No. 682,039. Patented Sept. 3, 1901.

E. B. CORNELL.

GAS GENERATOR.

(Application filed Oct. 24, 1900.)

(No Model.) 2 Sheets—Sheet 1.

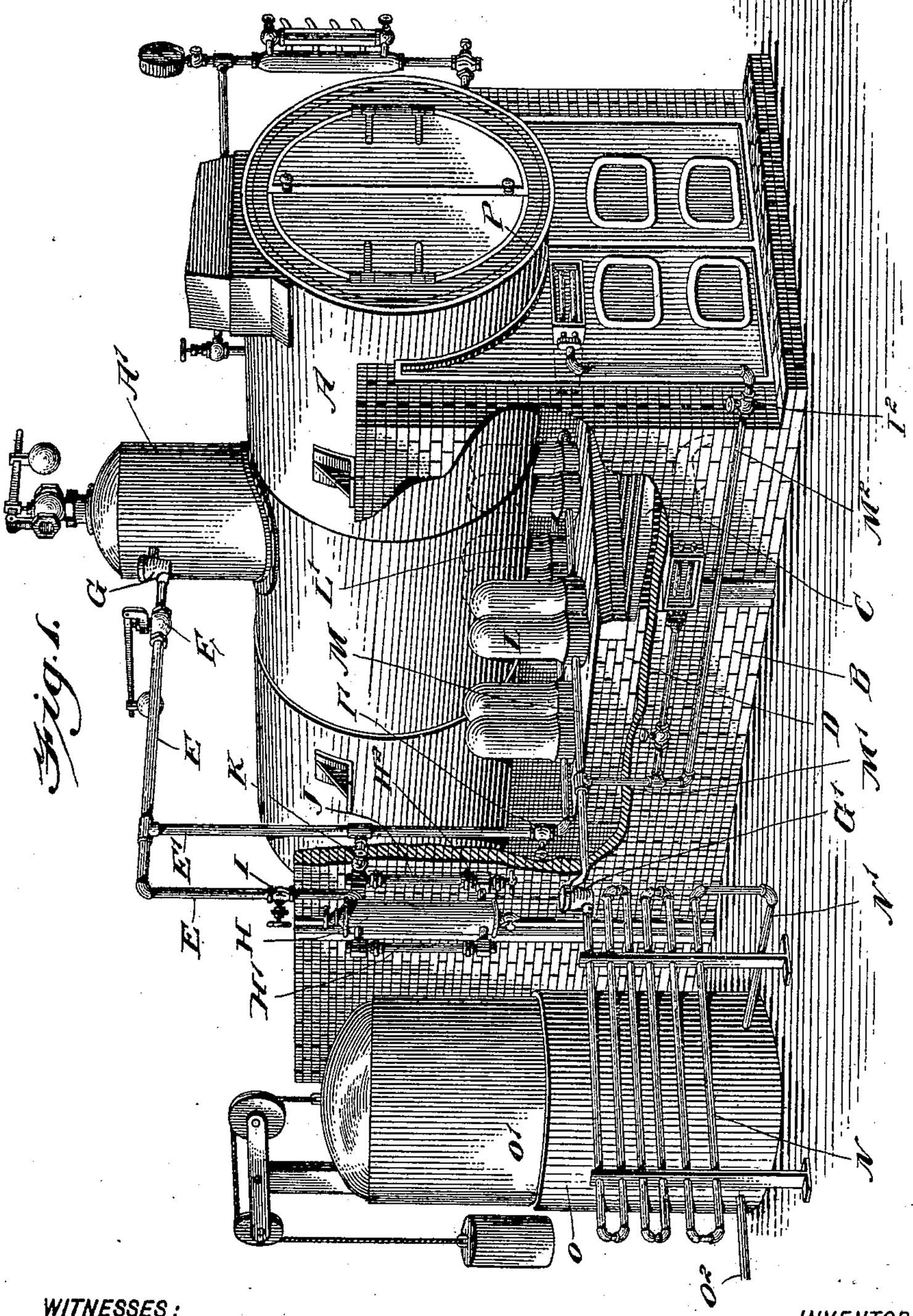

Fig. 1.

