(No Model.)

P. W. MACKENZIE.

PROCESS OF MAKING GAS.

No. 418,646. Patented Dec. 31, 1889.

Fig 1

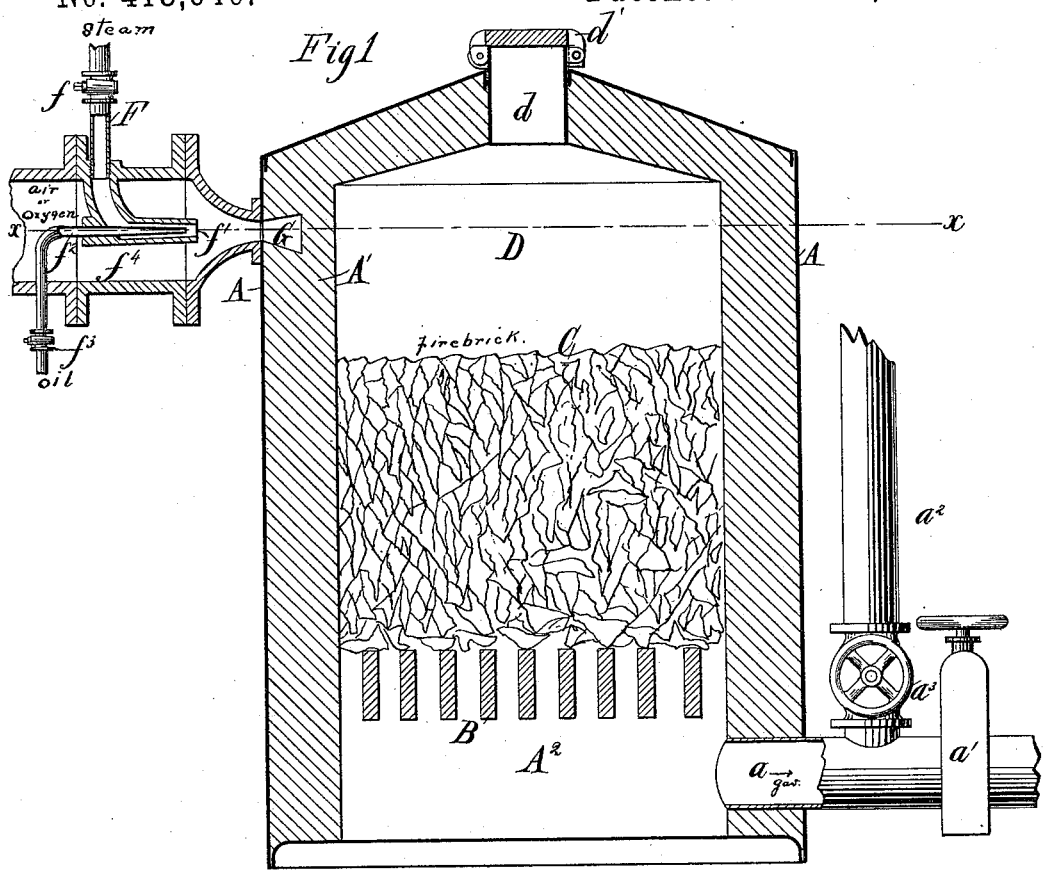
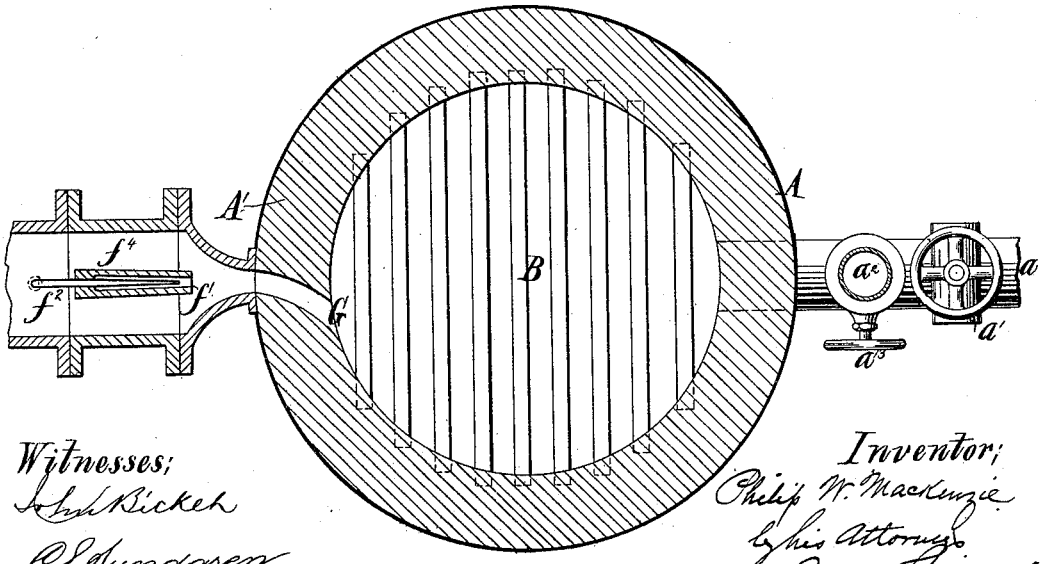


Fig 2.



Witnesses;
Robt Bickel
C. L. Sundgren

Inventor;
Philip W. Mackenzie
by his Attorneys
Brown Brownell

UNITED STATES PATENT OFFICE.

