

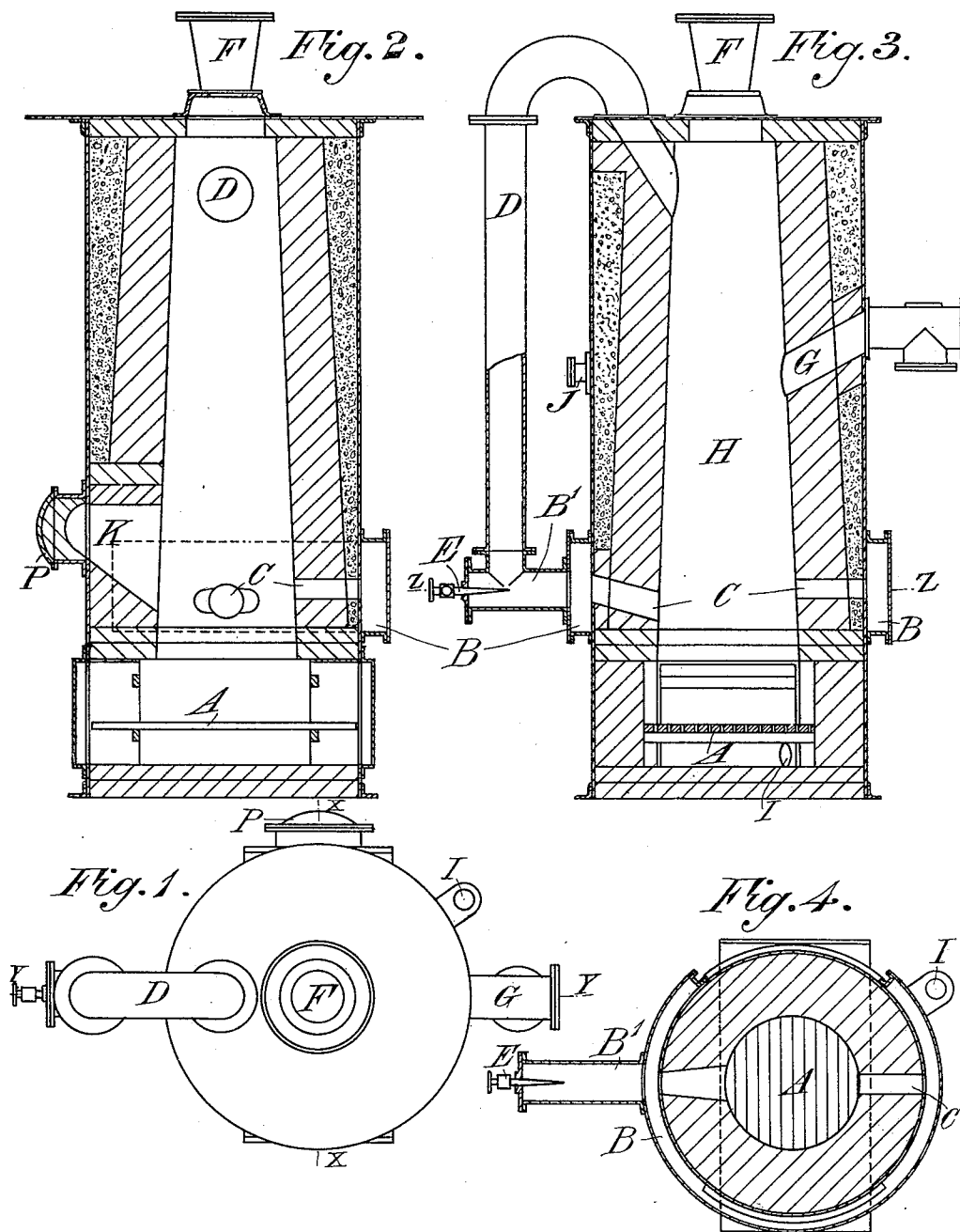
No. 650,697.

Patented May 29, 1900.

C. WHITFIELD.
APPARATUS FOR PRODUCING GAS.

(Application filed Dec. 30, 1897.)

(No Model.)



Witnesses
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UNITED STATES PATENT OFFICE.

CHARLES WHITFIELD, OF KETTERING, ENGLAND, ASSIGNOR TO HIMSELF,
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APPARATUS FOR PRODUCING GAS.

SPECIFICATION forming part of Letters Patent No. 650,697, dated May 29, 1900.

Application filed December 30, 1897. Serial No. 664,777. (No model.)

To all whom it may concern:

Be it known that I, CHARLES WHITFIELD, a subject of the Queen of Great Britain and Ireland, residing at Anglezarke, Kettering, in the county of Northampton, England, have invented an Apparatus for Making Gas, of which the following is a specification.

