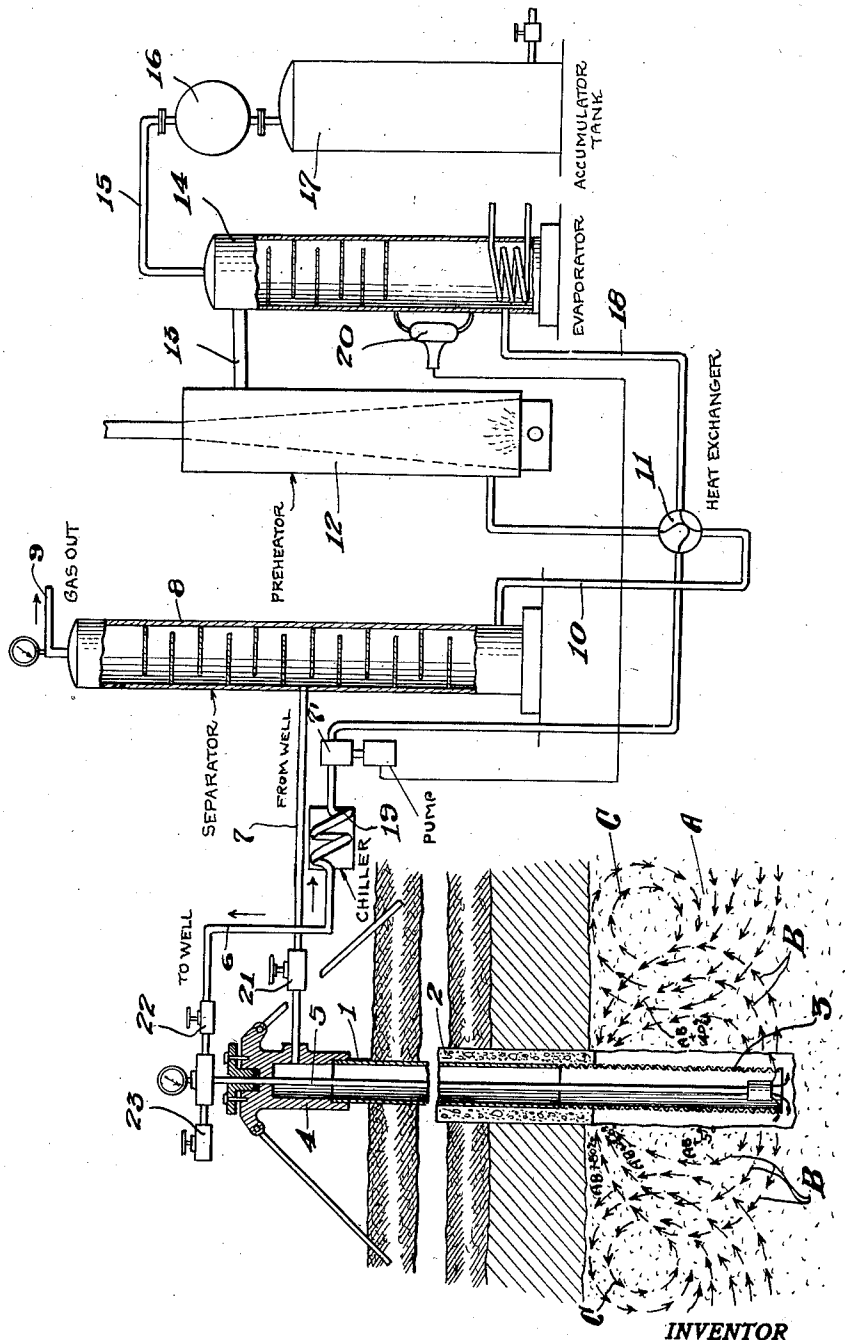
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METHOD OF RECOVERING EARTH COMPONENTS FROM WELLS

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METHOD OF RECOVERING EARTH COMPONENTS FROM WELLS

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This invention relates to a method for the recovering or extraction of earth components from wells and an object of the present invention is the provision of such a method the primary purpose of which is the economical operation of gas and oil wells so that only such fractions or components for which there is an immediate profitable market demand or a necessary use will be produced, leaving in the producing zone such fractions or components for which there is no immediate practical or profitable use, but which may become useful in future years through development of uses or facilities for use of such components.