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Fig. 2.

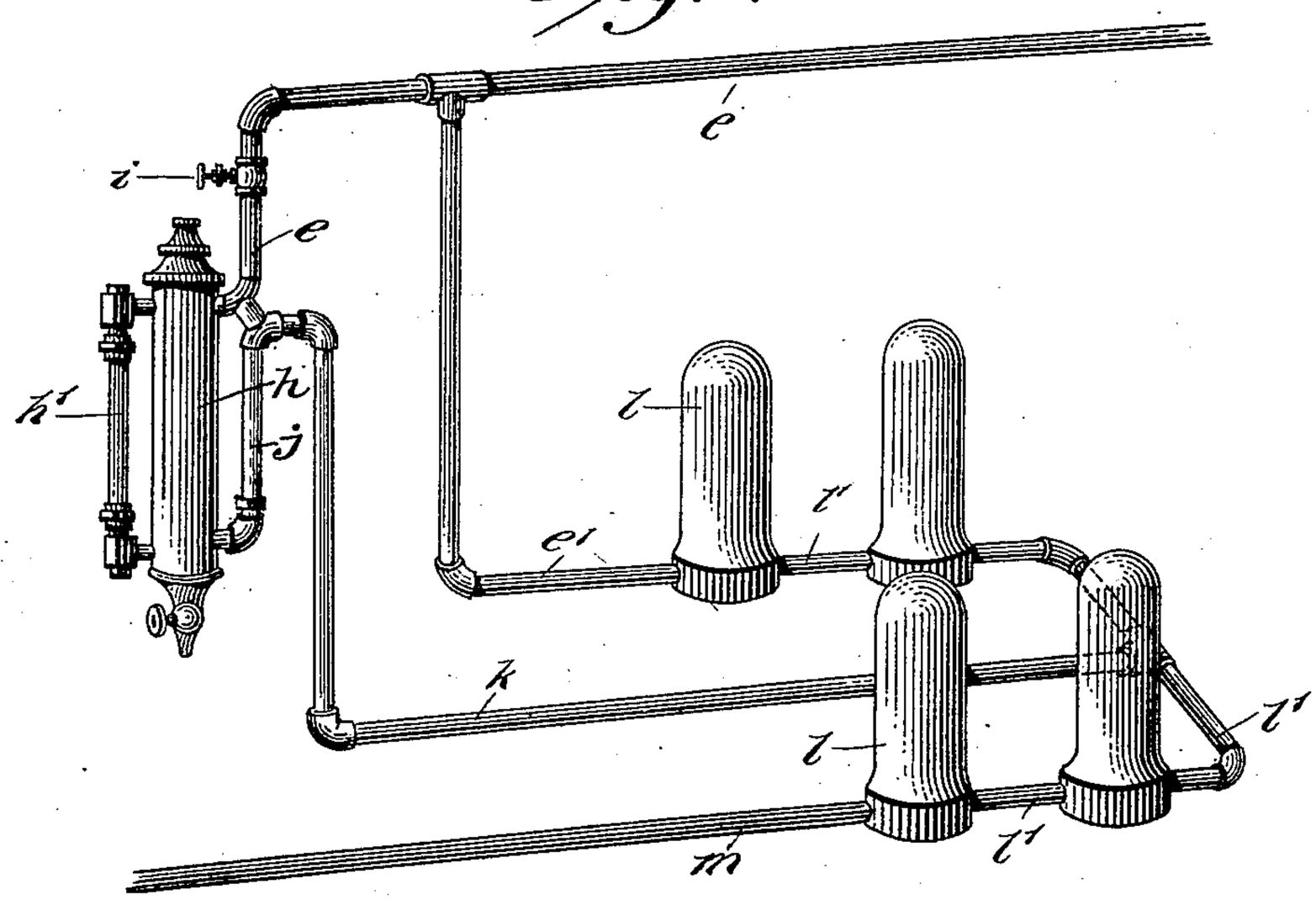
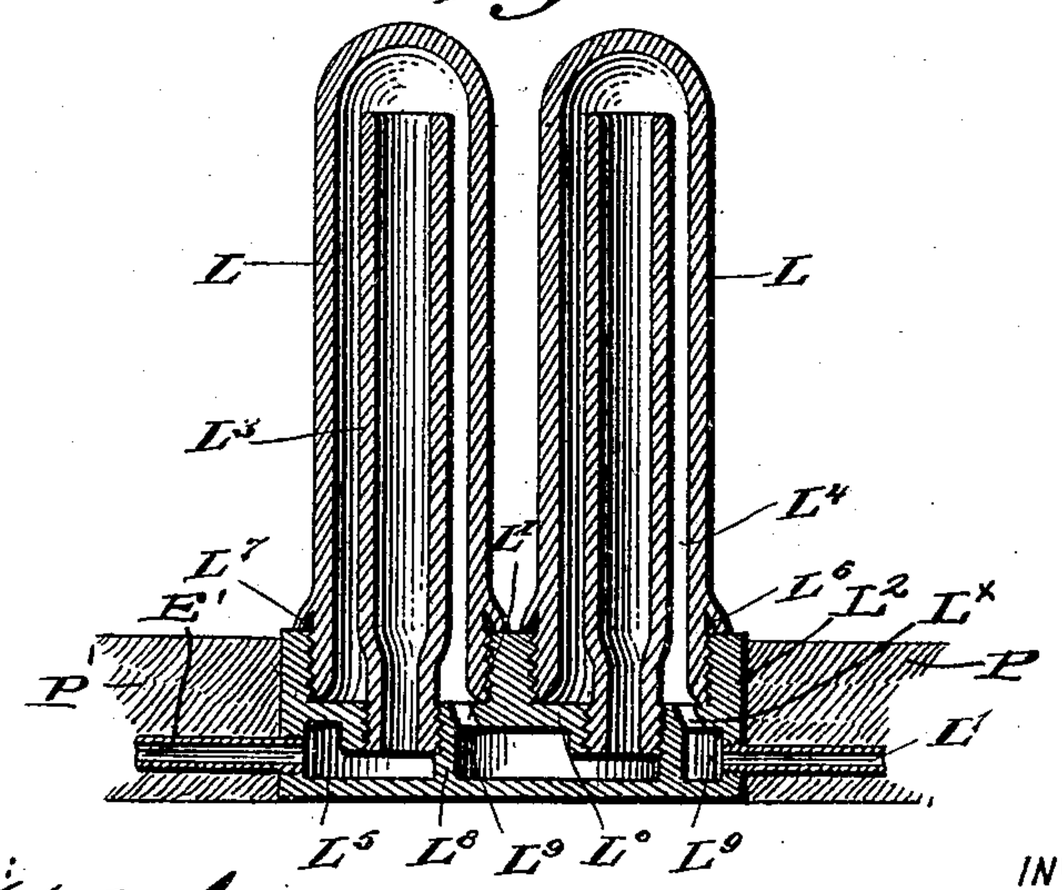