This invention has for its object the more complete conversion of solid and liquid hydrocarbon compounds into the gaseous state than has been possible by the means heretofore in use.

It is well known that when carbonaceous fuel is burned with oxygen carbonic acid is produced, and that when this compound is passed through a mass of incandescent carbon it is converted into carbonic oxid. When atmospheric air is used for supplying the oxygen for the combustion of the carbonaceous fuel and steam is added, the oxygen and hydrogen of which the latter is composed become dissociated, the oxygen thus liberated combining with some of the carbon, forming an additional supply of carbonic oxid. This additional supply of carbonic oxid and the dissociated hydrogen enrich the first products and reduce the percentage of diluent nitrogen in the resultant compound. Owing, however, to the cooling effect of the steam and carbonic acid on the incandescent fuel and to the fact that the conversion of carbonic acid into carbonic oxid can only be completely effected at a temperature of about 1,000° Fahrenheit, the amount of steam that can be treated in this way is limited by the amount of sensible heat (produced by the initial combination of the oxygen of the atmosphere with the carbonaceous fuel on the grate or near the twyers) which is available above that temperature. Also, as the heavier hydrocarbons are only converted into fixed gases when raised to a temperature somewhat above 1,000° Fahrenheit in contact with a further supply of oxygen or hydrogen, it becomes necessary to heat the vapors which are given off when the fuel is first placed in the generator or producer to or above that temperature. Now my invention has reference to a construction of generator or producer whereby vaporized or distilled hydrocarbons produced at the top of the generator or producer are combined with

a proper quantity of oxygen and hydrogen and are raised to a sufficiently-high temperature to convert them into permanent gases.

The cycle of operations consists, first, in raising the fuel to a high temperature at or near the bottom of the generator or producer by forcing air, either at ordinary temperatures or heated in any suitable way, through the grate or twyers; secondly, in injecting into the fuel, at a point above the zone of combustion where the said fuel is in a state of incandescence and where its temperature is sufficiently high, as much steam as the heated fuel will decompose, and, thirdly, in causing the said steam to convey the condensable and distillation products of the fuel into the said incandescent fuel before the gaseous products pass off through the main outlet.

In order to carry out the above-described method, which forms the subject of a separate application for Letters Patent, I construct a generator or producer as I shall now describe, with reference to the accompanying drawings, in which—

Figure 1 represents a plan of a generator or producer according to my invention. Figs. 2 and 3 are vertical sections taken on the lines X X and Y Y, respectively, of Fig. 1; and Fig. 4 is a horizontal section taken on the line Z Z of Fig. 3. Figs. 5 and 6 are similar views to Figs. 3 and 4, respectively, showing a modified construction.

At some distance—say one or two feet—above the grate or bottom A in the arrangement shown in Figs. 1 to 4, inclusive, there is provided a belt B, that extends more or less around the generator and is connected by openings C with the interior of the fuel-space just above the zone of combustion. The belt B is connected by a casing B' and a pipe or conduit D with the top of the generator, where the fuel is admitted through a hopper F. Into the casing B' projects a steam-nozzle E, in such a manner that the steam issuing from the nozzle will induce a current of gas to flow from the upper part of the generator to the belt, so that the steam which is to be decomposed carries with it the volatile compounds evaporated or distilled from the fuel at the said upper part of the generator. The steam-jet may be regulated by hand, or, if preferred,

automatically, by any suitable arrangement. The action of the steam-jet causes products of combustion and the vapors from the fuel in the upper part of the generator to pass in such a direction and manner as to render it almost impossible for any of the heavier vaporized hydrocarbon compounds to escape to the outlet G, which is placed at some distance—say two or three feet—from the top of the generator without first passing through a mass of incandescent fuel at H and there becoming decomposed or otherwise fixed.

I is an opening for the admission of air into the closed ash-pit below the fire-bars A from a blowing engine or fan.

J is a sight-hole for viewing the interior of the generator or producer when the same is at work, and K is an opening through which the generator or producer can be cleaned out when necessary. This opening is kept normally closed by a retort-lid P or other suitable air-tight door.

Instead of using a belt B, I sometimes, as shown in Figs. 5 and 6, connect the lower end of the downtake pipe or conduit D and branch pipe B' by a conical casing B² to an opening or passage L, which leads the steam and the volatile compounds from the upper part of the generator into the fuel at a point just above the zone of combustion.

