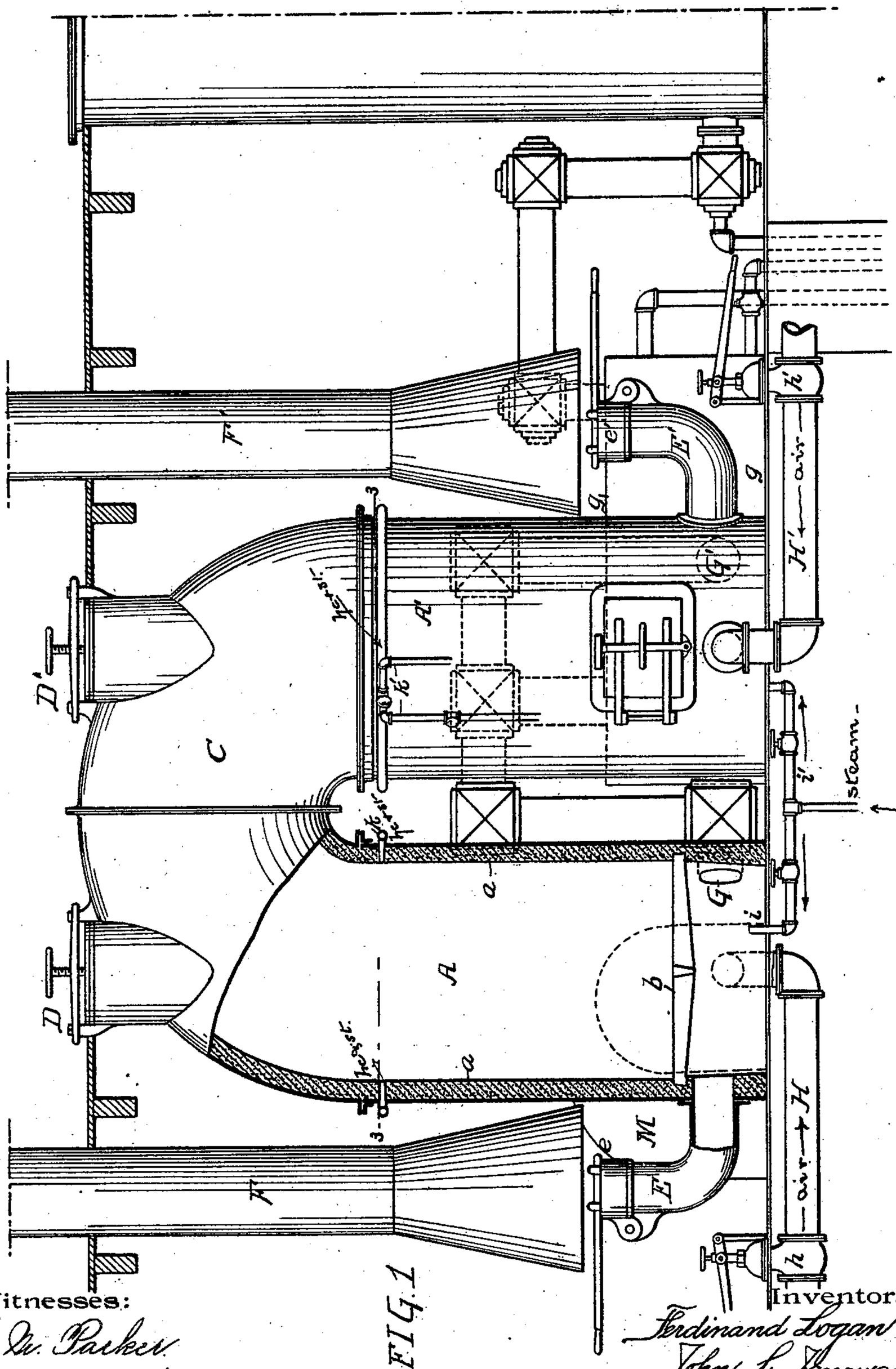
(No Model.) 2 Sheets—Sheet 1.

F. LOGAN & J. L. JANEWAY, Jr.

PROCESS OF MANUFACTURING GAS.

No. 539,064. Patented May 14, 1895.



