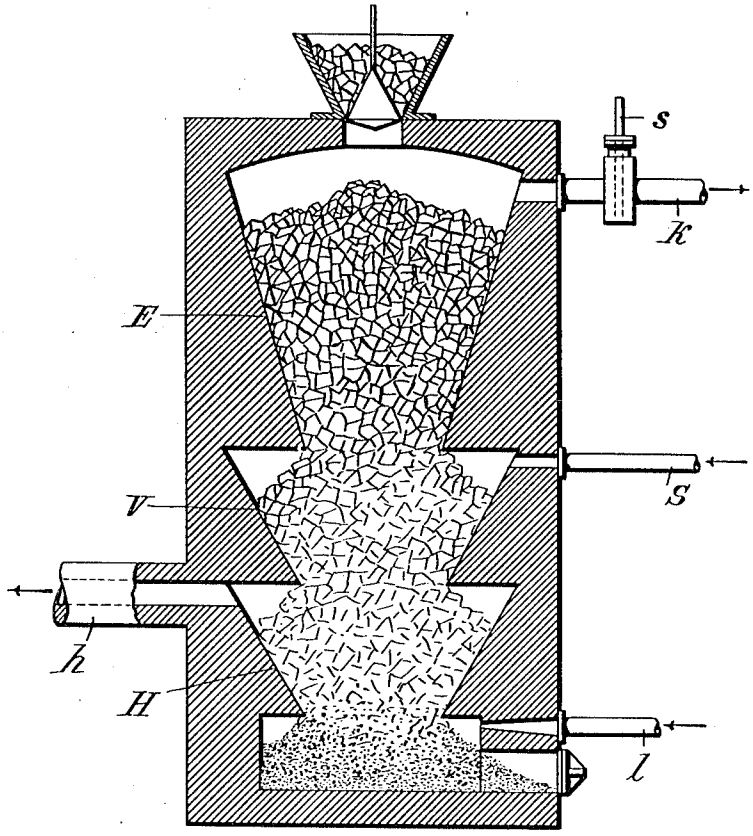
E. FLEISCHER.

PROCESS OF MANUFACTURING PRODUCER GAS.

APPLICATION FILED MAY 13, 1914.

1,273,474. Patented July 23, 1918.



Witnesses
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UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURING PRODUCER-GAS.

1,273,474. Specification of Letters Patent. Patented July 23, 1918.

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To all whom it may concern:

Be it known that I, EMIL FLEISCHER, doctor of philosophy, chemist, a subject of the German Emperor, and resident of Dresden-Altstadt, in the Kingdom of Saxony, Germany, Tiergartenstrasse 32, have invented a new and useful Process of Manufacturing Producer-Gas, of which the following is a specification.

In specification of U. S. Patent No. 1,041,058, a process is described of manufacturing a hot producer gas of over 1000° C. by distilling non-bituminous fuels such as coke, anthracite, or charcoal. The present invention relates to manufacturing such hot gas from bituminous fuels. The process is also suitable for obtaining by-products of coal such as tar, or ammonia, and at the same time a mixed gas of high calorific value.

The fulfilment of the objects of this invention introduces new and difficult problems in the manufacture of hot gas, which are solved according to the new process.

As explained in the prior specification, the manufacture of hot gas is effected merely by the fuel which enters the zone from which the hot gas escapes, being already heated practically to the temperature of the hot gas. This preliminary heating in the process for manufacturing hot gas from non-bituminous fuels, is effected by a small portion (about 10%) of the hot gas which passes through the upper column of fuel and escapes as "cooling gas."

The same process obviously could be used even in the case of fuels which are only slightly bituminous such as anthracite coals. For ordinary bituminous coals, however, it would be necessary to lead for the purpose a very considerable quantity of gas through the upper layers of coal in order to effect distillation and also to heat the coke produced to the hot gas temperature. For the distillation of 1 kg. coal alone requires a quantity of heat of in round figures 400 calories. If therefore bituminous coal were to be treated in exactly the same way as coke or anthracite, it would be impossible to obtain any good yield of hot gas. Moreover, the volatile products of the coal such as tar, ammonia, or lighting gas would be so strongly diluted owing to the large consumption of hot gas for distillation, that it would be impossible to rely on an economic production of these byproducts or to expect a mixed gas of high calorific value.