It will now be understood that, assuming the fuel at the lower part M of the generator or producer to be in a state of combustion and that at the part H to be in a state of incandescence and that the green fuel at the upper part is comparatively cool, but kept hot enough by the transmission of heat from the incandescent fuel below to give off volatile hydrocarbon compounds, these latter will be drawn away through the pipe or conduit D by the steam-jet E and delivered along with the steam into the incandescent fuel at the part H of the generator or producer just above the zone of combustion. These volatile hydrocarbon compounds and the steam are decomposed by the said incandescent fuel and pass off along with the carbonic acid produced by the combustion of the fuel at the lower part of the furnace through the outlet G.

The distance between the openings C, through which the steam and hydrocarbon vapors are admitted to the generator, and the outlet G, provided for conveying the gas to the holder or to the point where it is to be employed, may vary. The less this distance is the freer will the gaseous products escaping from the outlet G be from tar and condensable products. I have obtained very satisfactory results with a producer having a height of about twelve feet from the floor-level to the top of the fuel-chamber and an internal diameter of about two feet, the inlet or inlets C or L being about three feet above the grate A, the outlet G about eight feet above the grate, the pressure of the air supplied to the ash-pit being about equal to seven or eight inches of water, and the pressure of

steam admitted by the nozzle E being about seventy pounds per inch. With this data about one hundred and eighty pounds of coal can be burned per hour, yielding about thirteen thousand cubic feet of gas having a high calorific power.

The feeding of the fuel may be effected by hand or by any suitable automatically-acting apparatus, and where automatic apparatus is not employed the clinkering and poking may be effected as in other generators or producers.

By carrying out the process as above described it is possible to utilize the heat produced by the initial combustion of a given weight of fuel, first, for the production of carbonic acid, and, secondly, for the decomposition of the greatest possible volume of steam and the fixing of all the volatile hydrocarbons, whereby a compound containing the smallest percentage of diluent nitrogen with a high percentage of carbonic acid, hydrogen, and the lighter hydrocarbons is obtained, the volatile hydrocarbons being made to enrich what would be under ordinary circumstances only common producer-gas. Also the process enables cheap bituminous qualities of coal to be economically and advantageously converted into combustible gas in gas-producers in lieu of the more expensive anthracite and hard qualities of coal which it has heretofore been necessary to use, and not only so, but enables a gas having a higher calorific power to be obtained than can be obtained in the usual way from such expensive fuels.

I am aware that it has heretofore been proposed to introduce volatile compounds generated at the upper part of a gas-producer, with or without steam, into the ash-pit or into the zone of combustion; but such process, which I do not claim, differs essentially from mine, inasmuch as the resulting gas is altogether of a different and inferior quality to that obtained by my process.

What I claim is—

1. A gas-producer having an inlet for air only at its lower end so as to produce a zone of combustion only at the lower part of said producer, an inlet arranged to deliver hydrocarbon into said producer at a point above the zone of combustion produced by the air admitted to said producer through said inlet, means for injecting hydrocarbon through said inlet, and a gas-outlet arranged at a point some distance below the top of the producer and the normal level of the mass of fuel therein, substantially as herein described for the purpose specified.

2. A gas-producer having an outlet at its upper end for exit of volatile matter and products of distillation from the green fuel admitted to said producer, an air-inlet at its lower end only so as to produce a zone of combustion only at the lower part of said producer, one or more inlets arranged to admit hydrocarbons to the interior of the producer at a point above the zone of combustion pro-

duced by the air admitted by said air-inlet, means for inducing hydrocarbon vapors to flow from said outlet at the top of said producer to said inlet for hydrocarbon, and a gas-outlet arranged between the latter inlet and the outlet at the top of said producer, substantially as described for the purpose specified.

3. A gas-producer having an outlet at its upper end for exit of volatile matter and products of distillation from the green fuel admitted to said producer, an air-inlet at its lower end only so as to produce a zone of combustion only at the lower part of the said producer, one or more inlets arranged to admit hydrocarbons to the interior of the producer at a point above the zone of combustion produced by air, steam-jet apparatus adapted to withdraw hydrocarbon vapors from the top of said generator and force them together with steam through said inlet for hydrocarbons, and a gas-outlet arranged between the latter inlet and the outlet at the top of said producer and below the top of the mass of

fuel therein, substantially as described for the purpose specified.

4. A gas-producer comprising the vertical fuel-receptacle having an air-inlet I only at the bottom, the vapor-outlet at the top, the vapor inlet or inlets arranged to admit hydrocarbon to the interior of the producer at a point above the zone of combustion produced by air, the conduit D connecting said vapor-outlet with said vapor inlet or inlets, the steam-nozzle E for inducing vapors to flow from the top of said generator to said vapor inlet or inlets, and the gas-outlet G, located between said vapor outlet and inlet or inlets, substantially as described for the purposes specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES WHITFIELD.

Witnesses:

A. M. TROUP,
W. MAY.