

B. E. ELDRED.
PROCESS OF PRODUCING GAS.
APPLICATION FILED MAY 11, 1905.

3 SHEETS—SHEET 1.

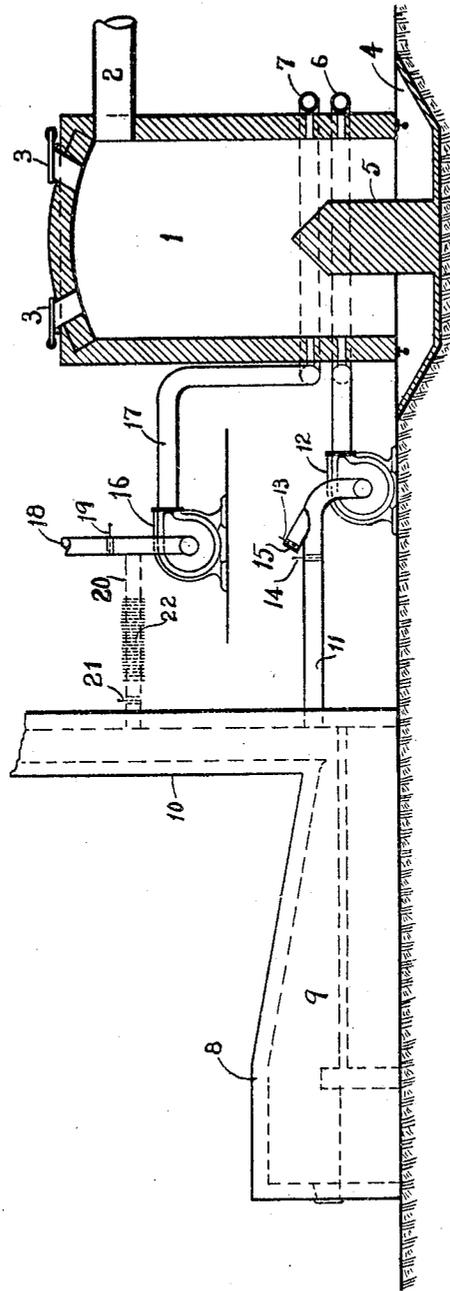


Fig. 1.

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3 SHEETS—SHEET 2.