More specifically, the present invention comprises the broad idea of circulating an absorption liquid, having an affinity for certain fractions or earth components, through a well, and the producing area, and withdrawing the fused absorption liquid and earth components, separating them and returning the absorption liquid to the well for recirculation, thereby permitting the withdrawal from the well and producing area of only such earth components as are desired, and leaving in the earth for future use, such other components as are not of immediate use. The broad idea of the present invention is similar to that of my co-pending application, Serial #53,141.

At the present time in practically all petroleum producing locations, there is a demand for fractions or earth components having a boiling point of 100° Fahrenheit or higher, such as pentanes, hexanes, or heavier hydrocarbons, whereas the lighter components such as butanes, propanes, and ethanes can not be economically produced at present. Likewise, there is a limited use for methane and other fuel gases, such use being controlled by the provision of piping or gas line connections to a place of domestic or industrial consumption or by the relatively small consumption of such gases on the producing grounds for the operation of engines, boilers and for use of individuals living on the lease, so that ordinarily such gases can not or are not produced without wastage.

With the employment of the method of the present invention, on wells with a bottom hole pressure in excess of 600 pounds, it is possible to produce or extract from the well only the fractions necessary in the manufacture of gasoline, kerosene, gas oil and fuel oil, leaving the butanes, propanes and ethanes in the producing area, and only bring to the surface such methanes or other fuel gases as are dissolved in the combined absorption liquids and the fractions or earth components withdrawn from the well, parts of which fuel gases are returned to the well without the use of compressors or analogous mechanisms.

A further object of the present invention is the provision of a method of extracting selected earth components from a well which will make the operation of high pressure wells simple and safe by balancing off most of the pressure in the casing and tubing of the well; a method which will permit of a very large production being handled through a relatively small distillation unit, and will render unnecessary much of the usual equipment in the present day approved type of gasoline plant.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts for carrying out the improved method of extracting or recovering selected earth components from a well, which will be first described in connection with the accompanying drawing showing a diagrammatic illustration of a well and the apparatus on the surface employed in carrying out the improved method and the features forming the invention will be specifically pointed out in the claims.

Referring more particularly to the drawing, a well of approved type is shown in which the casing 1 is sunk into the ground and may be packed or sealed in the usual approved method as shown at 2. The casing 1 has a screen 3 on its lower end and it has the usual approved type of head 4 on its upper end. A pipe 5 extends downwardly through the casing 1 and through the screen 3 and opens out near the bottom of the screen. This pipe 5 is connected by suitable piping 6 with a pump 7' of any approved construction, which pump pumps an absorption liquid downwardly through the pipe 5 and out of its lower end into the producing area indicated at A in the drawing.

The absorption liquid may be any approved type of absorption liquids or absorption oils which are now on the market, such as a natural gas oil of from approximately 7 pound to 7.7 pound weight per gallon, which oil has an affinity for various earth components. For instance, if it is desired to extract from the producing area A, the earth components for use in making gasoline such as those ranging from pentane to octane, the absorption oil will be a natural gas oil as above specified which is forced into the well at

the proper pressure and temperature to cause it to pick up or absorb the pentanes, hexanes or heavier hydro-carbons.

The absorption oil passes out of the pipe 5 through the bottom thereof into the producing sand or area at substantially a weight of 7 pounds per gallon, and travels in a series of paths as indicated by the arrows B, passing upwardly through producing sands or area and picking up the desired earth components, as it moves upwardly through the producing sands. The absorption oil at the weight of substantially 7 pounds is much heavier than the components which it picks up, and it enters the producing area at a predetermined temperature which is controlled in the manner hereinafter specified. As the absorption oil under the predetermined pressure and temperature picks up the various earth components, its weight decreases and its temperature increases until at the point where it enters the casing 1 of the well its weight will be substantially 2.2 pounds per gallon in a well with approximately 3000 pounds bottom hole pressure, as has been proven by actual tests of the weight of the fused absorption oil and earth components taken from the top of the well, and also checked by weight of the fluid columns, which is the difference between the bottom hole and surface pressure using a correction for temperature. The absorption oil passing in the paths of the arrows B decreasing in weight by volume and increasing in temperature as it passes upwardly through the producing area, will fractionate off the lighter components and continue to absorb the heavier fractions, equilibrium of vapor pressure being maintained at all times. In this way the very light weight components such as butane and propane are expelled, but a small amount of methane by weight remains in the mixture. The absorption oil as it enters the sand or producing area picks up both light and heavy components, but as it has the greater affinity for the heavier fractions as it continues to contact the mixture in the sand it picks up more of the heavier fractions and throws off the lighter earth components, which will set up, in effect, eddies or recycles of these lighter earth components such as indicated by arrows C, leaving these light earth components in the producing area. This action is also helped by the fact that the heat of absorption continues to raise the temperature of the mixture. The longer the path of the absorption oil through the producing area, the greater the percentage of earth components picked up will be, as for instance the absorption oil passing through the shortest paths will be AB plus 5 per cent, while through the second path it will be substantially AB plus 40 per cent and through the longest path substantially AB plus 80 per cent.