Therefore it was necessary to adopt a new method in order to accomplish the above mentioned objects. The principle of the present process is as follows: Before the coals reach the zone from which the hot gas escapes, they must be practically completely coked. In order, however, to insure that result, it is necessary to form above the zone from which the hot gas escapes, a separate fuel layer which receives from above—namely the distilling chamber—almost completely coked coal, and delivers below highly heated coke to the hot gas zone. In that way, the conditions for obtaining hot gas are complied with, and its manufacture is insured.

In order to insure good preliminary heating of the separated fuel layer, a small quantity of hot gas entering from below passes through the said layer, but is burnt by means of secondary air blown in, before it escapes from this preliminary heating compartment. In that way heat is supplied to the fuel in the said preliminary heating compartment, both from below and from above. The hot gases pass from the preliminary heating compartment directly into the coal distilling compartment situated above, and effects distillation of the coal contained therein. Thus, on the one hand, all the conditions for the hot gas manufacture are complied with, and at the same time only a small portion of the hot gas need be sacrificed for distilling the coal. Of course, the coal distilling compartment could be still further subdivided, and the distillation also facilitated by supplying combustion air to these compartments. But this step would dilute the waste gases, and thus render the manufacture of byproducts of the coals much more difficult, so that it is more rational to introduce secondary air only once. On the contrary, it is advantageous to mix steam with this secondary air, which facilitates distillation of the coals without any dilution of the waste gas being produced, thereby (as steam is precipitated in the condenser).

I have proposed in the application of my prior patent named above to introduce secondary air in the upper part of the producer in order to burn carbon monoxid at

once, and use the heat thus obtained to heat the fuel fed downward to the main combustion zone.

Further experiments proved that by using secondary air, as above described, it is also possible to use bituminous fuels which are transformed into gases. They are not only decomposed into their combustible ingredients, but also into the ingredients which can be subsequently distilled, such as tar and ammonia-containing gases, which are thus easily and commercially obtained. The difference between the prior invention and the present invention is that, according to the latter, a preliminary heating layer or zone is provided which receives from above almost completely distilled coal which, however, is not sufficiently hot.

A very important point (apart from the fact that the cooking process is completed in the preliminary heating zone) is that the coke thus obtained is so strongly heated that when it enters the zone from which the hot gas is obtained, it is already as hot as the said gas. The present invention consequently serves a new purpose, which is to distil efficiently the bituminous fuel, so that only hot coke reaches the hot zone, while bituminous fuel is fed in at the top of the producer. This difference in the purpose involves a difference in the whole process. No secondary air can reach the preliminary heating zone or layer, but only non-burnt hot gas. The secondary air is introduced above the said zone or layer in order to turn the coal into coke. Thus the secondary air is used for distilling the coal and for coking, the coke thus obtained being subsequently heated by means of non-burnt hot gas to a higher temperature in the preliminary zone located below.

Ordinary producers are not suitable for carrying out the process, but the producer must be built in accordance with the following principles.

As will be seen from the accompanying drawing, which shows in vertical section one form of producer adapted to carry out my process, the producer is divided into three sections, that is to say three compartments connected together. Through *l* air blast enters from below, whereby hot gas is produced in H, the greatest portion of the gas being discharged for use through *h*. A small portion of the hot gas, the quantity of which can be regulated by means of a valve *s*, passes through the preliminary heating compartment V, but it is burnt by means of the secondary air S which is preferably mixed with steam before the said gas leaves the compartment V, in order to pass into the upper distilling compartment E.

Owing to the hot gases passing through the coal distilling compartment E, the fuel passing from E to V reaches the latter in a highly heated state. The mixed gases and vapors produced in the distilling compartment E, are discharged through *k* or conveyed into condensers for obtaining tar and ammonia.

The producer is therefore characterized by the separate compartments, the number of which can of course be still more increased by further division of the coal distilling compartment E; the most essential compartment is the preliminary heating compartment V to which heat is supplied as already stated from above and from below, for, as already stated, without the said separate preliminary heating it would be impossible to obtain hot gas from bituminous fuels.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

The process of manufacturing from bituminous fuel, producer gas discharged from the producer burning zone at the temperature of the latter, without coming into contact with a superposed layer of cooler fuel, which consists in providing an intermediate heating layer of fuel immediately above the zone from which the producer gas escapes, passing a small portion of the producer gas through the intermediate heating layer, and simultaneously injecting secondary air mixed with steam into said intermediate layer, whereby complete combustion of the small portion of producer gas is secured, and carrying the resulting gases through the superposed layer of cooler fuel in order to distil the latter.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this first day of May, 1914.

DR. EMIL FLEISCHER.

Witnesses:
LEO BERGHOLZ,
PAUL ARRAS.