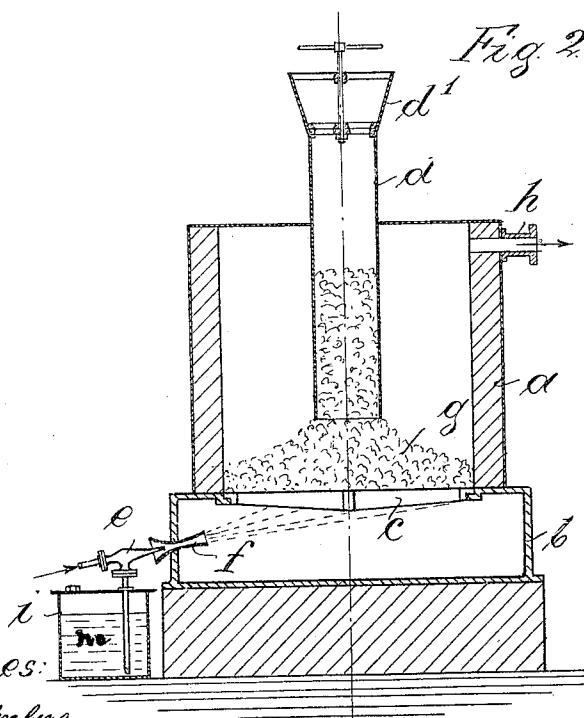
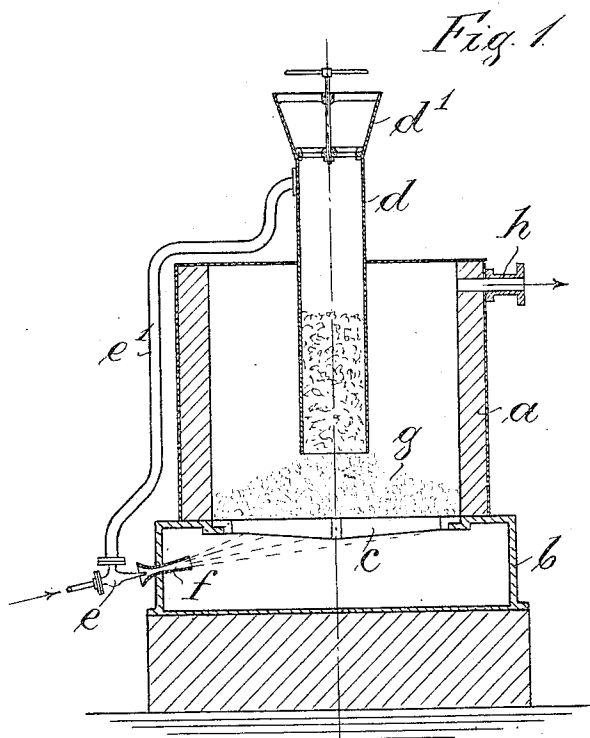


No. 887,058.

PATENTED MAY 12, 1908.

F. BAUKE.
METHOD OF PRODUCING GAS.
APPLICATION FILED MAY 2, 1906.

2 SHEETS—SHEET 1.



Witnesses:
Paul Wollenberg.
Arthur Lohr.