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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2

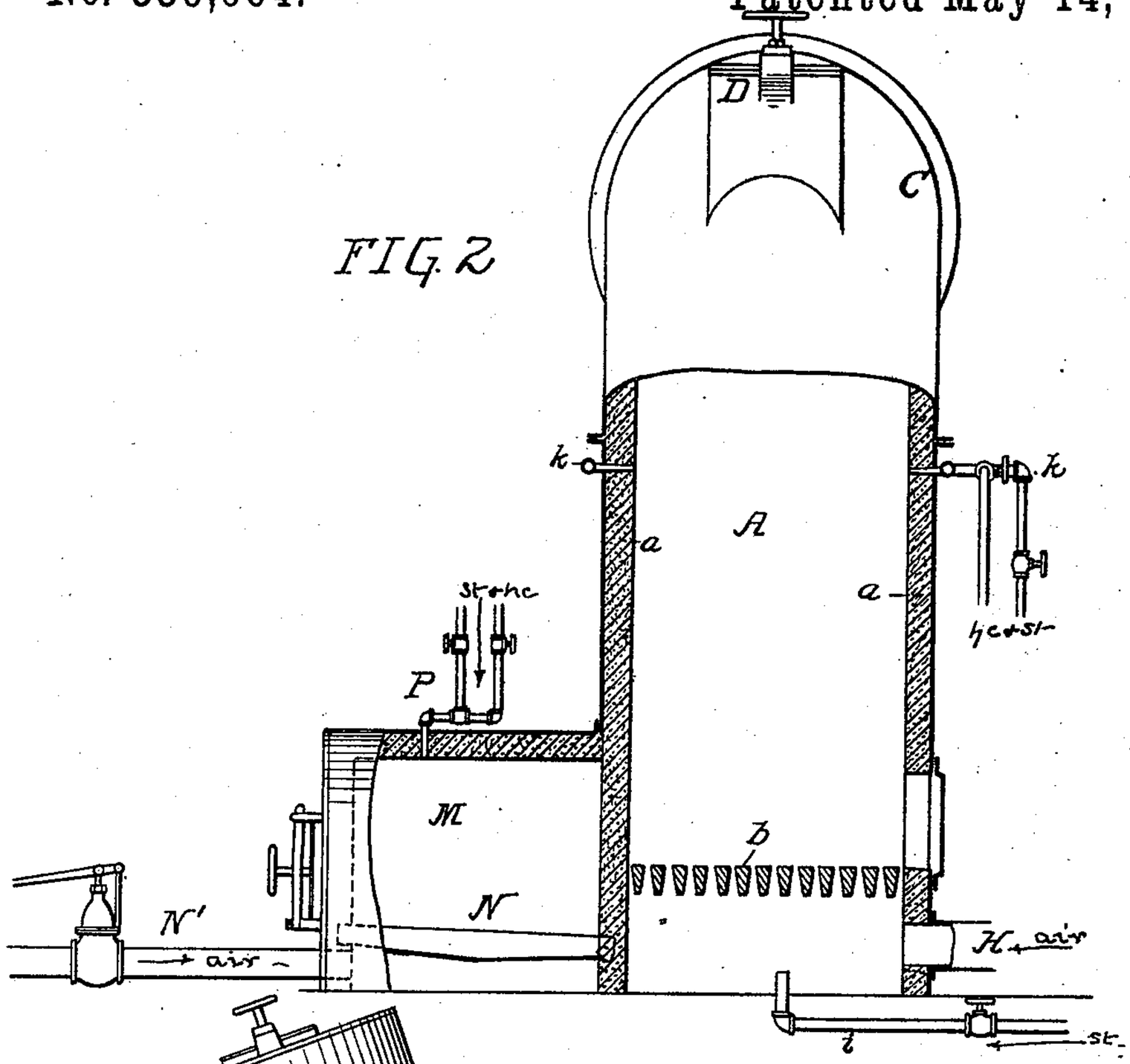

FIG. 3

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UNITED STATES PATENT OFFICE.

FERDINAND LOGAN AND JOHN L. JANEWAY, JR., OF PHŒNIXVILLE, PENNSYLVANIA, ASSIGNORS TO THE PHŒNIX GAS AND IMPROVEMENT COMPANY, OF CAMDEN, NEW JERSEY.

PROCESS OF MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 539,064, dated May 14, 1895.

Application filed February 12, 1894. Serial No. 499,844. (No specimens.)

To all whom it may concern:

Be it known that we, FERDINAND LOGAN and JOHN L. JANEWAY, Jr., citizens of the United States, residing at Phœnixville, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Manufacturing Gas; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Our invention relates to certain improvements in the process of manufacturing gas, and has for its object to simplify, improve and cheapen the method of producing the same.

