

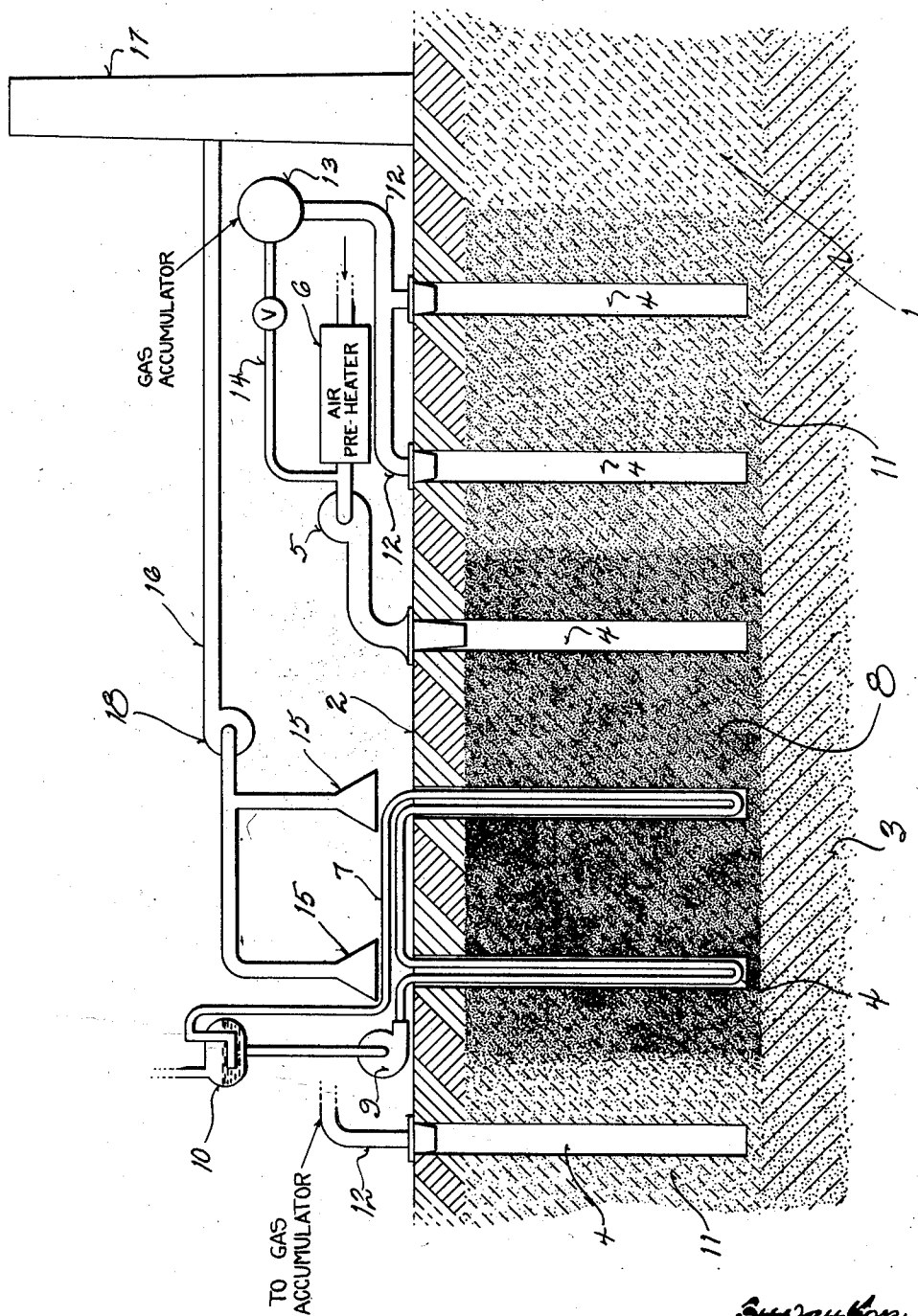
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UNDERGROUND EXPLOITATION OF FUEL DEPOSITS

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UNDERGROUND EXPLOITATION OF
FUEL DEPOSITS

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8 Claims. (Cl. 262-1)

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This invention relates to a method of burning and degassing subterranean fuel deposits, and more particularly to a method of burning such fuel deposits without mining them, in order to obtain the products of distillation thereof and to release and utilize their heat energy.

Underground deposits of such fuel minerals as shale and brown coal, having a high percentage of distillate products, are found in several locations in the United States, and are widely distributed in other parts of the world.

Heretofore it has been necessary, in order to obtain the volatile products of such deposits, to unearth them and subject them to dry distillation in large, specially constructed retorts.

Although this method is efficient in that it recovers a high percentage of the distillates present in the minerals, it nevertheless requires that the fuel be mined and specially handled.

