

(No Model.)

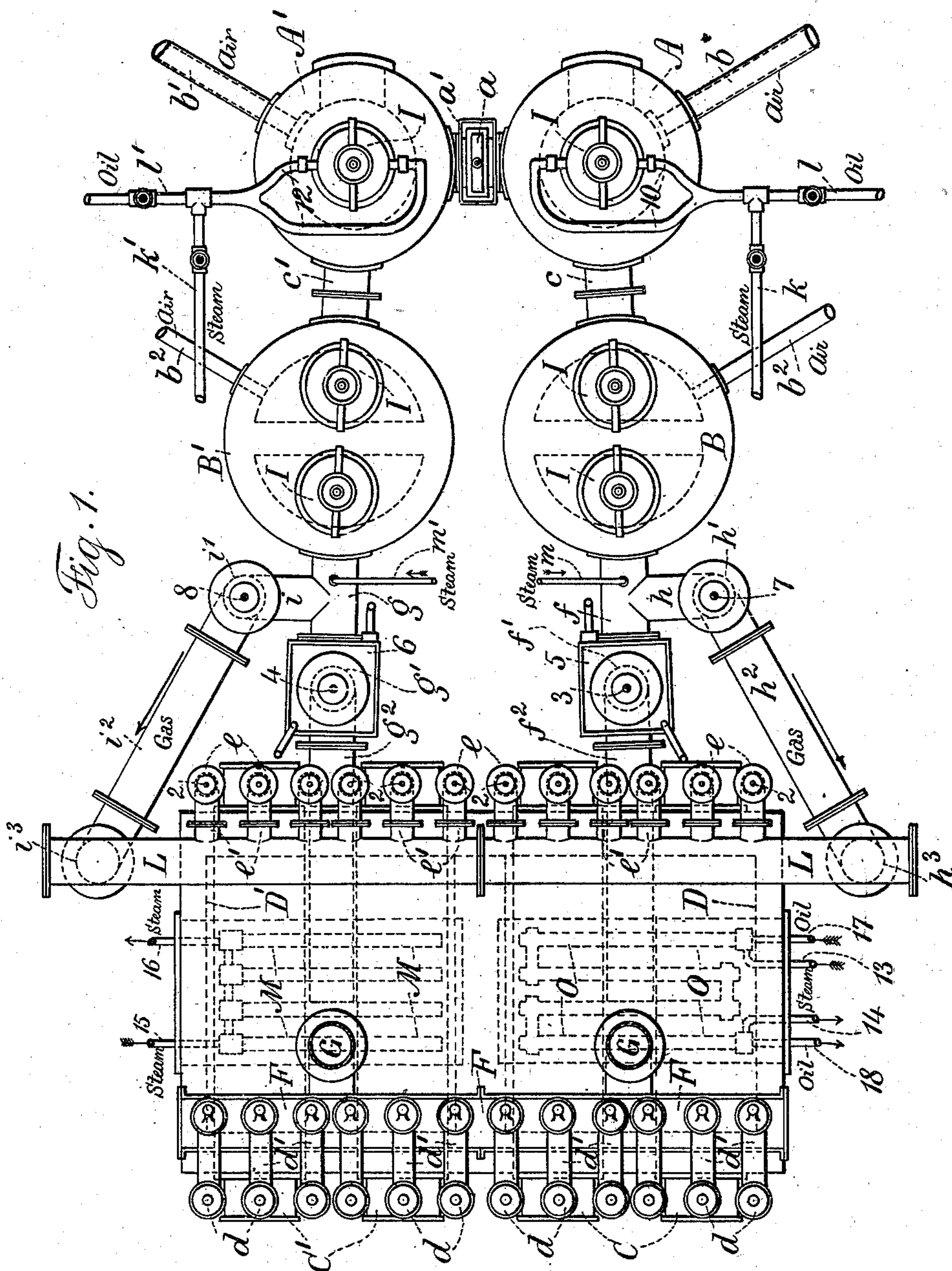
3 Sheets—Sheet 1.