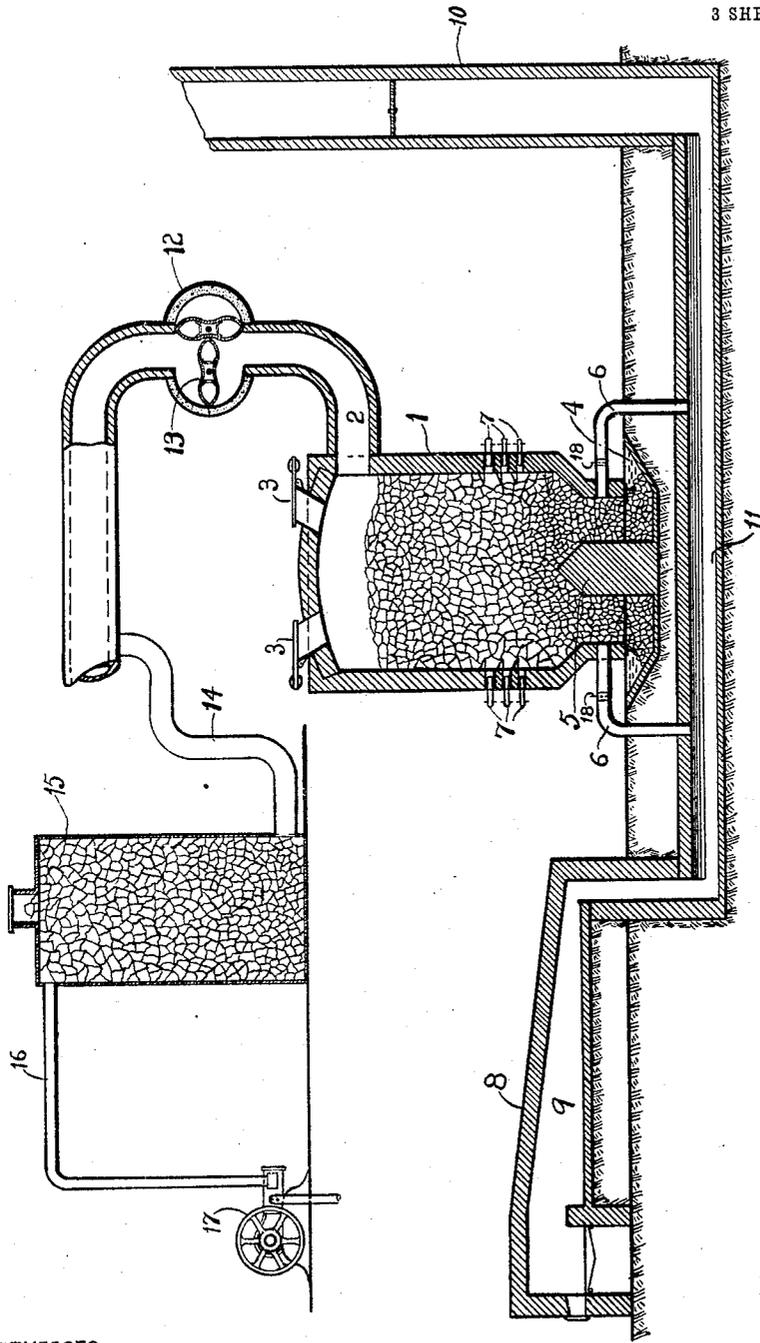


Fig. 2.

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3 SHEETS—SHEET 3.

