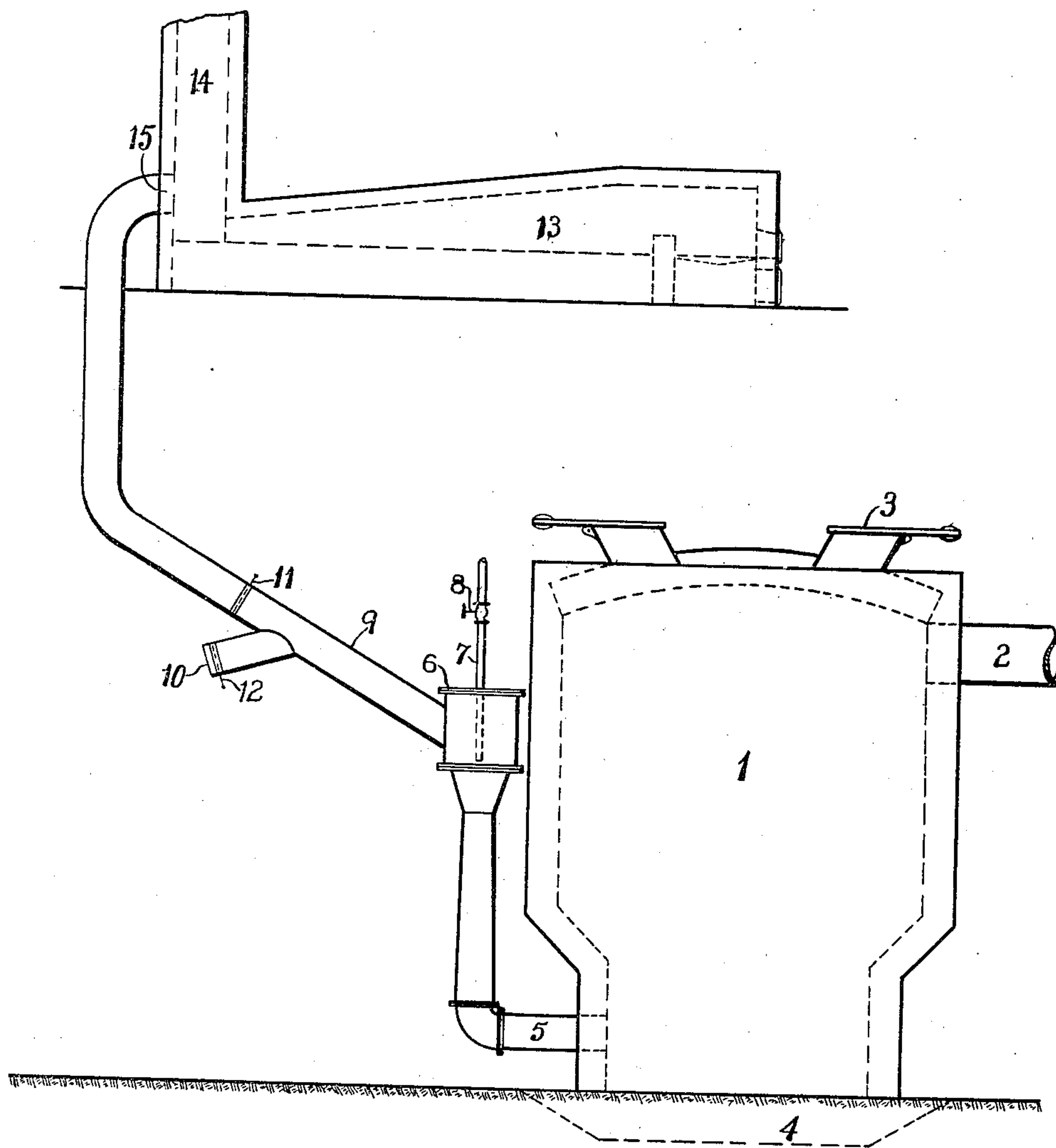


No. 843,669.

PATENTED FEB. 12, 1907.

