April 24, 1928. 1,667,403

M. J. TRUMBLE

METHOD OF PRODUCING POWER

Filed Oct. 25, 1922

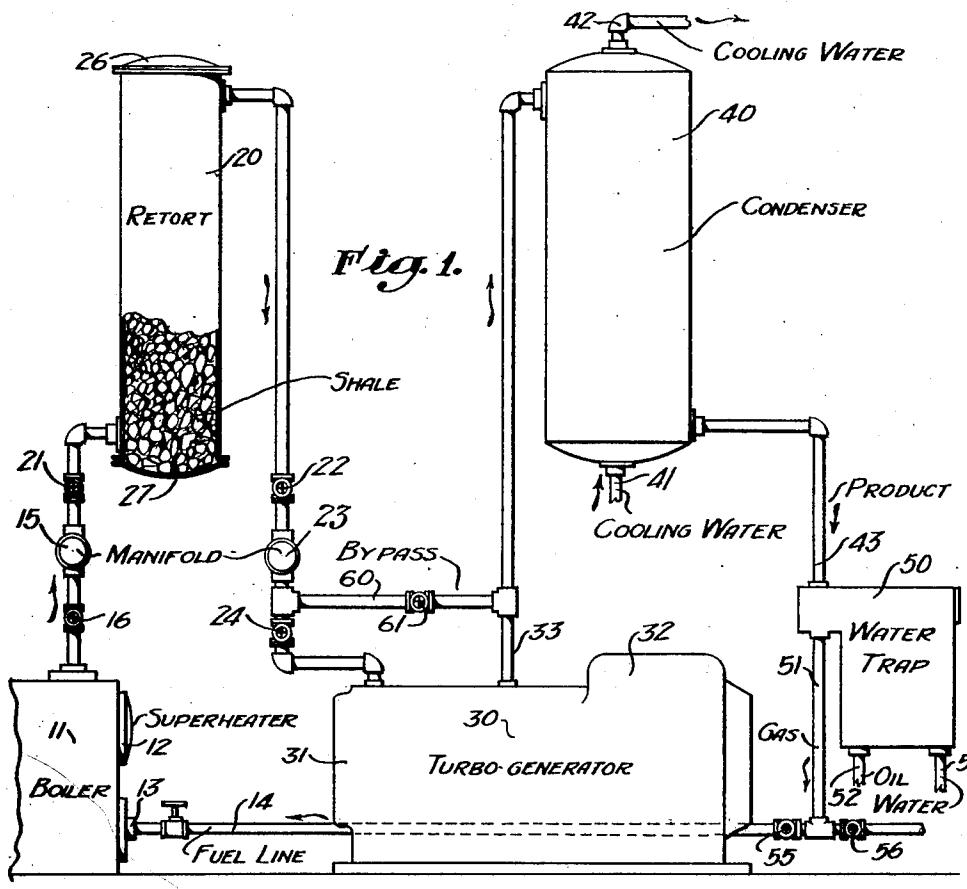


Fig. 1.

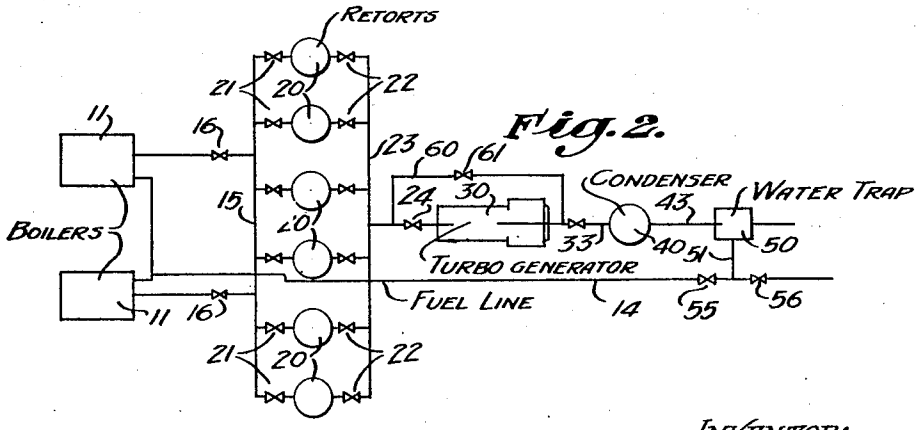


Fig. 2.

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UNITED STATES PATENT OFFICE.

MILON J. TRUMBLE, OF ALHAMBRA, CALIFORNIA.

METHOD OF PRODUCING POWER.

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My invention relates to methods of producing power, and is particularly applicable to the production of power from low grade hydrocarbons or minerals containing same.

The principal object of the invention is to provide a process of an apparatus for producing power from such low grade materials.

There exist in many parts of the United States large deposits of oil shale, oil sand, lignite, brown coal or the like which are unsuitable for burning beneath the ordinary boilers and which have not previously been economically used for the production of power. It is an object of my invention to provide means for so utilizing such material.

Further objects and advantages will appear hereinafter.

Referring to the drawing, which is for illustrative purposes only,

Fig. 1 is a side elevation of an apparatus adapted to carry on my invention.

