E. FLEISCHER.

METHOD OF MAKING HOT PRODUCER GAS.

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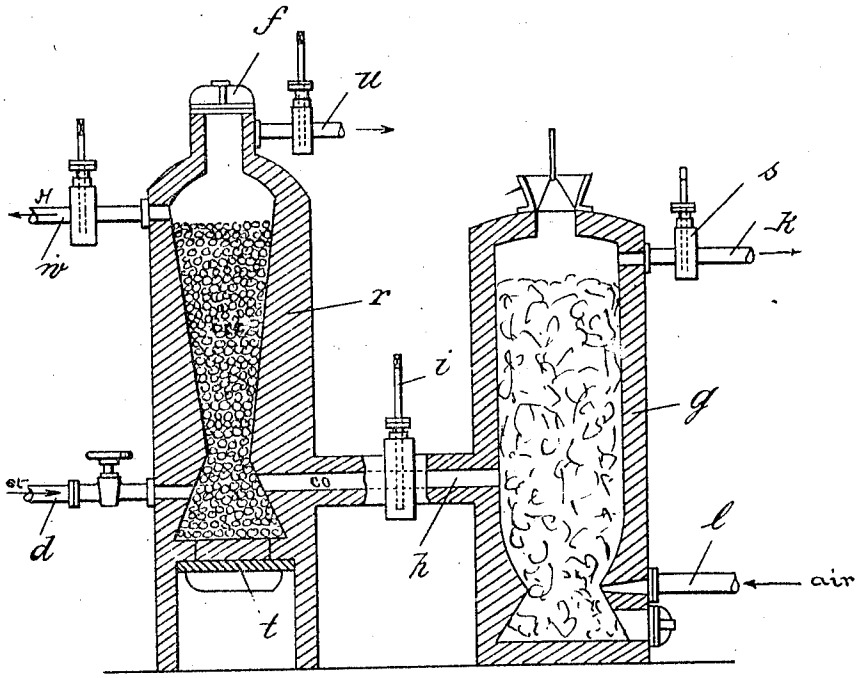
1,041,058. Patented Oct. 15, 1912.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING HOT PRODUCER-GAS.

1,041,058. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed October 26, 1910. Serial No. 589,178.

To all whom it may concern:

Be it known that I, EMIL FLEISCHER, a subject of the German Emperor, and resident of Dresden-Altstadt, in the Kingdom of Saxony, Germany, (with the post-office address Tiergartenstrasse 32,) have invented new and useful Improvements in Methods of Making Hot Producer-Gas, of which the following is a specification.

This invention relates to the manufacture of very hot carbon monoxid gas which can be used for the production of hydrogen and many other industrial purposes as hereinafter set forth.

The ordinary producers, particularly those for regenerative heating, deliver gas for further use at a temperature of 400 to 500° centigrade. This limits their applicability and in all applications which require higher temperatures precautions must be taken for supplying additional heat, most generally by highly heating the air used for firing.

In the new producer constructed according to this invention carbon monoxid is produced having a temperature of 1000° centigrade or higher. Hereby entirely new applications become possible; for instance the gas may be used for processes of reduction and oxidation which occur or are profitable only at high temperatures. Obviously it is necessary that the producer should be fed with such fuel and should be constructed on such principles as will result in the production of the greatest possible amount of heat therein.

For the production of hot gas, however, the mode of operating hitherto usual by which the gas issues only at one place in the producer is inadmissible. Another method must be adopted and this method is based on the new observations which I have made. If the gas which is produced by the combustion of carbon to carbon monoxid is to leave the producer having the temperature of combustion, it is essential, in order that subsequently descending cooler combustible should not cool the gas, that a quantity of carbon equal to that which is burnt should be simultaneously heated as far as possible to the temperature of combustion. This is, however, only possible by causing a part of the hot producer gas to traverse the whole column of fuel in order to pre-heat this, while the larger part of the hot gas leaves the producer at the zone of the white hot fuel. Thus the producer is characterized by the fact that the largest part of the producer gas which is produced by blowing air into a column of anthracite or coke at least one and a half meters high, passes only through part of the white hot fuel and then leaves the producer with the high temperature which it possesses while the rest of the producer gas (10 to 20% may suffice) traverses the whole column of fuel and leaves the producer through a controlling valve in an essentially cooler condition. In this manner one insures that that part of the column of fuel which is above the outlet for the hot gas is thoroughly pre-heated so that the fuel always remains very hot at the said outlet for the hot gas. Moreover by heating the blast of air, for instance by combustion of the cooler part of the gas, to 400 to 500° centigrade it is possible to produce a gas whose temperature exceeds 1400° centigrade. The reducing gas thus possesses in addition to its chemical activity a very considerable amount of heat so that it can be used for a great variety of chemical and metallurgical purposes. For instance by using such hot gas as a reducing agent and as the heating agent, hydrogen can be made very cheaply without retorts in accordance with the following method.