The absorption oil and the earth components picked up thereby are taken from the casing 1 through suitable piping 7 into a separator 8 of approved construction in which any of the lighter gases, such as ethane and methane, will be separated from the absorption oil and the desired earth components. The separated gaseous hydro-carbons will pass out of the separator 8 through a suitable outlet 9 from which they may be taken to any source of use or they may be returned to the well if desired.

The absorption oil and the heavier components, such as pentane, hexane, etc., are taken from the separator 8 through suitable piping 10, pass through a heat exchanger 11 into a pre-heater 12. In the pre-heater the combined absorption liquid and earth components are heated to the desired or necessary temperature, and they are taken from the pre-heater 12 through piping 13 into an evaporator 14 of any approved construction. In the evaporator 14 the absorption oil, being the heavier component, is separated from the extracted earth components and these latter are taken off through the pipe 15 and delivered to a condenser 16 where they are condensed, finally passing through the accumulator tank 17. From the accumulator tank 17 the net production from the well is measured and may then be delivered to a re-run still.

The denuded absorption liquid is taken from the bottom or lower part of the evaporator 14 and through a piping 18 to and through the heat exchanger 11. The heat exchanger 11 is of the usual approved type of heat exchanger which may be purchased upon the open market, and the absorption oil passing therethrough from the evaporator, gives up some of its heat to the combined absorption oil and earth components which are passing therethrough from the separator 8 to the preheater 12, thereby resulting in a savings of heat and reducing the quantity of fuel necessary in the pre-heater to bring the combined absorption oil and earth components to the proper temperature, and it also serves for reducing the temperature of the absorption oil and consequently reducing the size of the chiller or cooling apparatus 19. The pump 7' which is of any approved type receives the absorption oil from the heat exchanger and this pump is selected so as to put the proper pressure on the absorption oil which is delivered to the well through the pipe 5, while the temperature of such absorption oil is regulated or controlled to the desired points by means of the chiller 19 which is shown interposed in the pipe connection 6 between the pump 7' and the well pipe 5. If it is so desired or found practical, the chiller 19 may be eliminated. A float mechanism of any approved type is shown at 20 and it is operated by the level of the absorption liquid in the evaporator 14. The float control mechanism 20 of any conventional type is connected in any suitable approved manner for controlling the operation of the pump 7'. If the quantity of absorption liquid is reduced beyond a practical point, a make up supply of the absorption liquid may be added to the line at any desired point, preferably in the evaporator 14.

While in the foregoing description an absorption oil and the carrying out of the method has been described for use in extracting the earth components desirable for making gasoline, it is to be understood that the present invention is broader than this mere or single use and that by regulating the temperature and pressure of the absorption oil, the earth components extracted from the producing area may be controlled. It is a well-known fact that absorption oil under certain temperatures and pressures has an affinity for certain of the earth components, and under other temperatures and pressures has affinities for other earth components, so that by varying the temperatures of the absorption oil, by utilizing absorption oils having definite weights per gallon within certain predetermined high and low limits, and by varying the amount of absorption oil circulated through the producing area, any desired earth components may be extracted or recovered from the producing area A, while the

other earth components are left in the producing area for future use.

Also the present invention is practical for the extraction of helium from wells, since it has been proven by experiment that a gas oil absorption oil of predetermined temperature and pressure will have an affinity for helium, and will absorb the helium which may be extracted from the absorption oil in the manner heretofore described.

The fact that the absorption oil is heavier than the fused absorption oil and earth components which it absorbs, causes, together with the pressure at the bottom of the well, this mixture or fusion of absorption oil and earth components, to rise through the producing area as indicated by the arrows B in the drawing and also rise to the top of the well.

The present method embraces the forcing into the well and out from the bottom of the well into the producing area a quantity of absorption oil sufficient to fill the producing area adjacent to the well and block off the direct passage of gases to the well, thereby eliminating the passage of gases through the well except only such minute quantities as are absorbed by the absorption liquid.