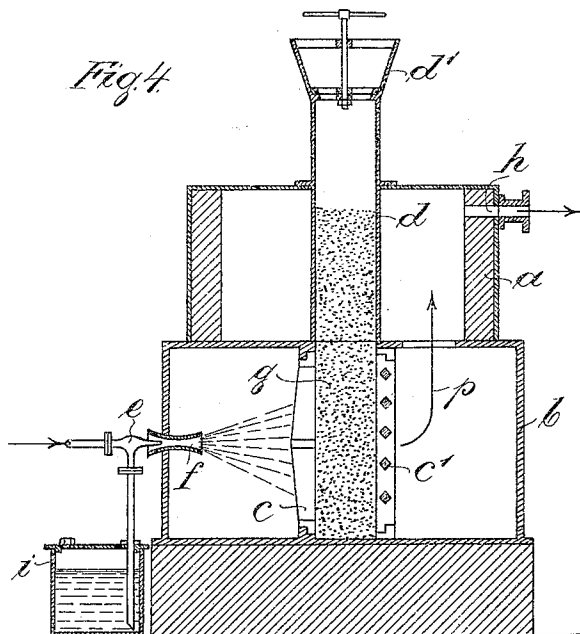
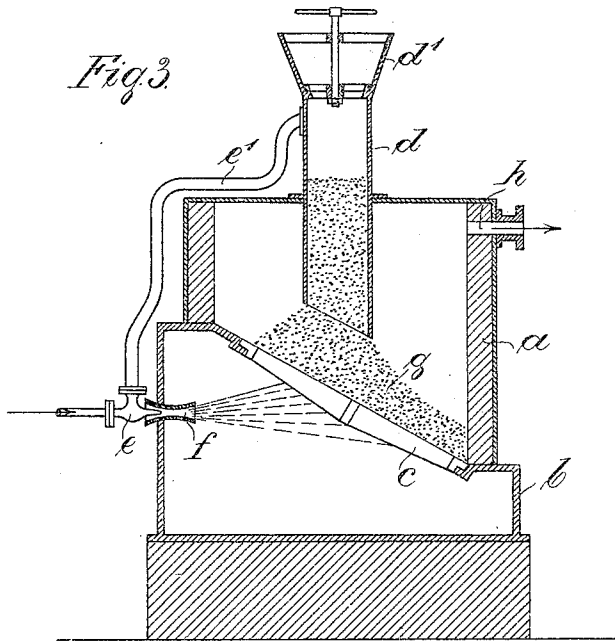
Inventor
Fritz Bauke.
by Rueschler
Attorney

No. 887,058.

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F. BAUKE.
METHOD OF PRODUCING GAS.
APPLICATION FILED MAY 2, 1906.

2 SHEETS—SHEET 2.



Witnesses:
Carl Rupp
Emil Kayser

Inventor:
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UNITED STATES PATENT OFFICE.

FRITZ BAUKE, OF BERLIN, GERMANY.

METHOD OF PRODUCING GAS.

No. 887,058.

Specification of Letters Patent.

Patented May 12, 1908.

Application filed May 2, 1906. Serial No. 314,860.

To all whom it may concern:

Be it known that I, FRITZ BAUKE, a subject of the King of Prussia, German Emperor, and resident of Berlin, Kingdom of Prussia, German Empire, have invented a new and Improved Method for the Production of Gas, of which the following is an exact specification.

My invention relates to a novel and improved method of making generator gas.

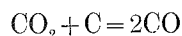
It has been accepted commonly that in generators, such as suction or forcing gas generators, the zone of reaction must have a certain minimum height, since otherwise chiefly carbonic acid would be produced. It has also been observed that as a rule the operation succeeds the better, the deeper the zone of reaction, and the hotter the temperature maintained. In attempting to insure such conditions, a number of defects are met, especially when working on a small scale, such as the choking of the fire grate, whereby continual alterations of the cross sectional area for the passage of air or steam will occur, thus causing irregularities in the reaction and a variable composition of the gas produced. These irregularities offer many difficulties, but they could be overcome by removing the clinkers from the fire-grate. In small works it is very difficult or even impossible to avoid these alterations of the cross sectional area, because the working of the apparatus has to be effected with the least possible attention. I conceived the idea of avoiding this defect by the employment of a shallow zone of fire and by operating at a lower temperature, at which the slag of course is not so liquid and adherence does not take place easily, but in my first attempts I found that a gas was produced which was not serviceable on account of its richness in carbonic acid gas. Further experiments in this direction have led to a perfectly new process whereby a heating and power gas of a perfectly new composition is obtained and whereby the defects above mentioned are at the same time overcome.

