PROCESS FOR PRODUCING WATER GAS FROM PULVERIZED COAL AND STEAM

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Fig. 2.

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Drawn, Described and Filed

By

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This invention relates to a process of and apparatus for producing water gas from pulverized coal and steam. In the production of water gas, coal and steam are made to react at a temperature of approximately 1100° C.

It is known to generate water gas in continuous operation from solid fuels, by conducting the necessary heat to the gas-forming materials with the assistance of alternately heated regenerators. If, however, pulverized coal or pulverized coke is employed, special measures require to be adopted in order to ensure the use of a cheap, simple and reliable apparatus.

The heating of the regenerators is effected by means of a part of the current of gas generated. In this manner the possibility is provided of employing an apparatus of compact construction, which is extremely economical from a thermal standpoint and very simple to regulate, and in which no valve arrangements are required which will be subject to wear. The reaction heat is supplied to the gas-forming materials either before or during their combination in the heater itself, or is introduced by means of a special agent, for example highly heated water gas. It is in all cases of great advantage to employ water gas for conveying the pulverulent coal, thus returning a part of the water gas generated back into the circulatory system.

The gas necessary for heating the regenerators is branched off from the main current of gas to be discharged from the apparatus without the use of valves or cocks subjected to the heat. The desired distribution of the flow is maintained by a difference in pressure which is caused to act at the point at which the heating gas is branched off from the main current. This difference in pressure is capable of regulation by suitable dimensioning of the resistance of the passages or openings traversed by the two currents, and by regulation of the valves or blowers which are situated at points where the same are not subjected to the heat.

This process is improved upon according to the invention by introducing steam or waste gas in circulation to the combustion process upon the alternate heating of the regenerators for the purpose of avoiding excessive temperatures, so that as little loss of heat results as possible.

Furthermore, according to the invention, the heat is also supplied after the commencement of the reaction to the gases already formed and to the materials capable of forming gas. The supply of heat to the gas-forming materials is preferably effected in gradual manner, as these materials must be brought into the reactive state at a sufficient and even temperature, and by the gradual supply of heat it is accomplished that a substantial cooling does not occur during the course of the reaction, but rather more an increase in the reaction temperature.

For this purpose either the gas-forming materials are united prior to being heated, or the point of contact of the previously highly heated gas-forming materials is expanded as much as possible by suitable construction or distribution of the openings required.

Two forms of embodiment of an apparatus suitable for carrying out the process as above are illustrated in diagrammatical form in the accompanying drawings. All parts having no direct connection with the invention have been omitted from the two figures in question for the sake of better comprehension.

Referring now to Fig. 1, 2 and 3 are heating chambers, which communicate with each other by means of openings 3 and 4 and also the passage 5, which latter simultaneously acts as dust separator. In the position shown the steam on the one hand and the mixture of water gas and pulverized coal on the other hand are introduced into the lower part of the chamber 1 at 6 and 7 respectively. The apertures 6 and 7 may be changed about. Within the chambers 1 and 2 a heat exchange checker work is provided partially shown in section for purposes of illustration. The conversion of the material occurs in and behind the heating chamber 1. The water gas generated, including the quantity employed as conveying means for the pulverized coal, passes through the opening 3 into
the dust separator 5, in which the major portion of the particles of ash carried along by the gas is deposited in the receptacle 8. In the dust separator or passage 5 the water gas is divided into two currents. The water gas to be removed from the apparatus is discharged at 9, whereby the gas employed for conveying the pulverized coal may be returned in circulation to the conveying fan. The remaining part of the gas passes through the opening 4 into the chamber 2 for combustion and heating purposes. The combustion air is introduced at 10, while at 11 is provided an ash receptacle. The cooled combustion gases escape through the opening 12.

An additional advantage in connection with the present method is attained by the fact that steam may be added to the combustion air introduced through 10. This is to be preferred in view of the fact that combustion of the current of gas branched off at 14 with pure air would result in very high temperatures, which might easily result in rapid wear of the material of the generator.

A modification of the above arrangement is shown in Fig. 2, in which the regenerators are furnished with a partition extending approximately to the middle and also heat exchange checker work partly shown in section. In this manner a separate heating of the gas acting as conveying means for the coal and of the steam is accomplished, whereby the partition extends so far that the extent of heating of the separately heated distillation materials is such that upon the said materials meeting together at the end of the partition in the hottest portion, which is not divided and which constitutes the continuation of the divided portion, a good concentration of the gas phase is ensured.

By the division of the regenerators it is also necessary to provide two separate discharge passages 12 for the burnt gas, as shown in the drawings.

If the chamber 1 has cooled down, the chamber 2 having been heated, the apparatus is switched over, the chamber 1 then being heated, while the chamber 2 is employed for producing gas.

Obviously in place of the two chambers 1 and 2 it is also possible to employ a larger number of regenerators, which may then be arranged circularly about the chamber or passage 5.

The apparatus accordingly makes provision for the connection of two or more heating chambers at their hottest ends by means of a passage which is incapable of being closed off and through which the highly heated mixture of gas and steam, in so far as the same acts as heating gas, passes from the one chamber into the other for the purpose of combustion, while the remainder, i.e., water gas for storage gas and gas for conveying purposes, is branched off under a certain drop in pressure. It will be obvious that in this apparatus the regulation of both the main current as well as the current for heating purposes may be readily performed by proper manipulation of the exhaust gas slide of the regenerator to be heated and with the assistance of the remaining valves, etc., ordinarily employed, which are situated at points in the pipes not touched by the heat.

It will of course be understood that no restriction is made to the exact forms of embodiment shown, and that various other means may be employed without departing from the spirit of the invention.

What I claim as new and desire to secure by Letters Patent is:

1. A method of continuously producing water gas from pulverized coal or coke and steam, consisting in passing steam and a mixture of part of the produced water gas with pulverulent coal or coke to a hot regenerator, producing water gas in said regenerator which thereby serves also as a generator, passing a part of the produced water gas to a regenerator temporarily not producing gas, passing off the remainder of the produced water gas from the space between said regenerators, passing combustion air to said latter regenerator and heating the latter regenerator by combustion of the gas therein until such time as the latter regenerator is sufficiently heated, and then reversing the direction of flow by introducing the material into the second named regenerator to form water gas and heating the first named regenerator by causing combustion therein of part of the gas produced in the second named regenerator.

2. The method according to claim 1 including separately passing said steam and the said mixture of water gas and pulverulent coal or coke to said regenerator and separately heating said steam and gas mixture currents in said regenerator, and combining the separately heated currents in said regenerator at the hottest portion thereof producing the water gas in said regenerator.

In testimony whereof I have affixed my signature.

HERMANN HILLEBRAND.