In the accompanying drawings, Figure 1 is a part-sectional elevation of a gas-producing apparatus by which our invention may be carried into effect. Fig. 2 is a sectional elevation of the same on the line 2 2, Fig. 3; and Fig. 3 is a sectional plan view on the line 3 3, Fig. 1.

In describing the apparatus employed, those portions which are duplicated, are for convenience, designated by corresponding reference letters.

A, A′, represent two generating chambers of circular form in cross section, and each lined from top to bottom with fire brick *a*, and provided with grate bars *b*. At their upper ends these chambers are united by a semi-circular flue, C, of a diameter equal to that of the chambers, and having also a lining of fire brick so as to form a continuous passage of the same diameter throughout from chamber to chamber.

The flue, C, is provided at points immediately above the chambers, with doors or manholes, D, D′, for feeding fuel, &c., into the chambers, and for using slicing bars to break up the mass of fuel from time to time. From the chambers, below the grate bars, extend discharge pipes, E, E′, communicating with discharge stacks, F, F′, and provided with valves *e*, *e′* by which the escape of the products of combustion may be governed when the apparatus is started into operation. The chambers are likewise provided with gas outlet pipes, G, G′, leading to a hydraulic main or wash box *g*, from whence the gas is discharged to the usual scrubbers, purifiers, &c.

Beneath the grate bars are air blast pipes, H, H′, having valves *h*, *h′*, and steam supply pipes *i*, *i′*, through which steam is admitted for the manufacture of water gas.

Near the upper portions of the generating chambers are pipes *k*, *k′*, through which oil and steam are forced into the chambers for enriching gas already formed, or for the purpose of manufacturing an oil gas, when desired, the pipes being preferably arranged in a circle around each chamber and provided with a number of equi-distant nozzles so that the supply may be evenly distributed within the chambers.

In starting the operation, a light wood fire is built on the grate of one of the chambers, say chamber, A, and on top of this is placed a quantity of carbonaceous material such as coke, coal, culm black or other material. The opposite chamber, A′, is also supplied with a quantity of coke, or anthracite coal, culm or slack, and air blast valve *h* and escape valve *e′* are opened and all other valves are closed. The blast of air is continued until the coke, coal, culm or slack in chamber, A, is raised to a very high temperature, and the products of combustion passing through the flue, C, and down through the chamber, A′, will raise the temperature of the coke, coal, culm or slack in the latter, until it assumes an incandescent condition. When the desired temperature is reached the valves *h* and *e′* are closed, and the charging door, D, of chamber, A, is opened, and a quantity of carbonaceous material, preferably bituminous coal, is thrown in on top of the highly heated coke. Steam is then admitted to chamber, A, through the pipe and a small quantity of air admitted through the air blast pipe, H, by opening the valve *h*, care being taken to admit just sufficient air to maintain the desired heat. The mixture of air and steam will make producer gas, and the coal will be heated to a sufficient degree to part with a portion of its gas, which with the

producer gas, will pass through the mass of highly heated fuel in the chamber, A′, and become a fixed gas, escaping finally through the pipe, G′ to the hydraulic main or wash box *g*. The steam in passing through the mass of highly heated coke in the chamber, A, is to a certain extent decomposed, and the disassociated oxygen combines with the carbon of the coal and becomes a carburized water gas, which after being fixed by its passage through the fuel in chamber, A′, may be used either as an illuminating or fuel gas. After a time the coal is decarburized and will no longer enrich the so formed water gas, or give off gas to mingle with the producer gas, and the valves of the steam and oil pipes are opened to permit the injection of the liquid hydrocarbon for the purpose, the quantity of steam injected being sufficient only to force the oil into the chamber and vaporize it so that it may more readily combine with the gases produced in chamber, A. The air admitted at the base of chamber, A, is not sufficient to support active combustion, and after a time this chamber will become cooled, and will no longer possess sufficient heat to form gas, while the temperature of the chamber, A′, is kept up by a partial combustion of its coke as the latter unites with the excess of oxygen from the steam admitted. When this occurs the valve *h* is closed and the steam from pipe *i*, and steam and oil from pipes *k* are shut off, and, all valves being closed, including the escape, G′, the door, D′, is opened and a charge of coal is thrown in on the incandescent coke in chamber, A′. Steam is then admitted through pipe *i*′, and air through pipe, H′, and the gas outlet, G, from chamber, A, is opened, while the process of manufacture goes on as before described, except that the flow of gas is in the opposite direction, and escapes through pipe, G.

