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PROCESS FOR EXTRACTING OILS AND HYDROCARBON MATERIAL FROM SHALE AND SIMILAR BITUMINOUS ROCKS.

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1,342,741. Patented June 8, 1920.

Fig. 1.

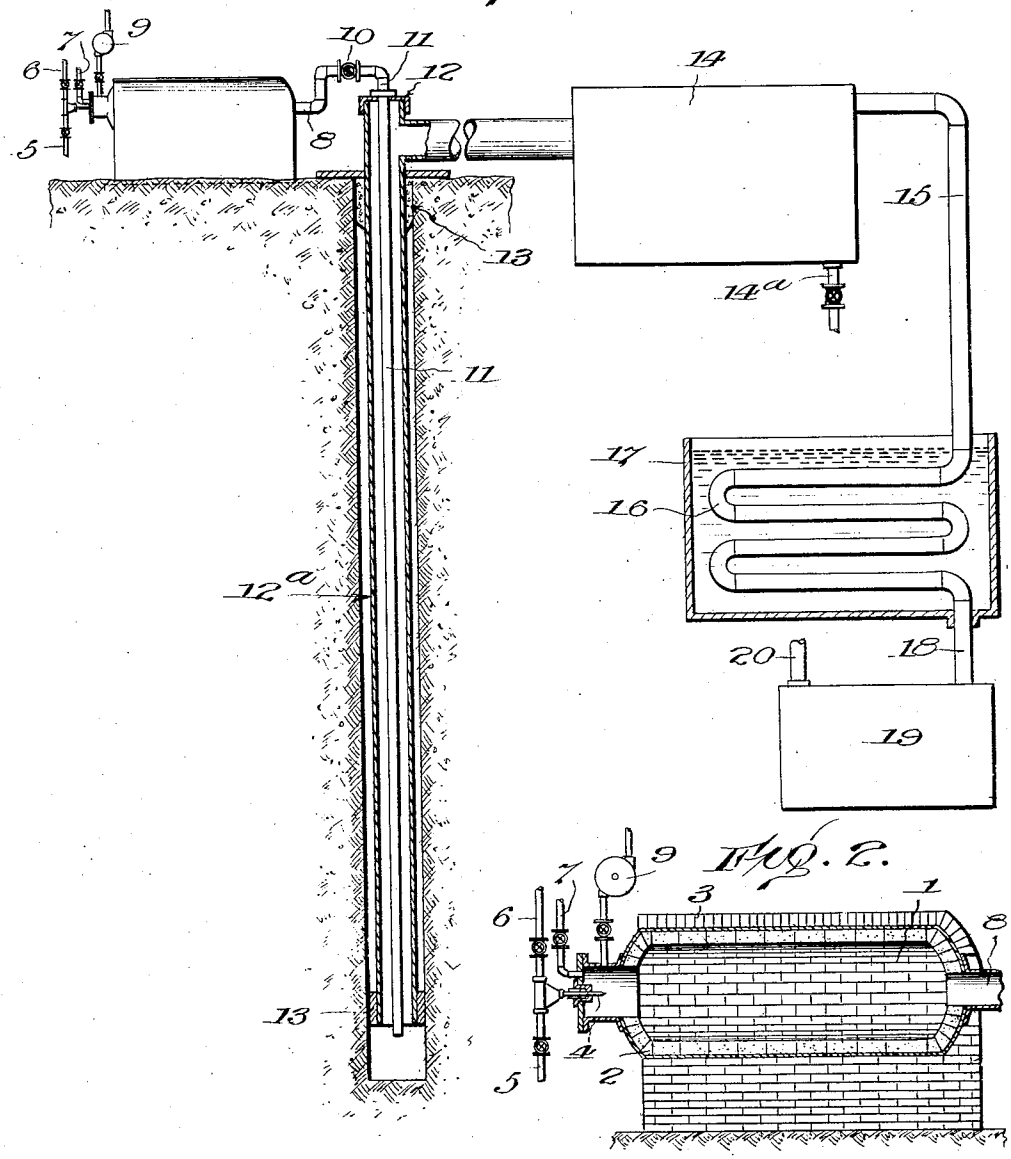

Fig. 2.