It is, therefore, an object of this invention to provide a method of recovering the distillate products of subterranean fuel deposits without the necessity of unearthing such deposits or constructing special apparatus for their distillation.

A further object of this invention resides in the provision of a method of releasing and utilizing the heat energy of underground fuel deposits without mining them.

In this connection it is another object of this invention to provide a steam generating unit adapted to be removably inserted into selected portions of a bed of burning subterranean fuel deposits and to be moved from place to place as combustion proceeds so as to utilize the heat energy of the fuel to the best advantage for the generation of steam.

Still another object of this invention resides in the cheap and convenient method which it provides for releasing the heat energy and distillate products of underground fuel deposits.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel method as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

The single figure represents a sectional view

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through an underground fuel deposit and illustrates one adaptation of this invention.

Referring now more particularly to the accompanying drawing, the numeral 1 designates generally an underground deposit of lignitic fuel lying between a noncombustible layer 2 of soil and rock which extends to the earth's surface and a layer of bed rock 3 underlying the fuel bed.

The first step in the application of the method of this invention is to drill a series of spaced apart holes 4 into the fuel deposit. Ordinarily these holes would be drilled from the surface of the earth though they might be drilled from the side of a mine shaft. Through at least one of these holes the underground fuel layer is ignited in any desired manner, as for example electrically. Air is pumped through another one or more of the holes, by means of a pump 5, in order to sustain combustion at the point at which the fuel bed has been ignited. Since lignitic fuel deposits are characteristically porous, air under pressure will penetrate through the interstices of the fuel material in quantities sufficient to maintain satisfactory combustion.

Preferably, though not necessarily, the air pumped into the fuel deposit is preheated in a suitable preheater 6. The preheating of the air facilitates the ignition and combustion of the fuel.

Tubes or other suitable ducts 7 are inserted into the holes in the combustion area 8, and a heat absorbing medium such as water or a water-steam emulsion is continuously forced through them by means of a pump 9. By regulating the flow of the heat absorbing medium, the temperature of combustion of the fuel bed in the combustion area 8 may be regulated so as to keep it below the sintering temperature of the fuel.

The heat energy of the medium so heated may be collected at some central point 10 as for instance a common steam dome. This enables the heat energy absorbed from the burning fuel bed 8 to be put to useful purposes in any known manner.

The tubes or ducts 7 are, of course, removable from the holes into which they are inserted to enable the same to be moved from place to place as required to most effectively utilize the heat of the burning fuel, and similarly the collecting unit 10 should be movable.

In the zone 11 surrounding the combustion area or adjacent thereto, distillation of the fuel material occurs as a result of the heating of the material in that zone by combustion of the fuel which is already burning. The distillates so re-

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leased are recovered by means of pipes 12 connected to the mouths of holes in the zone of distillation, which lead to a suitable accumulator 13 in which the distillates may be stored to be available for refinement or other desired use.

As the combustion process continues, the initially ignited area 8 burns through, and the combustion process spreads to the residual coke 11 left in the wake of distillation.

Dry distillation now occurs in a new zone surrounding or adjacent to the zone 11 of original distillation, as a result of the combustion of the residual coke, and the distillate products in the new zone of distillation are recovered in the manner described. Thus the combustion and distillation processes will spread outward, from the point of initial ignition as a center, with distillation occurring in the zone of unburned fuel in the neighborhood of the combustion area. As distillation is completed, combustion occurs in the residual coke.

To sustain combustion and maintain the distillation process, it is only necessary that compressed air be continuously forced into the neighborhood of the combustion area. If desired some of the distillation gas may be bled off from the accumulator 13 by a valved duct 14 which leads to the inlet of the pump 5. In this manner a readily combustible gaseous fuel mixture will be pumped into the fuel bed.

As the process advances through the fuel bed it is necessary from time to time to move the air supply 6 and the tubes 7 through which the heat absorbing medium flows, together with the pipes 12 and other means for collecting the distillate products.

The smoke and other waste products of combustion rising from the holes 4 which lead to the combustion zone are collected in hoods 15 appropriately placed over these holes, and ducts 16 carry these waste gases to a stack or chimney 17. Preferably an exhaust fan 18 is provided to more positively effect the withdrawal of the smoke and waste gases. Like all the other apparatus, the hoods 15 are movable and the ducts 16 are adjustable to enable necessary shifting of the hoods with little or no need for moving the stack or chimney.

Since sintering of the underground fuel deposit would seriously interfere with its proper combustion, it is necessary that the temperature of combustion be kept below that at which sintering occurs in the particular fuel. This is accomplished by regulating the flow of the heat absorbing medium through the tubes or ducts 7 which, however, at all times serves the additional purpose of recovering the heat energy released by the burning fuel.