H. M. PIERSON.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

No. 558,740.

Patented Apr. 21, 1896.



Witnesses:
J. Staib
Chas. N. Smith

Inventor:
Henry M. Pierson
per Lemuel W. Serrell

(No Model.)

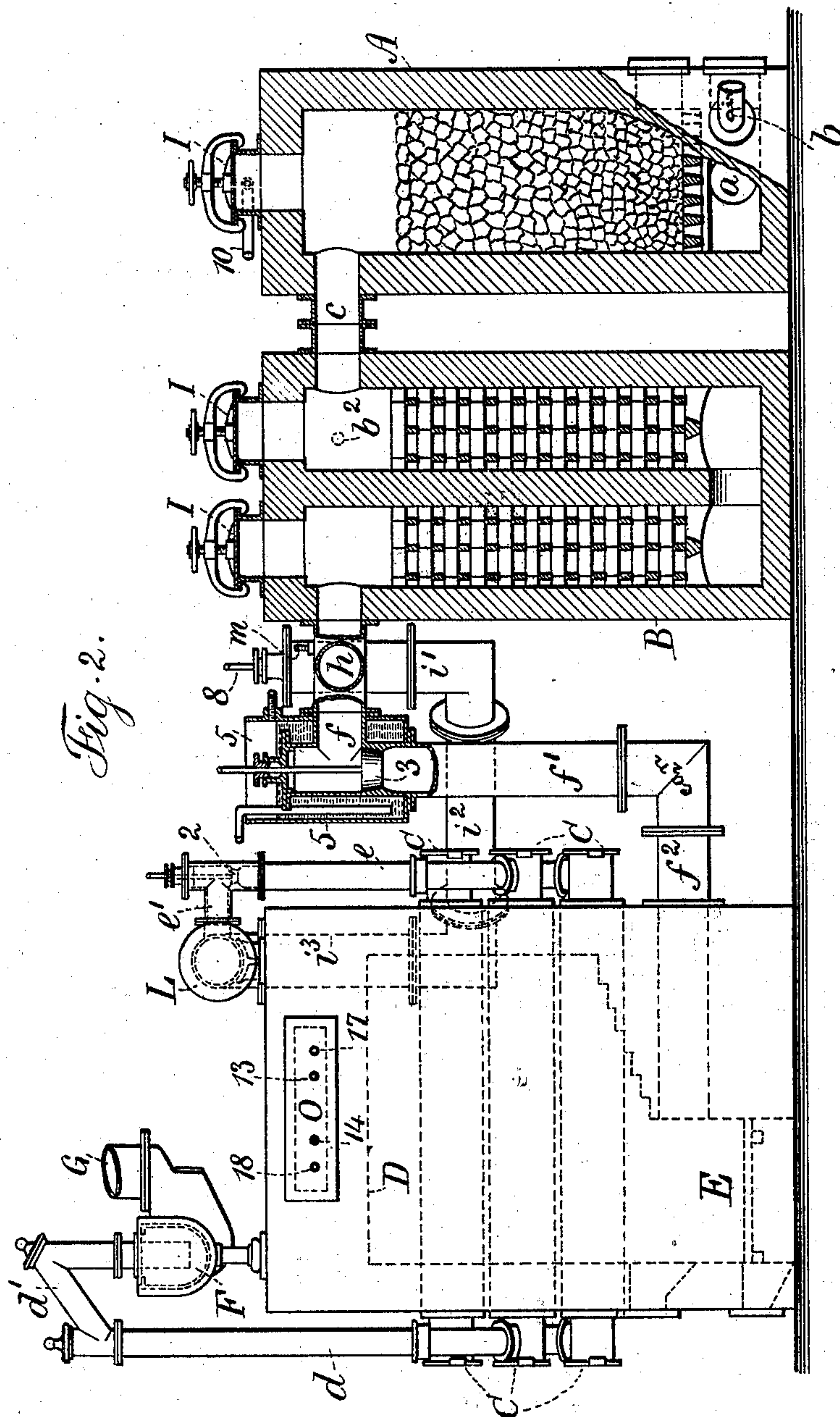
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3 Sheets—Sheet 3.