PHILIP W. MACKENZIE, OF NEW YORK, N. Y., ASSIGNOR TO THE FUEL GAS AND LIGHT IMPROVEMENT COMPANY OF AMERICA, OF SAME PLACE.

PROCESS OF MAKING GAS.

SPECIFICATION forming part of Letters Patent No. 418,646, dated December 31, 1889.

Application filed June 4, 1889. Serial No. 313,079. (No model.)

To all whom it may concern:

Be it known that I, PHILIP W. MACKENZIE, of New York, in the county and State of New York, have invented a certain new and useful Improvement in Processes of Making Gas, of which the following is a specification.

My invention relates to the production of gas to be used for fuel, which gas may have various heating qualities and is made from liquid hydrocarbon and water in the form of steam.

I will describe in detail a process embodying my improvement, and then point out the novel features in the claim.

The accompanying drawings illustrate apparatus by which my process may be conveniently carried out.

Figure 1 is a vertical section of such an apparatus. Fig. 2 is a horizontal section taken on the line x x, Fig. 1.

Similar letters of reference designate corresponding parts in both figures.

A designates the shell or body of the apparatus, which may be made of metal.

A′ designates a lining for the shell A, which lining may be of any desired thickness and made of fire-brick or other suitable refractory material. The lower portion of the shell or body comprises a chamber A^2, extending from which is an outlet a, provided with a valve a'. Extending also from the pipe a is a stack a^2, in which is arranged a valve or damper a^3. Above the chamber A^2 is arranged a grating B, which grating, as here shown, comprises a series of bars secured in the refractory material A′ at their ends. Upon the grating B, I place broken fragments of fire-brick or other suitable refractory material C to any desired depth. Above the broken refractory material C is a chamber D. The top of this chamber is of sufficient thickness to prevent loss of heat from the chamber D by radiation. In this chamber combustion takes place. Opening through the top of the chamber is a passage d, normally closed at its outer end by a cover d'.

Liquid hydrocarbon in the form of a spray is mixed with steam, preferably superheated, and air or oxygen, and the thoroughly-mixed product is delivered into the chamber D. I prefer to employ superheated steam to act as an injector. This superheated steam is delivered through a pipe F, provided with a cock f, into a nozzle f', with which nozzle communicates a pipe f^2, for liquid hydrocarbon, which pipe is provided with a cock f^3. The nozzle f' is arranged in an air-pipe f^4, which air pipe is provided with a cock. (Not shown.) The injector communicates with the interior of the chamber D through a passage G, which passage is, as here shown, curved, so that mixed air or oxygen, steam, and hydrocarbon will be delivered tangentially into said chamber and will be given a circular or whirling motion about the same.

The operation is as follows: A definite quantity of mixed hydrocarbon, superheated steam, and air or oxygen is delivered into the combustion-chamber D. The cover d' is raised and the gas ignited. When sufficiently burning, the cover is closed, and combustion is then continued in the chamber D. The valve a' in the outlet-pipe a is closed and the valve a^3 in the stack a^2 is opened. The products of combustion—carbonic acid and hydrogen — then pass downwardly through the fragments C into the chamber A^2, and are thence carried away through the stack a^2. This is continued until the mass of fragmentary material C is brought to a high state of heat. When this is accomplished, the supply of air or oxygen is shut off; but the supply of steam and hydrocarbon is continued in some what increased quantities. The valve a' is open and the valve a^3 closed. The circular or whirling motion given to the elements about the chamber D causes a thorough decomposition of all the atoms. The products of combustion pass downwardly, as before, through the highly-heated fragmentary mass C. The carbon of the hydrocarbon and the steam are practically burned together, producing carbonic acid and liberating the hydrogen. A portion of the oxygen of the carbonic acid absorbs carbon from the hydrocarbon, converting it into carbonic oxide. The permanent gas is delivered into the chamber A^2, and passes out from thence through the pipe a.

The operation is continued until the heat of the mass of material C is reduced to a

point where it will cease to be effective, and the operation of reheating is then repeated, as previously described, omitting the opening of the cover d', which is only necessary when igniting the gas for preliminary heating.

If richer gas is required, or when it might be used for illuminating purposes, a greater quantity of hydrocarbon is used, and when a continuous flow of gas is required two or more apparatuses having a common delivery-pipe may be used, which may be alternately heated.

Although I prefer to shut off the air or oxygen during the making of the permanent gas, I may employ it, and when air is used the nitrogen will be neutralized by the addition of a very limited quantity of carbon. By the use of separate superheating devices the different elements might be raised to a temperature such that a very limited quantity of air would be required for the maintenance of the heat, and consequently very little nitrogen would be produced.

I have filed an application for United States Letters Patent, Serial No. 313,078, June 14, 1889, for an improvement in gas apparatus adapted to carry out the process herein described and claimed. I do not herein lay claim to anything claimed therein.

What I claim as my invention, and desire to secure by Letters Patent, is—

The process of making fuel-gas, consisting in first converting hydrocarbon, steam, and air or oxygen by combustion into carbonic acid and hydrogen, next passing the product over refractory material to heat the latter to a high temperature, then discontinuing the air or oxygen and increasing the quantity of hydrocarbon, next burning this mixture and passing the products of combustion over the incandescent mass to convert them into a permanent gas by contact with the heated material, substantially as specified.

PHILIP W. MACKENZIE.

Witnesses:
ALBT. VAN DYKE,
GEORGE A. BAKER.