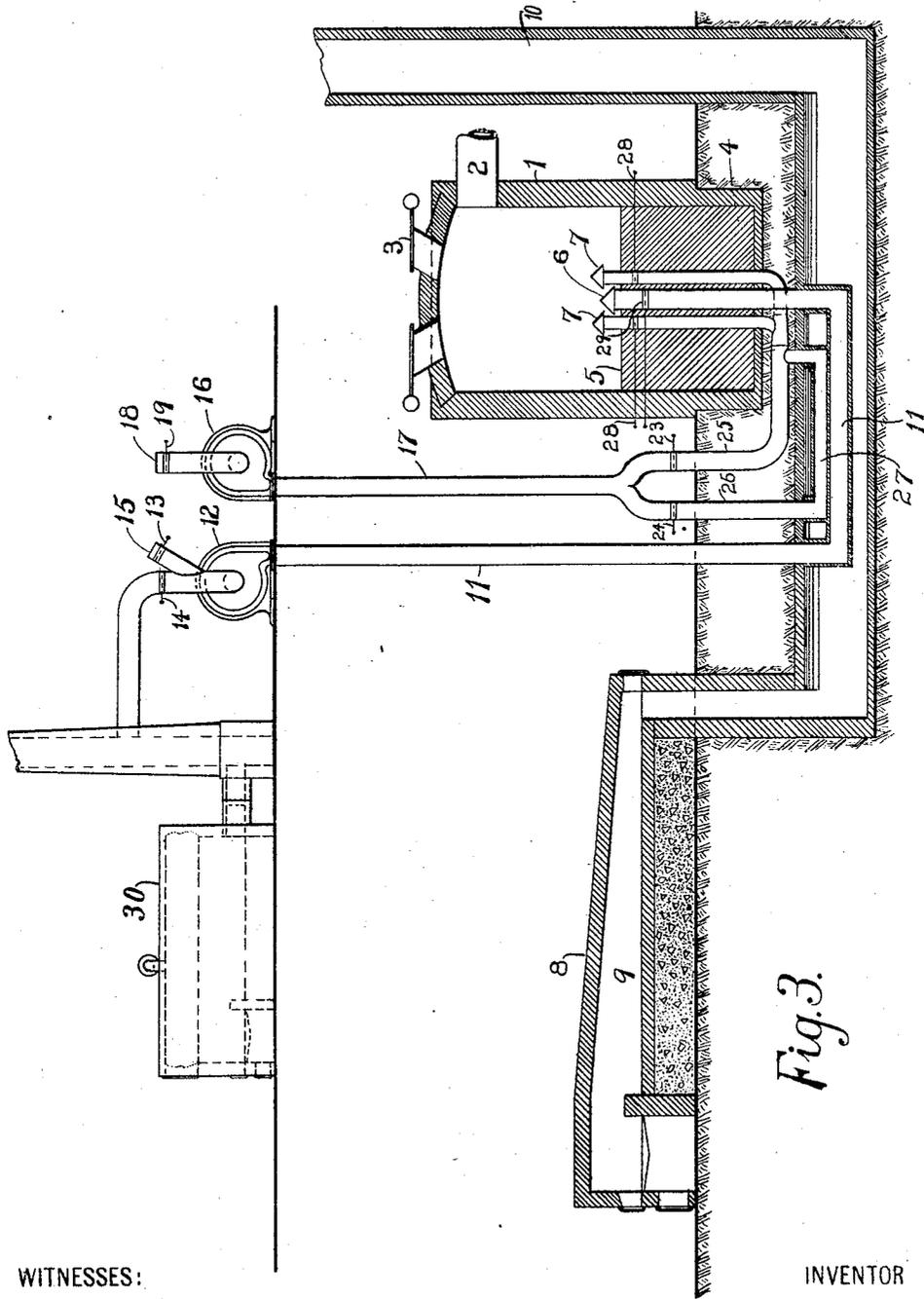


Fig. 3.

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UNITED STATES PATENT OFFICE.

BYRON E. ELDRED, OF NEW YORK, N. Y., ASSIGNOR TO ELDRED PROCESS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROCESS OF PRODUCING GAS.

No. 799,317.

Specification of Letters Patent.

Patented Sept. 12, 1905.

Application filed May 11, 1905. Serial No. 260,019.

To all whom it may concern:

Be it known that I, BYRON E. ELDRED, 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 Producing Combustible Gas, of which the following is a specification.

This invention relates to a process for producing combustible gas by the producer process as distinguished from the retort and water-gas processes and relates, moreover, to those systems of gas production and consumption in which the gas-producing mass of fuel is functionally remote from the place of gas consumption.

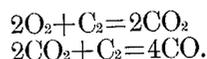
It relates particularly to a process for the control of the temperature and for the regulation of the combustion of the gas-producing mass by means of a fixed, endothermically-reacting permanent gas which by its reaction and interreaction with the combustible matter of the gas-generating fuel mass causes an endothermic absorption of heat to take place, and the gas-producing mass is thereby held or maintained at a desirable gasifying temperature.

This invention furthermore involves the application of the endothermically-reacting gas in a highly-heated condition.

It has been proposed to make use of hot products of combustion for the manufacture of producer-gas and to thereby reduce or eliminate the steam or water vapor now employed in the operation of gas-producers. Efforts to use products of combustion in a highly-heated condition have proved unsuccessful owing to the fact, it appears, that certain peculiar phenomena were not fully appreciated. In every chemical change the molecules entering into reaction are in a state of vibration, and their rapidity of vibration, together with their chemical affinities, gives rise to a certain rate of change which is denominated the "velocity of reaction." Velocity of reaction is dependent upon several conditions, chief and most important of which is temperature. Increase in temperature usually serves to increase the velocity of the reaction, although there are certain exceptions to this law. For the purposes of this invention, however, the above generalization is correct.