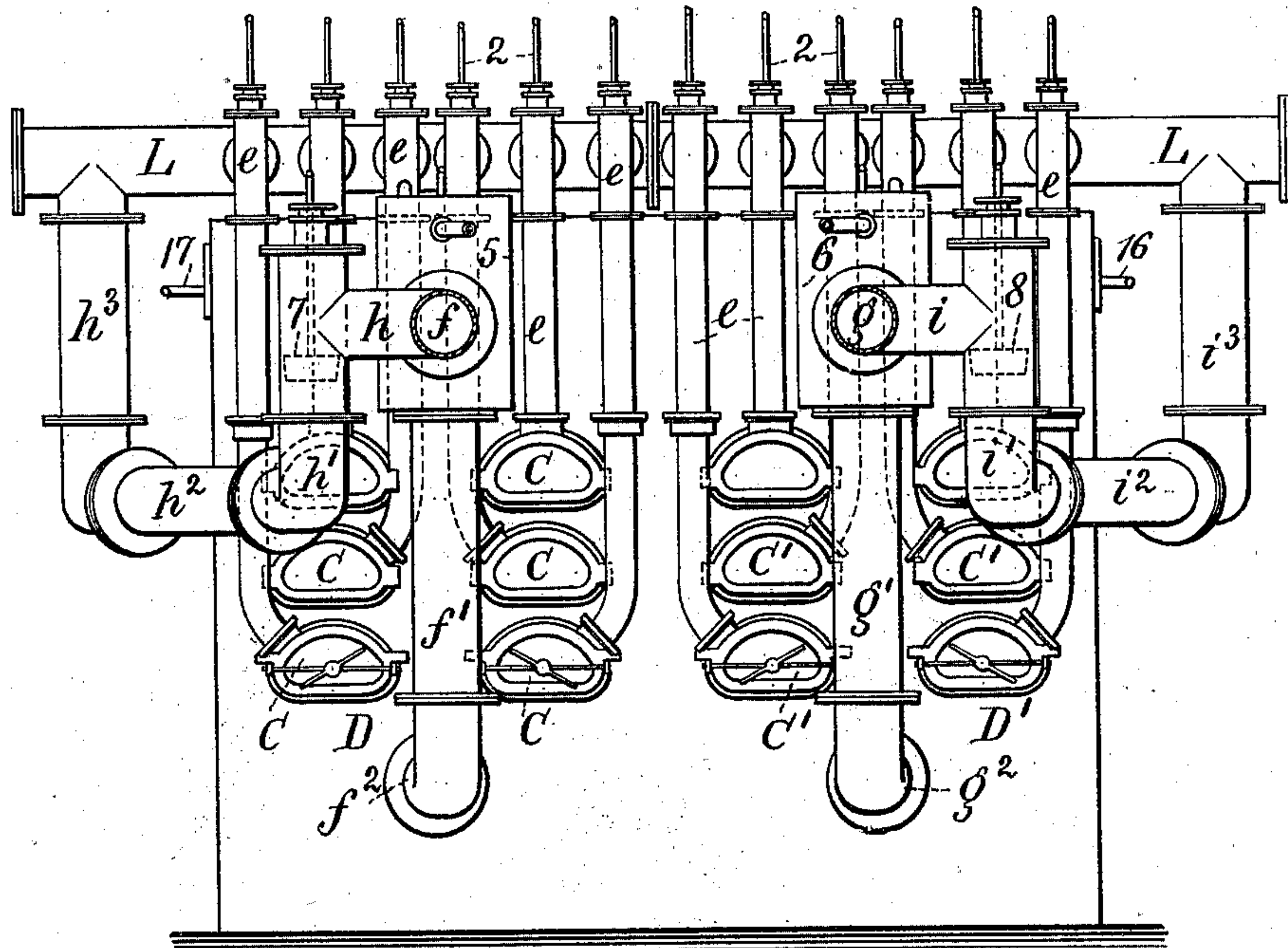
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Fig. 3.