The manufacture of gas is kept up continuously, the decarburized coal becoming as a matter of course, coke, to take the place of that consumed in the chambers, and the gradual feeding of coal from time to time being found sufficient to keep up the supply.

We have found in actual practice, that by using an apparatus of this construction we are enabled to carry on the process of production without stopping, except to supply fresh fuel and change the direction of flow of the products, and that the resultant gas, a mixture of so-called producer gas, water gas, coal gas, oil gas and carbureted hydrogen, will, when fixed by the heated mass in the fixing chamber, be capable of use as an illuminating or fuel gas, at pleasure.

The apparatus employed is susceptible of various changes in its general character, in order that we may make, with a single apparatus, producer gas of varying quality and character in accordance with the purpose for which it is required, or to suit the surrounding conditions of the plant. Thus, in some localities where it may be more economical to use coal or culm or slack or other lump carbon, than oil, the use of oil may be restricted to the enriching of the formed gas, while in other localities it may be more economical to employ oil alone as the gas producing agent. In order to meet this latter requirement, the apparatus is provided with a combustion chamber, M, situate to one side of one of the main chambers, and comprising merely a lined chamber provided with grate bars, N, an air blast pipe, N′, and a steam and oil pipe, P. This chamber may be made to communicate with the chamber, A, by simply moving the fire brick lining of the latter from a point below the junction of the shells of the two chambers, M, and, A, as will be seen by reference to Fig. 2. This portion of the lining being removed, the grate bars of both chambers, A, A′, are taken out and the two chambers, A, A′, and the flue C, are filled with checker work, as usual, the checker work extending from the base of the chamber and through the flue, C, so that the mixed steam and hydro-carbon will be subjected to more intimate contact with the heated surfaces of the checker work while pursuing its tortuous passage than if no impediments were in its path.

In using oil alone, a fire is started at the base, N, in chamber, M, and the air blast, N′, and oil and steam pipe, P, are turned on until the checker work in the chambers, A, A′, becomes thoroughly heated. The air blast is then nearly or quite cut off, a small quantity of air being preferably admitted to support combustion in a small way, and steam only is admitted through the pipe, P, the steam being superheated, and when it arrives at the top of the chamber, A, acting as a forcing medium for conveying the steam and oil admitted through the pipe *k* through the checker work in the chamber, A′, and producing a fixed gas. This latter process, however, forms no part of our present invention, the apparatus however being designed to more effectually carry out such process, and to lengthen the life of the checker work in the chamber, A. Usually, the manufacture of such gas is carried on by firing at the base of the chamber, A, and the high temperature at this point soon destroys the lower and more exposed portion of the checker work, causing it to crumble and give way, and permitting the upper portion to settle. This difficulty is avoided by the employment of the separate combustion chamber, M, as the force of the heated blast will not act so destructively on the checker work, and will enable it to be used for a much longer period of time.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

A continuous process of manufacturing gas, said process consisting in, first, heating to incandescence two bodies of carbonaceous material in separate chambers by igniting the material in the first chamber and blowing up-

wardly through the first chamber and thence over and downwardly through the second chamber, whereby the formation of ash and cinder in the lower portion of the second chamber is prevented; second, adding to one of such bodies, in the first chamber, a material rich in carbon; third, passing through such body of incandescent material and the rich carbonaceous material a supply of steam to form a gas, which latter is enriched and mingles with the gas produced from the added carbon, the quantity of steam admitted being so great that the oxygen it affords will be in excess of the quantity which can combine with the carbon in the first chamber, so that the steam will act as a forcing agent for carrying the gas through both chambers and will in the second chamber yield up its oxygen to maintain combustion in said second chamber; fourth, passing such formed gas and steam through the second body of carbonaceous material in the second chamber and fixing it, continuing such operation until the first body of carbonaceous material is partially cooled; fifth continuing the manufacture of gas as described and injecting into the first chamber, above the first body of carbonaceous material, a mingled quantity of oil and steam under pressure and forcing the oil as vaporized hydrocarbon and the water gas mingled with it down through the second body of carbonaceous material, the steam acting as a forcing agent for the oil being condensed after leaving the second chamber; sixth, adding to the second body of carbonaceous material, a material rich in carbon, and, finally, reversing the flow of air and steam and continuing such operations alternately, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

FERDINAND LOGAN.
JOHN L. JANEWAY, JR.

Witnesses:
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ERNEST LOWENGRUND.