It is known that iron oxid is reduced by reducing gases to iron sponge and that by subsequently leading steam over this finely sub-divided metallic iron the latter is reconverted into an oxid of iron with liberation of hydrogen. The fulfilment of this reduction of iron oxid is, however, connected with a temperature of at least 650° centigrade when carbon monoxid or reducing gases containing carbon monoxid are used. For this reason the reduction of iron oxid has hitherto been conducted in vessels, such as tubes or retorts, which are heated wholly externally and the reducing gas has been led through the red hot iron oxid in these heated vessels.

By use of the new very hot producer gas external heating of the vessel in which the reduction of iron oxid is conducted is no longer necessary and the reduction can be carried out in a cupola filled with iron oxid. This cupola or blast furnace, which is lined with fire-proof material, is connected with the producer by a short pipe adapted to be closed by a valve through which the hot producer gas passes to enter the furnace to

traverse the iron oxid therein. After the reduction has proceeded for a certain period in this manner (the excess of reducing gas which issues from the top of the furnace being, for instance, conducted under a boiler and there burned for producing steam) the valve in the connecting tube is closed and the valve on the pipe for admitting steam from the boiler into the furnace is opened together with a connection of the furnace with a scrubber and a gas holder; superheated steam is now blown into the furnace, hydrogen is formed and is collected in the gas holder after passing through the scrubber and like purifiers. When the iron has been thus oxidized again, the steam is cut off, likewise the connection with the scrubber, and the valve admitting the producer gas is again opened whereupon the reduction proceeds again.

When crude ore or the like which, owing to irregularity of working, is liable to be very much cooled has to be quickly heated up without the use of overmuch heating gas for the purpose, it is only necessary to mix with the gas a blast of air and to effect a rapid heating by the flame produced. When the mass which can be observed through spy holes has attained the necessary temperature the air supply is cut off and the supply of hot producer gas continued. The necessary attention to the producer may be given best in the intermediate periods which occur during the steaming or gas making period of the operation of the reducing furnace.

The accompanying drawing shows in vertical section an arrangement of apparatus for applying the method: *g* is the gas producer into the lower part of which air is blown through pipe *l*. The cool portion of the producer gas escapes through a pipe *k* controlled by a valve *s* while at about the middle of the height of the producer the hot gas escapes through the pipe *h* controlled by the valve *i* and passes to the reducing furnace *r*. The latter has at the bottom the discharging door *t* and the steam inlet *d*. The hydrogen produced escapes through the pipe *w* controlled by a valve and a second escape pipe *u* is provided for the excess of producer gas. *f* is the charging opening for fresh ore.

The application of the hot producer gas is not limited, however, merely to reduction processes; the gas may also be applied for the production of very high temperatures for if gas containing 29% of carbon monoxid and having a temperature of 1000° centigrade is burned with air at a temperature not exceeding that of the atmosphere the flame produced has a temperature of over 2000° centigrade. The hot gas therefore presents a very cheap and convenient means for producing high temperatures so that a large field of applicability is opened for it as a heating agent.

Now what I claim and desire to secure by Letters Patent is the following:

1. The method of making producer gas having a temperature of 1000° C. and upward, which consists in blasting fuel to incandescence in a suitable producer into which fuel is introduced from time to time, tapping off a portion of the producer gas from that portion of the producer which is at a maximum temperature and before the producer gas traverses the whole body of incandescent fuel, and passing a portion of the gas through the descending fuel sufficient to preheat the same to substantially the temperature of that at the zone where the hot gas is tapped off, substantially as described.

2. The method of making producer gas having a temperature of 1000° C. and upward, which consists in subjecting incandescent fuel, such as coke or anthracite in a producer to a blast of air, withdrawing a portion of the producer gas immediately from the hottest zone of combustion, passing a sufficient portion of the producer gas through the descending fuel to preheat the same to approximately the temperature of that at the hottest zone, and regulating the amounts of both portions of gas to insure the results aforesaid.

3. The method of making producer gas having a temperature of 1000° C. and upward, which consists in subjecting incandescent fuel, such as coke or anthracite in a producer to a blast of air, withdrawing a portion of the producer gas immediately from the hottest zone of combustion, passing another portion of the producer gas through the descending fuel to preheat a portion of the same to the temperature of that where the hot gas is tapped off, and preheating the air blast by means of combustion of the gas passed through the fuel charge.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this 13th day of October 1910.

EMIL FLEISCHER.

Witnesses:
PAUL ARRAS,
CLÄRE SIMON.