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UNITED STATES PATENT OFFICE.

HENRY M. PIERSON, OF BROOKLYN, NEW YORK.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 558,740, dated April 21, 1896.

Application filed October 23, 1895. Serial No. 566,632. (No model.)

To all whom it may concern:

Be it known that I, HENRY M. PIERSON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in the Process of and Apparatus for the Manufacture of Gas, of which the following is a specification.

My present invention is designed as an improvement upon the apparatus described and shown in Letters Patent granted to me November 12, 1895, No. 549,657, and also upon the method and apparatus described and shown in Letters Patent granted to me July 5, 1892, No. 478,459, and June 27, 1893, No. 500,424, all of which relate to the manufacture of coal-gas, water-gas, and oil-gas, and which gases are commingled to form a permanent compound gas.

My present invention relates to the particular arrangement of the apparatus employed and to the method of operating the same to produce the desired result in the most economical and expeditious manner.

In carrying out my invention I employ connected generating-furnaces, refractory-material fixing-chambers connected with the generators, benches of coal-gas retorts heated by retort-furnaces having continuous fires, pipes connecting the fixing-chambers with the retort-chambers adjacent to the fires of the retort-furnaces, pipes connecting the fixing-chambers with a main pipe and branches therefrom to the ends of the coal-gas retorts, and rising pipes from the other ends of said retorts to a hydraulic main and away to a common holder.

The details of the apparatus and the method of operating the same are hereinafter more particularly described.

In the drawings, Figure 1 is a general plan representing my improved apparatus. Fig. 2 is a general side elevation, one generating-furnace and one fixing-chamber being in section; and Fig. 3 is an elevation of the back of the retort-chambers and benches of retorts and section of the pipes for gas, &c., just back of the fixing-chambers.

A A' represent the companion generating-furnaces. These are of usual construction and receive coke from the coal-gas retorts above their grate-bars, and are provided with

inlet-pipes *b b'*, admitting air under pressure below their grate-bars. These generating-furnaces are connected below their grate-bars by a pipe and valve *a*, around which valve a water-jacket *a'*, as shown, may be placed, if found desirable.

B B' represent circular two-part refractory-material fixing-chambers, which are each constructed with a central wall with an open-arched base and checker-brick laid up in the usual manner upon tile arches in the two chambers or compartments formed by the central wall. The heating-passage is by this construction practically doubled and the efficiency increased.

The generating-furnaces A A' and fixing-chambers B B' are connected together by the throats *c c'* at their upper ends, and gas-tight covers I are provided upon the generating-furnaces and fixing-chambers to provide for access to the fixing-chambers and for introducing fuel or coke into the generating-furnaces. Air-pipes *b²* are provided and open into the upper ends of the fixing-chambers for admitting air, if desired, and at the proper time for insuring perfect combustion of the gases as they enter the fixing-chambers.

D D' represent the retort-chambers, each containing a bench of coal-gas retorts. I have shown the two benches C C' each of six retorts. More or less may be employed without departing from my invention.

Within the retort-chambers under the benches of retorts are the retort-furnaces E, and upon the retort-chambers is a hydraulic main F and pipes G therefrom to a common holder. Pipes *d*, with branches *d'*, connect the hydraulic main F with the retorts of the benches at one end.

The other ends of the coal-gas retorts are provided with stand-pipes *e* and branches *e'*, connected to a main L, extending along over the top of the retort-chambers. In the upper end of each stand-pipe *e* is a plunger-valve 2, that may be operated in any desired manner, and these valves may be operated singly or all together, or in any desired number or group.

Extending out from the fixing-chambers B B' at their upper ends are lined pipes *f g* with branches *h i*. These pipes *f g* have descending members *f' g'* and horizontal mem-

icc

bers $f^2 g^2$ at their bases entering the retort-chambers in proximity to the retort-furnaces E. At the junction of the pipes $f g$ and $f' g'$ are plunger-valves 3 4 and surrounding water-jackets 5 6, the construction of which is well known. The branch pipes $h i$ have connected with them the descending horizontal and rising members $h' h^2 h^3$ and $i' i^2 i^3$, the rising members h^3 and i^3 connecting with the respective ends of the main L. At the junction of the branch pipes $h i$ and descending pipes $h' i'$ are plunger-valves 7 8.