Fig. 3.



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ELIJAH BEANS CORNELL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO WILLIAM C. ALDERSON, OF SAME PLACE.

GAS-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 682,039, dated September 3, 1901.

Application filed October 24, 1900. Serial No. 34,158. (No model.)

To all whom it may concern:

Be it known that I, ELIJAH BEANS CORNELL, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and Improved Gas-Generator, of which the following is a full, clear, and exact description.

My invention relates to apparatus for producing gas by heat, and has for its object to provide an efficient apparatus for utilizing the heat of a furnace for the production of a fixed gas suitable for illuminating and heating purposes and capable of use for heating the furnace which serves to generate said gas.

The invention will be fully described hereinafter and the features of novelty pointed out in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of a boiler-furnace having my invention applied thereto with parts broken away. Fig. 2 is a diagrammatic perspective view of a portion of a slightly-different construction, and Fig. 3 is a sectional elevation of a set or bench of retorts forming part of my improved gas-generator.

In the drawings, A represents an ordinary steam-boiler with its setting B, a grate C of any suitable construction, and a bridge-wall D. From the steam-dome A′ leads a steam-pipe E, provided with a safety-valve F and with a pressure-reducing valve G, and said pipe connects with the upper portion of a cup or casing H, having a gage-glass H′, the connection being controlled by a cock or valve I. This casing is constructed after the style of a hydrostatic sight-feed, such as those used for lubricating steam-engines. From the lower end of the casing H a nipple H^2 leads to a transparent sight-feed tube J, and from the upper end of the latter by a pipe K to a branch E′, connected with the steam-pipe E. This branch pipe E′ leads to the retorts L, arranged in sets at each side of the boiler A, as shown, and communicating with each other by tubes L′, which are protected by being embedded in fire-brick. This protective brickwork has been omitted from Fig. 1 for the sake of clearness, but is shown at P in Fig. 3. A cock or valve I′ controls the connection of the pipe E′ with the retorts L. The retorts are constructed in detail as shown in Fig. 3. Each two retorts have a common base L^2, into which screw the retorts proper or shells L and the tubular cores L^3, opening at their upper ends into the chamber L^4 between the shell and the core and at their lower ends into the inlet-chamber L^5 of the base L^2. The shells L have flanges L^6, recessed to receive packing-rings L^7. A partition L^8 separates the inlet-chamber L^5 from the outlet-chamber L^9, and another partition L^0 separates the annular chamber L^4 from the inlet and the outlet chambers, an aperture $L^\times$ establishing communication between the outlet-chamber of one retort and the inlet-chamber of the other retort on the same base. The retorts are made of cast-iron lined interiorly with a non-oxidizable material, such as carbid of iron.

By the above-described construction the steam and hydrocarbon in their passage through the several retorts will be subjected to successive contractions and expansions, thus retarding them, so that the steam will be decomposed and the hydrocarbon completely broken up and thoroughly mixed with the decomposed steam.

The outlet-pipe M leads from the last retort of the apparatus to a suitable condenser N, at the inlet of which is located a pressure-reducing valve G′, the condenser consisting of a coil which is preferably immersed in a cooling liquid, such as water. (The drawings do not show the tank containing this liquid, but the arrangement is so common that it will be understood without further illustration.) The outlet N′ of the condenser leads to a gas-holder O, having a balanced movable bell O′ or constructed in any other approved manner. From the outlet-pipe M a branch pipe M′ leads to burner-pipes M^2, having at their ends burners P of any suitable construction, said burners being located either above or below the grate C in any position that may be most convenient in each individual case.

I^2 represents valves controlling the supply

of gas to the burners, and O^2 is a main or service pipe for distributing the gas to places where it is used for lighting, heating, or motive purposes.

In operation to start the apparatus a fire is made on the grate C and is kept up until sufficient gas is generated to heat the furnace by means of the burners P. When steam is formed in the boiler and the valves G, I, I′, and G′ are open, a portion of the steam will pass from the dome A′ into the pipe E and directly to the retorts L through the branch pipe E′. Another portion of the steam will enter the cup or casing H, which is filled with oil or other suitable liquid hydrocarbon, and this hydrocarbon in a globular condition will pass from the sight-feed tube J and the pipe K to the pipe E′ to enter the retorts together with the steam passing directly through the said pipe E′. In the retorts (see Fig. 3) the mixture passes first upward through the hollow core L^3 and then spreads as a thin film in the surrounding chamber L^4, so that every particle of the mixture is subjected to an intense heat by contact with the shell L, which is directly exposed to the combustion-gases and becomes red-hot. The steam is decomposed into its elements (oxygen and hydrogen) and the latter forms a fixed gas with the hydrocarbons. The connections L′ are of a smaller diameter than the pipe E′, so as to retard the flow of the gaseous mixture and to allow more time for a thorough reaction. The production of a fixed gas in the manner described is not claimed by me in this application, but forms the subject-matter of another application for a patent filed concurrently herewith. The gas produced in the retorts passes through the condenser or cooler N to the gas-holder O, to be supplied therefrom to the service-pipe O^2. A portion of the gas may be fed to the burners P by opening the valves I^2, so as to render the further burning of fuel on the grate C unnecessary.