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PROCESS FOR EXTRACTING OILS AND HYDROCARBON MATERIAL FROM SHALE AND SIMILAR BITUMINOUS ROCKS.

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To all whom it may concern:

Be it known that I, DAVID T. DAY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented new and useful Improvements in Processes for Extracting Oils and Hydrocarbon Material from Shale and Similar Bituminous Rocks, of which the following is a specification.

This invention relates to a process for extracting oils and similar material from shale and bituminous material which is in its natural condition in the ground. The process has to do with the distillation of the volatile contents of the shale, bituminous sandstone, or bituminous lime stone.

Heretofore, it has been customary to mine the shale and treat it in retorts by various processes. In some cases it has been suggested to introduce hot solvent or steam into holes bored in the ground to drive out or extract the oil material.

The present invention provides for the extraction of the oil material by the introduction of hot gases of combustion, or other hot gases substantially devoid of oxygen, into holes drilled in the shale to effect the vaporization of the volatile matter in the shale and carry the same to the surface of the ground where suitable condensing apparatus or separators collect the oil material. The process is essentially one for heat treating oil shale while in its native state to vaporize all of the oil from the shale while in the ground, and the condensation of such oil after being recovered above the ground.

The invention provides for the generation of the hot gases in suitable apparatus located above the surface of the ground, and provides for the application of the hot gases to the shale under pressure greater than atmospheric pressure and at high temperatures. By the use of hot gases of combustion, the process may be operated at the highest efficiency. The gases carry and absorb a very large amount of the oil and there is less condensation than if steam is used.

In conducting the process, apparatus may be used designed according to the form represented diagrammatically in the accompanying drawing, in which—

Figure 1 represents a section of a driven well in the shalelike material together with the apparatus for conducting the process;

Fig. 2 represents an enlarged sectional view of the combustion chamber used for generating the hot gases of combustion.

Referring in detail to the drawing, 1 represents a combustion chamber of suitable metal which preferably is tested for pressure of at least six hundred pounds and is lined on the inside with fire brick 2. An outer covering may be provided by ordinary red brick 3 according to the condition and mounting desired for the combustion chamber. 4 represents a mechanical spray for injecting oil or oil and steam which may be admitted from the pipes 5 and 6 respectively. An additional pipe 7 is provided for admitting air to the combustion chamber at a point relatively near the spray 4 so that the combustion may be facilitated. A discharge passage leading from the combustion chamber is indicated at 8. A predetermined pressure may be brought about by a pump 9 which is connected to the combustion chamber at the injector end. The outlet passage or pipe 8 is provided with a control valve 10 adapted to regulate the flow or volume of the gases being delivered to the bottom of an opening in the ground. Referring to Fig. 1, an opening or driven well is shown extending downwardly into the ground and the lower end thereof is presumed to be located in a bed of shale or other unmined material containing the desired hydrocarbon oils which are to be extracted. The outlet pipe 8 is continued by the downwardly extending pipe 11 which extends to a point immediately adjacent the lower end of the boring. The pipe 11 is supported at a point above the ground by cap 12 covering the upper end of the shaft casing 12^a which also projects for a suitable distance down into the ground and is designed to prevent the soil from falling into and closing the lower end of the driven well. At the top and if desired also at the bottom there may be an annular plug of concrete or some other solid material as indicated at 13 and designed to prevent the escape of gases from the boring. Hot gases are discharged through the pipe 8 and sent downwardly through the pipe 11 to the lower end of the boring. At this point the hot gases act on the oliferous matter contained in the shale or bituminous sand stone or similar material surrounding the lower end