The new process is carried out by the introduction of finely divided carbonaceous material into a fire zone having a very shallow depth, similar to that of a plane grate fire. The finely divided carbonaceous material may be in the form of dust, of a liquid or of

a gas. The introduction preferably takes place by means of steam and air serving as driving power and distributing means respectively.

I will now proceed to give an explanation of this particular process, as it will take place according to my opinion: As is well-known, in a plane grate furnace the fuel and air burn in such manner that the resulting combustion gases contain a very high percentage of carbonic acid and therefore are not suitable for heating and power purposes. In the usual generation processes a high temperature is produced by providing for a high column of glowing material and owing to the great heat the products of distillation driven out by the heat and introduced from below into the hottest fire-zone are decomposed in such manner that the percentage of hydrocarbon is very high for obtaining a gas having a high caloric effect. In the said usual process the high temperature of the resulting gas is a great defect.

In my process I form a shallow bed of the glowing and distilled material discharged from the feeding shaft and without the introduction of carbonaceous matter the resulting gas would have a high percentage of carbonic acid as usual in plane grate furnaces, that is to say such gas would represent an almost complete combination of carbon with oxygen to form carbonic acid and therefore would be unsuitable for heat and power purposes. As soon, however, as finely divided carbonaceous matter thoroughly mixed with air is introduced into this shallow bed of fuel which otherwise would produce too much carbonic acid, the finely divided carbon *in statu nascendi* binds one molecule of the carbonic acid (CO_2) just formed, according to the formula



thus causing a large portion of the carbonic acid to be transformed into carbonic oxid, as will appear from the analysis results given hereinafter.

The height of the zone should vary in accordance with the quality of the combustible used. In using mineral coal having much ash, of course, this height must be greater than in the case of using best anthracite. In using, however, lignite and products con-

taining it a correspondingly higher fire zone should be used.

Convenient forms of furnaces which may be used for carrying out my new process are illustrated in the drawings annexed hereto.

Figures 1 and 2 represent vertical sections of furnaces showing a shallow fire zone and a horizontal fire grate. Fig. 3 is a similar view of a furnace having an inclined fire grate, and Fig. 4 shows a furnace having a vertical fire-grate.

The same reference letters designate the same parts in all the figures.

a is the wall of the furnace, *b* the base provided with an opening for receiving the fire grate *c*, arranged horizontally in Figs. 1 and 2. In the axis of the furnace a filling tube *d* is arranged leaving an annular space between the wall *a* and the filling tube.

d' is a hopper which can be closed by means of a cover.

e is an injector and *e'* a pipe connecting the same with the upper part of the tube *d*.

The injector *e* discharges into the nozzle *f* leading into the base *b* below the fire grate *c*.

g indicates the shallow fire zone forming the so-called zone of reduction.

The furnace as described works in the following manner: The material to be acted upon is distilled in the filling pipe *d* and descends to the zone of reduction *g* having a height such as is usual in plane-grate fires. The products of distillation driven out from the descending material by the waste gases are sucked by means of the steam injector *e* from the upper part of the pipe *d* and forced through the fire-grate *c* into the zone of reduction. The resulting generator gas is taken from the furnace at *h*. According to the Fig. 2 hydrocarbons in a liquid state taken from the vessel *i* are forced into the zone of reduction.

In Fig. 3 the furnace is similar to that of the Fig. 1, but has an inclined fire-grate *c*. The furnace shown in Fig. 4 is provided with a vertical fire grate *c* and a grating *c'* for maintaining a shallow zone of reduction *g*. As indicated by the arrow *p*, the generator gas rises after having passed through the reduction zone *g*.

In using coke and similar materials from which distillates will not be produced, mixtures of suitable materials such as distillates of tar, petroleum, carbureting oils and so on, with air and if desired with steam, may be forced into the fire zone.