While I have shown the application of my invention to a boiler-furnace, I desire it to be understood that this is an example only, as the invention may be applied wherever a sufficient degree of heat is available. The retorts themselves should be exposed to the heat directly, but the connections L′ should be protected, as described. In some cases where the heat is very high, as in certain metallurgical furnaces, I find it advisable to subject the hydrocarbon to the heat for a shorter time than the steam. This I may effect by the arrangement shown in Fig. 2, in which steam coming from the boiler through the pipes *e* and *e′* passes through all the retorts *l*, while the hydrocarbon conveyed from the cup or casing *h* through the pipes *j* and *k* passes only through one-half of the retorts—that is to say, the steam passes through the first set of retorts and is decomposed, forming hydrogen gas, and then the hydrocarbon is introduced into the said gas as it passes from the retorts and both the gas and hydrocarbon will enter the second set of retorts together, forming carbureted hydrogen gas, and in their passage through the several retorts, being subjected to a series of successive contractions and expansions while highly heated, will pass from the said retorts as a fixed illuminating-gas. It will be understood that the first set of retorts will become foul, owing to decomposition, and will occcasionally require cleaning. Of course, as circumstances may require, the hydrocarbon may be made to pass through a greater or smaller portion of the retorts.

Various modifications may be made without departing from the nature of my invention as set forth in the appended claims. Thus the number, the size, and the location of the retorts may be altered.

I desire to state that with my improved process I can effect a very considerable economy of fuel. In fact, with an apparatus of the character shown I can produce sufficient gas not only to supply the burners P and keep up in the boiler A the steam-pressure necessary for motive purposes, but in many cases to light the entire building in which the machinery or furnace is located.

It will be seen that in my invention I employ a conventional type of horizontal boiler with its furnace and bridge-wall, such as is ordinarily used for supplying steam for motive power. I also employ a gas-making apparatus in which its retorts are located on the bridge-wall and within the influence of the same heat that raises steam, and also an external gas-cooling device and gasometer. The parts of this organization are so correlated as to produce an intimately coacting organization of liquid-fuel economizer, in which the well-known form of furnace does double duty and a permanent fixed gas is produced without depositing carbon, both for use in heating the boiler and retorts and for lighting, and whereby also the full value of the steam-boiler for motive power is preserved.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a furnace, of retorts arranged in sets on the bridge-wall of the furnace, the sets being connected together, a steam-supply connected with one set of the retorts, and a hydrocarbon-supply connected with the connection between the sets of retorts, as set forth.

2. The combination with a furnace, and a boiler, of retorts arranged in sets on the bridge-wall of the furnace and on opposite sides of the boiler, a connection between the sets of retorts, a steam-pipe leading from the boiler to one of the sets of retorts, and an automatic oil-feed connected with the connection between the sets of retorts, as set forth.

3. A gas-generator of the character described, comprising sets of retorts connected

together and adapted to be placed in a furnace to be acted upon directly by the heat thereof, a steam-pipe leading to one set of retorts, a hydrocarbon-reservoir connected with the steam-pipe, and a connection connecting the reservoir with the connection between the sets of retorts, as set forth.

4. A gas-generator of the character described, comprising sets of upright double-walled retorts arranged in sets connected together, said retorts being adapted to be placed in a furnace to be acted upon directly by the heat thereof, a steam-pipe leading to one set of retorts, a hydrocarbon-reservoir connected with the steam-pipe, a sight-feed tube connected with the reservoir, and a pipe leading from the sight-feed tube to the connection between the sets of retorts, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ELIJAH BEANS CORNELL.

Witnesses:
JOHN LOTKA,
EVERARD BOLTON MARSHALL.