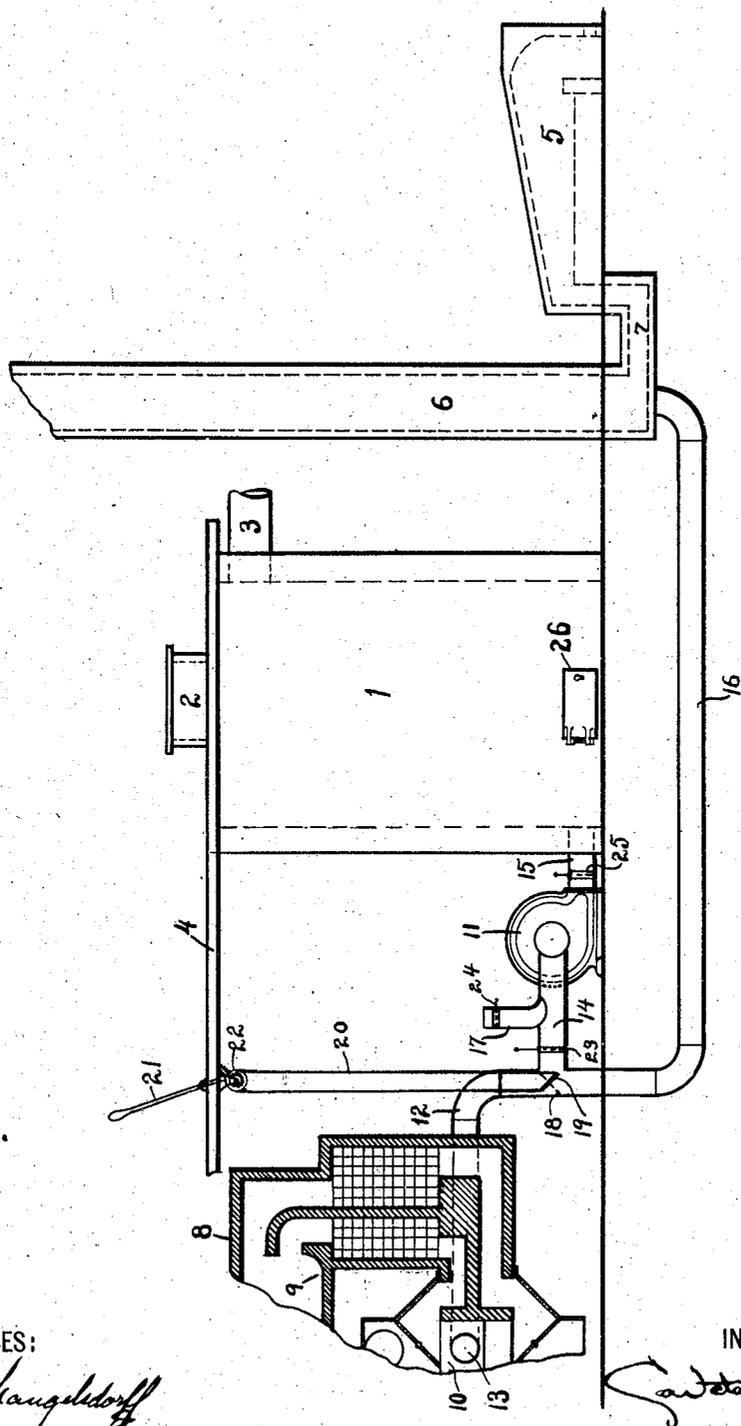


No. 790,489.

PATENTED MAY 23, 1905.

C. ELLIS.  
PROCESS OF MANUFACTURING COMBUSTIBLE GAS.  
APPLICATION FILED MAR. 6, 1905.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

CARLETON ELLIS, OF NEW YORK, N. Y., ASSIGNOR TO ELDRED PROCESS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## PROCESS OF MANUFACTURING COMBUSTIBLE GAS.

SPECIFICATION forming part of Letters Patent No. 790,489, dated May 23, 1905.

Application filed March 6, 1905. Serial No. 248,468.

*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 Processes of Manufacturing Combustible Gas, of which the following is a specification.

My invention relates to process for the manufacture of producer-gas in which carbon dioxide in lieu of the commonly-used steam is employed as the endothermic cooling agent for regulating or depressing the temperature of the fuel-producing mass. In a copending application, Serial No. 228,915, I have described a method for the use of carbon dioxide and air for the purpose aforesaid which requires that the carbon dioxide or products of combustion used in the draft-current supplied to the gas-producing appliance to be cooled before introduction into the producer. Various means are therein shown for this purpose, such as the passage of the hot products of combustion over a checker-work that has previously been cooled by the passage of gas or air at a lower temperature.

The use of the cooled carbon dioxide offers many advantages in most instances; but in some cases, however, hot carbon dioxide may be used to advantage. A well-known difficulty arising from the use of the latter, unless large quantities of steam be employed therewith, is that the gas-producer temperature is not easily controlled.

The present invention relates particularly to the use of such highly-heated products of combustion, and in a novel manner of such a character that the evil effects heretofore experienced from the use of such intensely-heated gases have been avoided.