From the foregoing description, taken in connection with the accompanying drawing, it will be readily apparent that this invention provides a method for burning and degassing subterranean fuel deposits in order to release and recover from them their distillate products and heat energy without necessitating digging them out of the earth.

What I claim as my invention is:

1. The method of degassing and burning a subterranean fuel deposit which comprises the steps of: drilling a plurality of spaced apart holes into the fuel deposit from the surface of the earth; igniting the fuel deposit at one point; forcing combustion supporting fluid into the fuel deposit through at least one of the holes in order to sustain combustion of the fuel deposit; inserting

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tubes into the holes in the area of combustion; circulating a cooling medium through said tubes to thereby regulate the heat of combustion of the burning fuel bed to keep it below the sintering point of the fuel; and collecting from the mouths of holes in a zone adjacent to the combustion area the distillation products released by the heat of combustion.

2. The method of obtaining the heat energy and distillates of an underground fuel deposit which comprises the steps of: drilling a plurality of spaced apart holes from the surface of the earth into the fuel deposit; igniting the deposit at one point; continuously forcing combustion supporting fluid into the deposit near the point of combustion to sustain combustion; inserting tubes into holes in the deposit in the area of combustion; passing a cooling medium through said tubes whereby the temperature of combustion of the burning fuel will be kept below the sintering point of the fuel; collecting and utilizing the heat energy absorbed by the cooling medium; and collecting from the mouths of holes in a zone adjacent to the combustion area the distillates released by the heat of the combustion process.

3. The method of releasing and utilizing the heat energy of a subterranean fuel deposit which comprises the steps of: boring a plurality of spaced apart holes from the surface of the earth into the fuel deposit; igniting the fuel deposit; forcing combustion supporting fluid into the fuel deposit to sustain the combustion thereof; inserting tubes into the holes in the area of combustion; circulating a heat transfer medium through said tubes; and collecting said heat transfer medium and utilizing the heat energy absorbed thereby.

4. The method of releasing and utilizing the heat energy of subterranean fuel deposits which comprises the steps of: boring a plurality of spaced apart holes from the surface of the earth into the fuel deposit; igniting the fuel deposit at one point; forcing combustion supporting fluid through one of said holes into the fuel deposit to sustain combustion thereof; inserting tubes into holes in the area of combustion; passing a heat transfer medium through said tubes in such quantities as to regulate the heat of combustion of the fuel in order to keep it below the sintering point thereof; and collecting the heat transfer medium and utilizing the heat absorbed by it.

5. The method of releasing and utilizing the heat energy of a subterranean fuel deposit which comprises the steps of: boring a plurality of spaced apart holes into the fuel deposit; igniting the fuel deposit; forcing combustion supporting fluid into the fuel deposit to sustain combustion thereof; inserting steam generating coils into the holes in the area of combustion; positively circulating a water steam emulsion from a common steam accumulator through all of the coils and back to the accumulator to thus carry off the heat of combustion and convert it into steam energy; and moving the steam generating coils from burned out areas into freshly burning areas as combustion of the fuel deposit proceeds.

6. The method of releasing and utilizing the heat energy of a subterranean fuel deposit which comprises the steps of: boring a plurality of spaced apart holes into the fuel deposit; igniting the fuel deposit; forcing combustion supporting fluid into the fuel deposit to sustain combustion thereof; inserting steam generating coils into the holes in the area of combustion; positively circulating a water steam emulsion from a common steam accumulator through all of the coils and

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back to the accumulator to thus carry off the heat of combustion and convert it into steam energy; collecting the smoke and waste products of combustion issuing from the holes which lead to the burning portions of the fuel deposit; and conveying the collected smoke and waste products to a stack.

7. The method of exploiting an underground fuel deposit which comprises: igniting the fuel deposit; forcing combustion supporting fluid into the fuel deposit to sustain the combustion thereof; inserting heat exchange ducts into the fuel deposit in the area of combustion; circulating a heat exchange medium through said ducts to thereby maintain the temperature of combustion of the fuel below its sintering point; and collecting the heat exchange medium so circulated and utilizing the heat energy absorbed by it.

8. The method of exploiting an underground fuel deposit which comprises: forming a plurality of holes into the deposit; igniting the deposit; forcing combustion supporting fluid under pressure into the fuel deposit through at least one of said holes to sustain combustion; inserting heat exchange ducts into said holes in the area of combustion; circulating heat exchange medium

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through said ducts; regulating the flow of said heat exchange medium through said ducts to thereby control the temperature of combustion of the fuel; collecting said heat exchange medium to utilize the heat absorbed by it; and collecting from the mouth of a hole in a zone adjacent to the combustion area the products of distillation released by the heat of combustion.

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