C. ELLIS.  
APPARATUS FOR PRODUCING GAS.  
APPLICATION FILED MAY 11, 1905.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR PRODUCING GAS.

No. 843,669.

Specification of Letters Patent.

Patented Feb. 12, 1907.

Application filed May 11, 1905. Serial No. 259,925.

*To all whom it may concern:*

Be it known that I, CARLETON ELLIS, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Apparatus for Producing Gas, of which the following is a specification.

This invention relates to gas-producer apparatus, and especially to those in which the products of combustion or a portion thereof from any convenient furnace yielding stack-gases carrying an abundance of carbon dioxide are delivered to the producer and passed through the bed of fuel therein. I have discovered that these products owing to the presence of carbonic acid may be made the means of keeping down the temperature of the producer and avoiding the production of soot and slag or clinker in objectionable amounts. It is well known that steam has heretofore been largely utilized for that purpose, and as it necessarily is used in large quantities it is open to serious objections, principally due to the imperfect decomposition which steam undergoes in passing through the fuel-bed. Then, too, the steam is usually generated in steam-boilers located often at some distance from the producer plant, and the condensation which occurs in transmitting steam at high pressure to the producer constitutes another loss. The fuel energy expended in generating the steam for operating the producer is entirely wasted, as the stack-gases from the furnace in which the producer-gas is burned invariably leave the furnace at a temperature above that at which the steam is generated, and consequently the heat energy of the water-vapor or steam is not utilized.

The present invention relates especially to gas-furnaces whose products of combustion contain a large constituent of carbonic acid whose endothermic reaction, together with that of some water-vapor or steam generated by the sensible heat of the stack-gases, or otherwise, is made the basis of the cooling action above referred to on the contents of the gas-producer.

This invention comprises novel improvements in apparatus for carrying into effect the composite endothermic reactions above mentioned, and it also includes certain useful arrangements of conduits, dampers, pipes,

and mechanical draft - producing means, whereby a portion of the stack-gases may be diverted from their usual course into the producer.

In the accompanying diagrammatic drawing, 1 is a gas-producer having a gas-outlet 2, the feed-hoppers 3, water-seal 4, and twyer 5. A draft-current is supplied to twyer 5 by means of a conduit having an injector-collar 6, provided with a steam-pipe 7, provided with a jet-nozzle in said collar and extending to a source of steam, (not shown,) valve 8 controlling the supply thereof. Beyond the collar the conduit extends as pipe 9, provided with an air-inlet 10, having a valve 12. This pipe extends to the furnace 13, where it enters the stack 14 at the point 15.

My method of operation is as follows: A deep bed of fuel is brought to a suitable state of ignition in the gas-producer and the steam-jet 7 put into operation. This creates a suction in the pipe 9, causing air to be drawn in at the inlet 10 or products of combustion to enter the pipe 9 at 15. By adjusting the valves or dampers 11 or 12 the relative proportion of these exothermic and endothermic constituents may be regulated. Observation of the producer temperature will indicate the proper amount of endothermic medium to use. Instead of steam an air-blast may be introduced through 7 by connecting thereto an air compressor or blower. With this air-jet of sufficiently high pressure the products of combustion may be easily drawn from the furnace 13 and entered into the gas-producer 1.

I do not limit myself to the exact construction of apparatus herein described. Any form of gas-producer may be used without departing from the scope of this invention. Neither is it necessary to draw the products of combustion from any particular type of furnace, as these may be derived from any convenient source supplying the quality of gases desired.

I am aware of United States Patent, No. 45,343, granted to Reese, which involves the combustion of fuel on a very high temperature plane, so that the mineral matter or ash of the fuel may be withdrawn from the apparatus in the form of molten slag. The gas generated by this apparatus is also burned at the place of generation, thereby forming a flaming mass of fuel. I do not claim as



my invention apparatus of this character, for my invention relates to the production of combustible gas at a seat of generation remote from the place of consumption and also to the production of the gas at a very low temperature and with insufficient oxygen to produce a flaming fuel-bed. The apparatus is therefore designed to permit of the use of a bed of fuel of great depth, thereby allowing no free oxygen to pass through at the upper part of the bed of fuel. The gas-producing apparatus is also provided with a means for the removal of the ash in the form of a finely-divided and friable material.