of the pipe 11. The material is heated and the oily matters and any water present will be driven out as vapor or as gas through the casing 12ª. If there be lateral cracks or porous strata in the shale or surrounding earthy material it may be that separate borings located at a distance from the pipe 11 could be provided to conduct to the surface the vapors or gases which have been generated and which are so provided under pressure in the porous strata or fissures. The treatment at the bottom of the boring brings about a vaporization which is conducted under pressure greater than atmospheric pressure and at very considerable temperature. The vaporized material and the gases of combustion pass upwardly through the casing 12ª and are directed into a trap 14 in which the heavier materials condense and may be drawn off through an outlet pipe 14ª. The lighter materials pass outwardly through a pipe 15 and are conducted into a condenser having coils 16 located within the condenser box 17. Liquid condensed in the coils together with the remaining gases pass through the pipe 18 into a final trap 19 where the liquid is confined and the gases may be led off through the pipe 20 to any suitable gas tank, not shown.

From the foregoing it will be seen that this invention provides a relatively inexpensive method of generating heat on the surface of the ground and applying this heat in an incombustible form to the deposit of oil bearing material located within the earth to vaporize the desired material and transport a maximum amount of the volatile products to the surface without mining the material. It is known that processes have been provided for providing combustion at the bottom of oil wells to throw out the oil material, paraffin and similar material and it is also known that various devices have been provided for operation at the bottom of the wells in order to generate heat at that point. This invention is an improvement over all such previous inventions in that the heat is generated above the ground and the hot gases are used for the production of valuable vapors, ammonia, and other material without mining the material and without the unsatisfactory results to be found when solvents are used introducing foreign material as is necessary when liquid solvents or steam is used. This process is particularly useful for the extraction of hydrocarbon materials when the residue does not constitute a valuable waste product such as is the case when certain shales are used which do not contain any appreciable amount of other useful material.

What I claim is:—

1. The process of extracting hydrocarbon material from earthy material while in its natural state, in the ground, which comprises the production of hot gases of combustion substantially devoid of oxygen, the introduction of said hot gases of combustion into an opening extending into the earth and into contact with said earthy material containing the desired hydrocarbon material, heating and vaporizing the hydrocarbon material by contact with said hot gases of combustion, the conduction of the combined vaporized products and hot gases of combustion in their aeriform state from said opening in the earth, and the separation of the combined materials so extracted.

2. The process of extracting hydrocarbon material from earthy material while in its natural state, in the ground, which comprises the production of hot gases of combustion, the introduction of said hot gases of combustion into an opening extending into the earth and into contact with said hydrocarbon material, vaporizing the hydrocarbon material by contact with said hot gases of combustion under a pressure greater than atmospheric pressure, the conduction of the combined vaporized products and hot gases of combustion while in their aeriform state from the earth, and the separation of the combined materials so extracted.

3. The process of extracting hydrocarbon material from earthy material while in its natural state, in the ground, which comprises the production of hot gases of combustion, the release of a current of said hot gases of combustion within the earth and into contact with the hydrocarbon material to be extracted, vaporizing at least a portion of said hydrocarbon material by contact with said hot gases of combustion, the removal of the hot gases of combustion and the extracted hydrocarbon material taken up thereby while in the aeriform state, and the recovery of the extracted material.

4. The process of extracting hydrocarbon material from earthy material while in its natural state, in the ground, which comprises the production of hot gases of combustion, the introduction of a current of said hot gases of combustion into an opening extending into the earth and into contact with said hydrocarbon material, vaporizing at least a portion of said hydrocarbon material by contact with said current of said hot gases of combustion under a pressure greater than atmospheric pressure, the removal of said hot gases and the hydrocarbon material taken up thereby while in the aeriform state, and the separation of said material so removed.

5. The process of extracting hydrocarbon material from shale and similar material while in its natural state in the ground, which comprises producing hot gases of combustion substantially devoid of oxygen at a point removed from the shale, releasing

said hot gases under pressure greater than atmospheric pressure into contact with the shale containing the desired hydrocarbon material, thereby vaporizing the hydrocarbon material from said shale by said hot gases of combustion, removing the resultant hot gases with the extracted hydrocarbon material taken up thereby while in the aeriform state, and recovering the extracted material.

In testimony whereof I have hereunto set my hand.

DAVID T. DAY.