Fig. 2 is a diagrammatic plan view of the same.

In the form of the invention shown, I provide a boiler 11 having a superheater 12, this boiler being fired by oil or gas delivered through a pipe 14 to an oil burner 13 inside the boiler. In practice, I prefer to use one or more boilers which feed steam into a common manifold 15 through valves 16.

I also provide a plurality of retorts 20 which are connected through valves 21 with the manifold 15 and which are connected through valves 22 with a manifold 23. The manifold 23 is connected through a valve 24 with a turbo generator 30, this turbo generator 30 consisting of a steam turbine 31 which is directly connected to an electric generator 32.

The exhaust side of the steam turbine 31 is connected by a pipe 33 with a condenser 40 which is cooled by water delivered through a pipe 41, the heated water being withdrawn by a pipe 42. The condenser delivers fluid through a pipe 43 to a trap 50 which is adapted to separate gas, oil and water; the gas being delivered through pipe 51, the oil through the pipe 52, and the water through pipe 53. The gas delivered through the pipe 51 is delivered through a valve 55 into the pipe 14 or through a valve 56 to a suitable storage. A bypass pipe 60, having a valve 61, is adapted to bypass vapors past the turbine 31.

The retort 20 is provided with a tight cover 26 and a tight bottom 27, both of which may be removed for convenience in charging and removing the spent material. All of the individual apparatus shown is old in the art and other well known forms may be substituted therefor without departing from the spirit of my invention.

While my invention is applicable to operation with many types of carbonaceous material, I will discuss my invention as applied to the utilization of oil shale.

This oil shale, as is well known, contains considerable quantities of light oil. When operating upon shale, the method of operation is as follows: The retorts 20 are arranged in a series, being charged with shale as shown in Fig. 1. As soon as the retort has been charged and the cover 26 and the bottom 27 have been secured thereto, the valves 21 and 22 from that particular retort are opened and steam is taken from the manifold 15, being blown through the shale into the manifold 23. This steam is taken from the boiler through the superheater 12 in which it is raised to a high temperature. The retorts 20 are adapted to sustain considerable pressure and a distillation takes place therein, the heat of the steam under pressure distilling and vaporizing the hydrocarbons carried by the shale.

The manifold 23 therefore carries a mixture of oil vapor and steam under high temperature and pressure. This oil vapor and steam is passed through the steam turbine 31 turning the generator 32 and delivering electrical power which may be applied to any use.

After leaving the steam turbine, the mixture of vapors is delivered to the condenser 40 in which a certain portion thereof is condensed. The mixture entering the condenser 40 is at a high temperature but a low pressure. Upon reducing the temperature in the condenser, the steam forms water and a portion of the hydrocarbon vapors form oil. There will in some cases be considerable quantities of fixed gas which is separated from the exhaust vapors by the trap 50, this fixed gas being then utilized with or without other fuel to maintain combustion in the boiler 11. In cases where there is not sufficient gas to furnish all the fuel a portion of the oil delivered through the pipe 52 may be used.

The retorts 20 may be readily cut out of service for charging by the valves 21 and 22

and while in service are maintained at boiler pressure and super-heater temperature.

It will be noted that the turbo-generator 30 acts as a pressure reducer for the steam and oil vapors, enabling a considerable portion of the energy delivered by the boiler 11 to be applied to useful work and at the same time allowing the retorts 20 to be carried at high temperatures and pressures without excessive expenditures of energy.

In starting the vapors may be allowed to bypass through the bypass pipe 60. The valve 61 is, however, normally closed as the process is a continuous one, one or more of the retorts 20 being always out of service, being charged and being again cut back into service, when charged.

When operating on oil shale or oil sand, the spent material in the retorts 20 after distillation is free from carbon and of little value.

When lignite or low grade coal is used, the spent material in the retorts may be coke which has a considerable commercial value.

In any case, in addition to the power produced by the turbo-generator 30, I produce as another commercial product the oil delivered through the pipe 52, a part or all of which is available under the usual conditions of operation.

If I maintain the retorts 20 at or above five hundred degrees Fahrenheit and at a pressure of one hundred pounds per square inch or over, a certain amount of cracking of the shale oil takes place in the retorts and a considerable portion of the oil delivered to the pipe 52 is a light gasoline or toluene or other cracked product of high commercial value. The quality of this product can be readily controlled by a regulation of the temperature and pressure of the steam in the manifold 15.

I claim as my invention:

1. A method of utilizing low grade fuel comprising: placing the fuel in an enclosed chamber; blowing steam through said fuel to vaporize the hydrocarbons contained in said fuel; utilizing said steam and hydrocarbon vapors together in a prime mover; and recovering, by condensation, some of the hydrocarbon values from the exhaust of said prime mover.

2. A process as in claim 1 in which a portion of the hydrocarbon values contained in the exhaust vapors of the prime mover are utilized to generate the steam used to vaporize the hydrocarbons contained in said fuel.

3. A process as in claim 1 in which the steam is superheated before being passed through said fuel, by the combustion of gases separated from said hydrocarbon values.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 19th day of October, 1922.

MILON J. TRUMBLE.