The gas made according to the method as before described has a composition somewhat different from that produced from the same material by the usual processes, and above all, it contains a very low proportion of carbonic acid. Some chemical analyses of gases obtained by my new process from coal are given as follows:

	1.	2.	3.	4.	65
Carbonic acid----	8.4	7.4	7.0	7.4	
Oxygen-----	1.8	1.6	2.0	1.6	
Carbonic oxid----	15.6	19.4	18.8	19.0	
Hydrogen-----	14.1	14.4	11.5	12.7	
Nitrogen-----	60.1	57.2	60.7	59.3	70

It will be observed that in each form of my invention, I forcibly project against that side of the grate which is opposite to that from which the resulting gas is taken, an intimate mixture of carbonaceous material and air, sometimes with the addition of steam. The constituents of this mixture are admitted together, and virtually they are mixed before or at the moment they enter the base of the furnace. I thereby insure much better results than if the carbonaceous material and the air were introduced into the furnace separately and made to intermingle there. The direction in which the mixture is projected, forms an angle with that exposed surface of the fuel against which it is projected, so that the mixture is forced into the burning layer, practically over the entire extent of said surface.

I claim as my invention—

1. The process of producing gas for power and heating purposes, which consists in pre-heating the fuel, then spreading it into a shallow burning layer of such dimensions that of itself it would produce a gas too rich in carbonic acid to be available for power or heating purposes, withdrawing gas from one of the broad surfaces of said shallow burning layer, and projecting against the other broad surface of said layer and at an angle to said surface, an intimate mixture of air and carbonaceous material.

2. The process of producing gas for power and heating purposes, which consists in spreading the fuel into a shallow burning layer having two exposed surfaces of relatively large dimensions at a relatively small distance from each other, withdrawing gas from one of the broad exposed surfaces of said shallow burning layer, and projecting against the other broad exposed surface of said layer and at an angle to said surface, an intimate mixture of air, steam, and carbonaceous material.

3. The process of producing gas for power and heating purposes, which consists in distilling the fuel at a relatively low temperature and removing the tar-vapors, then spreading the distilled fuel, substantially free from tar vapors, into a shallow burning layer having two exposed surfaces of relatively large dimensions at a relatively small distance from each other, said layer being of such dimensions that of itself it would produce a gas too rich in carbonic acid to be available for power or heating purposes, withdrawing gas from one of the broad

exposed surfaces of said burning layer, and projecting against the other broad exposed surface of said layer and at an angle to said surface, an intimate mixture of air with the
5 tar-vapors removed at the first stage of the process.

4. The process of producing gas for power and heating purposes, which consists in pre-heating the fuel, then spreading it into a
10 shallow burning layer of such dimensions that of itself it would produce a gas too rich in carbonic acid to be available for power or heating purposes, withdrawing gas from one
15 of the broad surfaces of said shallow burning layer, and projecting against the other broad surface of said layer and at an angle to said surface, an intimate mixture of air, steam, and carbonaceous material.

5. The process of producing gas for power
20 and heating purposes, which consists in spreading the fuel into a shallow burning layer having two exposed surfaces of relatively large dimensions at a relatively small distance from each other, withdrawing gas
25 from one of the broad exposed surfaces of said shallow burning layer, and projecting against the other broad exposed surface of said layer and at an angle to said surface, an

intimate mixture of air and carbonaceous material.

6. The process of producing gas for power and heating purposes, which consists in distilling the fuel at a relatively low temperature and removing the tar vapors, then
30 spreading the distilled fuel, substantially free from tar vapors, into a shallow burning layer having two exposed surfaces of relatively large dimensions at a relatively small distance from each other, said layer being of
35 such dimensions that of itself it would produce a gas too rich in carbonic acid to be available for power or heating purposes, withdrawing gas from one of the broad exposed
40 surfaces of said burning layer, and projecting against the other broad exposed surface of said layer and at an angle to said surface, an intimate mixture of air and steam
45 with the tar vapors removed at the first stage of the process.

In witness whereof I have hereunto set my
50 hand in the presence of two witnesses.

FRITZ BAUKE.

Witnesses:

HENRY HASPER,
WOLDEMAR HAUPT.