If it is so desired, suitable hand controlled valves as indicated at **21**, **22** and **23** may be provided for controlling the flow of the liquids through the pipes **6** and **7** respectively.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In the art of oil wells, the method of recovering selected gaseous or liquid earth components which includes, circulating an absorption liquid having a specific gravity greater than the specific gravity of the components to be recovered in and out of a well and through the producing strata and removing from the producing strata the ascertained components having an affinity for and absorbed by said absorption liquid, and leaving other components in the producing area.

2. In the art of oil wells, the method of recovering selected gaseous or liquid earth components which includes, circulating an absorption liquid having a specific gravity greater than the specific gravity of the components to be recovered in and out of a well and through the producing strata and removing from the producing strata the ascertained components having an affinity for and absorbed by said absorption liquid, leaving other components in the producing area, then separating the ascertained components from the absorption liquid, and recirculating the absorption liquid through the well and producing strata.

3. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid having a specific gravity greater than the specific gravity of the selected components to be recovered, through the bottom of a well and up through the producing strata into the well at a point above the bottom of the well, removing from the well the absorbing liquid and the absorbed earth components, and separating the absorption liquid and the absorbed earth components.

4. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid having a specific gravity greater than the specific gravity of the selected components to be recovered, through the bottom of a well and up through the producing strata into the well at a point above the bottom of the well, removing from the well the absorbing liquid and the absorbed earth components, separating the absorption liquid and earth components, and recirculating the absorption liquid through the well and producing strata.

5. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid which has an affinity only for the selected components through a well and out at the bottom of the well and up through the producing strata into the well at a point above the bottom of the well removing the absorption liquid and the absorbed earth components from the well and separating the absorption liquid and absorbed earth components.

6. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid through a well and out at the bottom of the well and up through the producing strata into the well at a point above the bottom of the well, then separating the selected earth components which were absorbed from the absorption liquid, and recirculating the absorption liquid through the well and producing strata.

7. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid having a specific gravity greater than the specific gravity of the selected components to be recovered, through the bottom of a well and up through the producing strata into the well at a point above the bottom of the well, removing from the well the absorbing liquid and the absorbed components, separating the absorption liquid and earth components, cooling the absorption liquid and recirculating the cooled absorption liquid through the well and producing strata.

8. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes, forcing an absorption liquid having a specific gravity greater than the specific gravity of the components to be recovered and having an affinity for the components to be recovered, downwardly through the well and out into the producing area in a quantity sufficient to fill the producing area adjacent to the well and block off the direct passage of gases to the well, withdrawing the absorption liquid and absorbed earth components from the producing strata through the well, separating the absorption liquid and the absorbed components and returning the absorption liquid through the producing strata and well.

9. In the art of oil wells, the method of recovering selected gaseous or liquid earth components which includes, circulating an absorption liquid having a specific gravity greater than the specific gravity of the components to be recovered in and out of a well and through the producing strata and removing from the producing strata the ascertained components having an affinity for and absorbed by said absorption liquid, separating the absorption liquid and the absorbed components by evaporation and recirculating the denuded absorption liquid through the well and producing strata.

10. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid

having a molecular weight greater than the molecular weight of the selected components to be recovered through a well and out of the bottom of the well and up through the producing strata into the well at a point above the bottom of the well, denuding the absorption liquid of the absorbed components, increasing the pressure on the denuded absorption liquid, cooling the denuded absorption liquid and recirculating the cooled absorption liquid through the well and producing strata.

11. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid having a molecular weight greater than the molecular weight of the selected components to be recovered downwardly through a well and up through the producing strata into the well at a point above the outlet of the absorption liquid into the producing strata, separating the absorption liquid and the absorbed earth components, increasing the pressure on the separated absorption liquid, and recirculating the absorption liquid through the well and producing strata.

12. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid having a weight by volume of substantially three times the weight of the earth components to be extracted through a well and the producing strata, removing from the well the absorption liquid and the selected absorbed earth components, separating the absorption liquid and earth components, and recirculating the absorption liquid through the well and producing strata.

13. In the art of wells, the method of recovering selected gaseous or liquid earth components which includes circulating an absorption liquid having a molecular weight greater than the molecular weight of the selected components to be recovered through a well and the producing strata, varying the temperature and the rate of circulation of the circulated absorption liquid to control the earth components absorbed, removing from the well the absorption liquid and the absorbed earth components, separating the absorption liquid and the earth components, and recirculating the absorption liquid through the well and producing strata.

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