In the manufacture of producer-gas by

means of the passage through a deep bed of ignited fuel of a blast-current composed of oxygen, nitrogen, and carbon dioxide the following reactions occur:



The oxygen on striking the lower part of the bed of fuel burns the carbon thereof to carbon dioxide, and this in passing upward through the fuel-bed becomes reduced to carbon monoxide. The carbon dioxide introduced from an extraneous source is reduced in a similar manner. The nitrogen is not reactive and passes through the bed of fire unchanged. In the first reaction above given carbon is burned to carbon dioxide and a great amount of heat is developed. It is therefore an exothermic reaction. In the second reaction the changes taking place in the carbon dioxide formed by the first reaction or introduced from an external source are shown. It is therefore an endothermic reaction. Obviously in the lower part of the gas-producer an intense heat will be developed by the first reaction and in gas-producer practice intense heat in any part of the producer must be avoided, owing to the formation of clinker and slag which retard the passage of the blast through the fuel and prevent that continuity of operation so highly essential in all gas-producer work. The carbon dioxide introduced from an external source is, as above stated, endothermic in its reaction; but its speed of combination or velocity of reaction with the carbon of the fuel is not as great as that of oxygen. Consequently in its passage through the fuel it does not exert its endothermic action as quickly as the oxygen of the blast exerts its characteristic exothermic reaction. As a result the lower portion of the fuel mass is heated to a high degree, while immediately above this zone of high temperature a pronounced cooling action takes place, owing to the splitting up at that point of carbon dioxide. Such lack of uniformity in the combustion of the fuel is productive of unsatisfactory operation, leading to great fluctuations in the temperature of the producer and extreme variations in the quality of the producer-gas.

It is the object of the present invention to operate the gas-producer in such a manner that, as above described, fluctuation of tem-

perature and formation of zones of unequal temperature are practically avoided and a uniform production of combustible is secured.

If in order to overcome the intensely-high temperature in the lower part of the producer, due to the relatively great speed of the exothermic reaction over that of the endothermic reaction, an endeavor is made to introduce a large portion of the endothermic constituent, it being understood that the gases are introduced in a highly-heated condition, it will be observed that while the preponderating amount of the endothermic constituent is exerting a noticeable cooling action on the region of the high temperature in the lower part of the producer it also exerts a similar influence in the upper part of the producer, where ordinarily fresh fuel is added and where it is essential the temperature be such as to evolve the volatile hydrocarbons from the fuel. The result of increase in the endothermic constituent at the point at which a satisfactory control of temperature in the lower part of the producer is secured inevitably results in the cooling of the upper part of the fuel mass, with consequent fluctuation in the quality of the gas.

My invention, as aforesaid, has for its object the use of highly-heated products of combustion and their use in such quantities that the temperature in the lower part of the producer is maintained below the slagging or clinkering point of the particular fuel employed, while the upper part of the producer is maintained at a temperature sufficiently high to effect the desired evolution of the hydrocarbons of the fuel by the uniform distillation thereof.

My invention consists in applying hot products of combustion to the lower part of the gas-producing mass and introducing above or beyond this a regulated amount of air. In this manner the temperature of the gas of the lower part of the gas-producer may be maintained at the degree required, while the upper part of the gas-producer may have its combustion accelerated by the addition of the requisite amount of oxygen.

In the accompanying diagrammatic drawings, Figures 1, 2, and 3 represent different forms of apparatus which may be used in the practice of my process.

In Fig. 1, 1 is a gas-producer having the gas-outlet 2, feed-apertures 3, water seal 4, blast-baffle 5, and blast inlets or twyers 6 and 7. 8 is a furnace having the hearth 9 and stack 10. 11 is a conduit extending from the stack 10 to the twyers 6. Interposed in this conduit is a fan-blower 12, having on the inlet side an air-inlet 15. 13 and 14 are valves or dampers for regulating the flow of gases. 16 is a fan having connection with the upper set of twyers 7 by means of the conduit 17. 18 is an air-inlet pipe with controlling-damper 19, by means of which air may be en-

tered into the gas-producer through the twyers 7. 20 is a conduit or pipe having the damper 21 and the cooling-veins 22.

In the operation of the above apparatus hot gases are taken from the furnace 8 and propelled into the lower part of the producer through the twyers 6. Immediately above, through the twyers 7, fresh air or air containing a small amount of products of combustion is admitted to an extent sufficient to maintain the temperature of the lower part of the gas-producing mass at an effective gasifying heat.