My invention consists in the use of not solely hot products of combustion, but in the use of hot products of combustion in conjunction with or alternation with cooled products of combustion.

The drawing illustrates a diagrammatic view.

For this purpose the apparatus shown in

the accompanying drawing shows a means by which my process may be carried into effect. 50

In the drawing, 1 is a gas-producer having the fuel-feed hopper 2 and the gas-outlet 3. The top of the producer is on a level with the coal-feeding floor 4.

5 is a furnace (shown of a reverberatory type) having the stack 6, connected by a flue 7.

8 illustrates a section of a portion of a regenerative furnace of the reversing type, having the hearth 9 and stack-passage 10. 60

11 is a fan-blower having stack gas-inlet pipe 14 joining pipe 12, which connects with the stack-passage of the furnace 8 at 13. The exhaust side of the fan is connected by the pipe 15 with the gas-producer 1. A passage 65 16 connects the flue 7 of furnace 5 with the fan-inlet pipe 14.

17 is an air-inlet pipe.

18 is a damper at the junction of the pipes 12, 14, and 16 and is operated by the lever 19, chain 20, sprocket and gearing 22, and lever 21. By the operation of the lever gases may be conducted either from the furnace 5 or the furnace 8 at will. Gates 23, 24, and 25 serve to regulate the amount of the products of combustion and air which are taken into the fan and carried into the gas-producer 1. 75

My method of operation is as follows: A deep bed of coal is brought to a suitable state of ignition in the gas-producer 1, the green fuel being fed through the hopper and the ashes being removed through the ash-pit door 26. Stack-gases are drawn through pipe 16, which is suitably insulated so that there may be little or no loss in heat, and the highly-heated gases are propelled into the gas-producer 1. The lever 21 is then drawn forward, closing the pipe 16 and opening the pipe 12, which causes the products of combustion from the furnace 8 to be drawn into the fan 11. 80 These products of combustion have been cooled by passing through the regenerative checker-work of furnace 8, and they therefore tend to reduce the temperature of the fan 11 and passage 14 through which the products of combustion from furnace 5 have previously passed. 95

These cooled products of combustion mixed with air in predetermined amount enter the gas-producer and exert a cooling action. Through the splitting up of their contained carbon dioxide they exert an endothermic action low down in the mass of fuel—much lower, in fact, than does the gas from the furnace 5—owing, it appears, to variation in the velocity of reaction of the gaseous mixture, containing carbon dioxide and oxygen, with the temperature. At very high temperatures the oxygen shows a selective action over carbon dioxide for the carbon of the fuel, and the exothermic reaction therefore predominates over the endothermic reaction. This results in overheating the lower part of the fuel-bed. By introducing at the proper moment products of combustion which have been positively cooled the overheating is prevented, as the constituents of the cooled gases react at substantially similar velocities with the carbon of the fuel and the endothermic and exothermic action take place at the same rate. This results in cooling the producer and preventing the high temperatures which result in formation of clinker and in other actions of an injurious character. By leaving the damper 18 set at a certain angle it is possible to draw from the furnace 5 and the furnace 8 products of combustion of different temperatures and to cause them to mingle in the passage 14. It is possible also to operate the process in this manner. The gas produced by this method is collected in the upper part of the gas-producer and is withdrawn through pipe 3 to be delivered unburned at the point of consumption. The ashes arising from the combustion of the fuel may be withdrawn in any suitable manner. In the diagrammatic sketch used for illustrating this process it has not been deemed advisable to complicate the drawing by showing details of the means for the removal of ashes. A water seal, for instance, may be employed or grates on which the fuel rests and an ash-pit beneath from which the ashes may be removed through a suitable door. In any case the ashes produced are not in the form of a slag, but are

in the form of finely-divided uncindered or unfused particles, and are therefore readily removable from the producer.

It is not the object of this invention to carry on the production of gas at that high temperature which would result in the fusion of the ash and formation of slag; but it is intended to run it on such a temperature plane that while a nearly-complete reduction of the carbon dioxide introduced into the draft-current of the producer is effected, yet all tendency to formation of slag or clinker which have heretofore been the cause of so many troubles from clinking and the like is completely eliminated.

What I claim is—

1. Process of producing combustible gas which consists in passing through a deep mass of ignited fuel a draft-current composed alternately of heated and cooled products of combustion together with a predetermined amount of air or oxygen and in collecting and delivering the gas unburned to the place of consumption.

2. Process of generating combustible gas which consists in passing through a deep mass of incandescent fuel alternately a draft-current containing intensely-heated products of combustion and a draft-current containing cooled products of combustion in order to regulate the temperature of the producer and prevent clinking of ash.

3. Process for the manufacture of combustible gas which consists in admitting to the air-current supplied to the producer, alternately, intensely-heated products of combustion and positively-cooled products of combustion in order to depress the temperature of the producer below the clinking and slagging points of the fuel.

Signed at New York city, in the county of New York and State of New York, this 4th day of March, A. D. 1905.

CARLETON ELLIS.

Witnesses:

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