The introduction of carbon dioxid into a gas-producer has a certain effect on the fuel aside from its endothermic reaction, as will be apparent from a consideration of certain of the laws of physical chemistry. Producer-gas always contains carbon dioxid. Complete reduction to carbon monoxid is impossible. This is due to the fact that a balanced reaction or equilibrium exists, and in accordance with the laws of mass action carbon dioxid cannot be reduced below the point at which a certain partial pressure prevails, this depending on the nature of the producer, &c. The introduction into the gas-producer from an external source of sufficient carbon dioxid to artificially create the aforesaid partial pressure results in largely preventing the formation from the fixed carbon of the coal of any appreciable amount of carbon dioxid. The final and net result, therefore, is the complete gasification of the coal or complete conversion of the fixed carbon of the fuel to carbon monoxid. The carbon dioxid present in the producer-gas ordinarily used in the operation of furnaces represents, as gaseous ash, from ten to twenty per cent. of the total calorific value of the gas. The necessity for cooling the gas prior to its introduction into the engine makes it impossible to utilize the great sensible heat of the producer-gas, due to the complete combustion to carbon dioxid of so large a percentage of the fuel in the producer. The creation of aforesaid partial pressure therefore represents a very large economy in fuel.

In a copending application, Serial No. 242,873, filed January 27, 1905, Patent No. 790,487, May 23, 1905, I have disclosed a means for producer operation by carbon dioxid and steam. I do not claim, broadly, the ideas therein set forth. Neither do I claim specifically an air-jet for impelling products of combustion into a gas-producer.

What I claim is—

1. In a gas-producing plant, the combination of a gas-producer adapted to contain a

deep bed of fuel, a gas-delivery pipe therefor, a source of products of combustion, a direct pipe connection between such source and the draft-inlet of the producer, a valved inlet opening to the air on such pipe connection, a valve in the pipe connection between the source of products of combustion and the air-inlet, an injector-collar on the pipe connection between the air-inlet and the producer, and a valved pipe passing through the collar and ending in a jet-nozzle inside the pipe connection, whereby a controllably-proportioned mixture of products of combustion and air may be introduced into the draft-inlet of said producer by the action of said jet-nozzle.

2. In a gas-producing plant, the combination of a gas-producer adapted to contain a deep bed of fuel, a gas-delivery pipe therefor, a source of products of combustion, a direct pipe connection between such source and the draft-inlet of the producer, a valved inlet opening to the air on such pipe connection, a valve in the pipe connection between the source of products of combustion and the air-inlet, an injector-collar on the pipe connection between the air-inlet and the producer, and a valved steam-pipe passing through the collar and ending in a jet-nozzle inside the pipe connection whereby a controllably-proportioned mixture of steam, products of combustion and air may be introduced into the draft-inlet of said producer by the action of said jet-nozzle.

3. In a gas-producing plant, the combination of a gas-producer adapted to contain a deep bed of fuel, a gas-delivery pipe therefor, a fuel-burning furnace provided with a chimney-stack, a pipe connection between the said stack and the draft-inlet of the producer, a valved air-inlet open to the atmosphere on said connection, a valve in the pipe connection between the stack and the producer, an injector-collar on the pipe connection between the air-inlet and the producer, and a valved steam-pipe passing through the collar and ending in a jet-nozzle inside the pipe connection, whereby a controllably-proportioned mixture of air, products of combustion from said stack and steam may be introduced into the draft-inlet of said producer by the action of said jet-nozzle.

Signed at New York city, in the county of New York and State of New York, this 10th day of May, A. D. 1905.

CARLETON ELLIS.

Witnesses:

A. M. SENIOR,  
JAS. K. CLARK.