In Fig. 2, 1 is a gas-producer having the gas-outlet 2, feed-hoppers 3, water seal 4, blast-baffle 5, twyers 6, and air-inlets 7. 8 is a furnace having the hearth 9, the stack 10, and connecting-flue 11. 12 is a blower of the positive type having the propeller-wheels 13. 14 is a pipe or passage extending from the gas-outlet pipe 2 to a scrubber or purifier 15. 16 is a passage connecting with the gas-engine 17.

In the operation of the above apparatus products of combustion are drawn through the producer by suction of the fan 12 entering through the twyers 6. Air is allowed to enter higher up in the producer through the inlet 7. These are arranged at different heights in the producer, so that air may be admitted at any suitable point.

Fig. 3 shows a modified form of apparatus in which 1 is a gas-producer; 2, the gas-outlet; 3, feed-hoppers; 6, twyers for the entrance of products of combustion, and 7 air-twyers. 8 is a furnace having the hearth 9 and the stack 10. 30 is a steam-boiler. From the stack of this boiler a conduit 11 extends to the twyers 6. A portion of this conduit is situated in the chimney-flue of the furnace 8 and acts as a regenerative passage through the tubes of the steam-boiler. Interposed in the conduit is a fan 12. On the inlet side of the fan is placed the air-entrance 15. Dampers 14 and 13 control the flow of products of combustion and air, respectively. 16 is an air-fan having the inlet 18 and damper 19. On the exhaust side of this fan a conduit 17 branches to form the passages 25 and 26. The former leads directly to the twyers 7. The latter passes through a continuous heat-recuperating flue placed in the stack-flue and shown diagrammatically at 27. 23 and 24 are dampers regulating the flow of air through each of these passages. 28 and 29 are dampers for additional regulation and control of the blast.

What I claim is—

1. Process for using hot products of combustion for the production of combustible gas which consists in the introduction into one extremity of a mass of ignited fuel, of a heated blast containing a preponderating amount of carbon dioxid and sufficient to cool the lower portions of the fuel mass, and in introducing a blast-current containing a preponderating amount of oxygen into the fuel mass at a point distant from said extremity in order

to produce a uniform gasifying temperature throughout the mass.

2. Process of using hot products of combustion in the manufacture of combustible gas which consists in introducing into one extremity of a mass of ignited fuel a heated blast containing carbon dioxid in such amount that the exothermic reaction of this constituent with the carbon of the fuel is sufficient to cool the lower portion of the fuel mass below the slagging-point of the fuel and in adding a highly-oxygenated blast beyond this extremity to secure a temperature sufficient to distil the volatile hydrocarbons from the fuel.

3. Process of producing combustible gas which consists in applying at different points in the fuel mass a blast-current containing highly-heated products of combustion and a blast containing air or oxygen and in so portioning the volume of these two blasts with regard to their endothermic and exothermic constituents and to their respective velocities of reaction that the fuel mass is maintained at a uniform gasifying temperature.

4. Process for producing combustible gas which consists in the use of highly-heated products of combustion introduced at one point

in a mass of fuel and in maintaining an amount of carbon dioxid sufficient to suppress the exothermic action of the oxygen introduced in the same blast and in adding at a distance beyond the place of introduction of the carbon-dioxid blast a blast of air or oxygen sufficient in amount to raise the temperature of the fuel mass to an effective distilling-point.

5. Process of producing combustible gas which consists in the introduction into one extremity of a mass of ignited fuel of a heated blast containing carbon dioxid and oxygen, in regulating the relative amounts of these two constituents with respect to their velocities of reaction in order to retard the velocity of combination of the oxygen with the fuel and in adding air at a point beyond said extremity to produce a substantial equilibrium and uniformity of temperature throughout the mass.

Signed at New York city, in the county of New York and State of New York.

BYRON E. ELDRED.

Witnesses:

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