The steam-supply pipe k and oil-supply pipe l are provided with valves and are brought together, and therefrom a union-pipe 10 opens into opposite sides of the neck of the generating-furnace A. A like construction is preferred for the generating-furnace A', wherein the steam-pipe k' and oil-pipe l' and the union-pipe 12 are employed.

I provide steam-pipes $m m'$, opening into the pipes $f g$, adjacent to the fixing-chambers for a purpose hereinafter described.

In my allowed application, Serial No. 548,166, heretofore referred to, I have shown receptacles over the retort-chambers in the furnace-wall and pipes in series therein for superheating steam and for highly heating liquid hydrocarbons, and in the present application I have indicated similar series of pipes, the steam series being shown at M and the oil series at O. In these series steam from a boiler passes by the pipe 13, through the series O, and away by the pipe 14 to the pipe 15 and through the series M and away by the pipe 16 to the steam-pipes $k k' m m'$, as may be required for use in the gas-making processes. In these series oil or liquid hydrocarbons come from a source of supply to the pipe 17 and through the system O and away by the pipe 18 to the pipes $l l'$, as may be required in the gas-making processes.

As usual in gas-making operations bituminous coal is distilled in the retorts of the benches C C' and the coal-gas passes therefrom by the stand-pipes d , branch pipes d' , through the hydraulic main F, and by the pipes G to the holder.

The operation or process of gas-making in my improved apparatus is as follows: The valve a and plunger-valves 7 8 are closed and the plunger-valves 3 4 are opened. Air under pressure is now admitted by the pipes $b b'$, and the fuel in the generating-furnaces A A' is brought up to a condition of incandescence, the products of combustion passing from said furnaces through the throats $c c'$ down and up through the two compartments of the refractory-material fixing-chambers B B', bringing the checker-brick therein to a highly-heated condition, by the pipes $f f' f^2$ and $g g' g^2$ into the retort-chambers D D' adjacent to the fires of the retort-furnaces, up around the coal-gas retorts, and away in any desired manner to discharge-chimneys. If desired, during this blowing-up operation air may be admitted into the fixing-chambers

B B' by the pipes b^2 to insure perfect combustion of the gases and the highest attainable heat therefrom. After the blowing-up operation the plunger-valves 3 4 are closed, 7 is kept closed, 8 is opened, and the valve a is also opened, and steam previously superheated in the systems of pipes O and M is admitted by the pipes k and 10 into the upper part of the furnace A for the formation of water-gas. This steam passes down through the incandescent fuel in the generating-furnace A, across through the pipe and past the valve a and up through the incandescent fuel in the furnace A', where it is transformed into water-gas and reaches a very high heat, and in the upper part of this furnace A' the water-gas is met in its highly-heated condition by the vapors of liquid hydrocarbons coming from the system O and admitted by the pipes l' 12 under some pressure, and the resultant gas, a mixture of water-gas and oil-gas, passes by the throat c' into and down and up through the compartments of the refractory-material fixing-chambers B', in whose increased length of fixing-chamber the greatest efficiency is obtained, and by the pipes g, i, i', i^2 , and i^3 into the main L and down all or any desired number of the pipes e' and e into the coal-gas retorts during the process of distillation and making coal-gas, and therein the resultant gas, in passing through said retorts, becomes enriched by taking up and combining with the light tarry matters or hydrocarbons such light tarry matters as have heretofore usually passed over into the hydraulic main and become lost by commingling with the tar. The resultant gas thus enriched passes by the stand-pipes and branches $d d'$, through the hydraulic main, and so to the gas-holder. During this process the highly-heated steam in passing down through one generating-furnace and up through the other is completely transformed into water-gas, wherein there is practically no watery vapors, and the gas resulting from the mixture of the water-gas and oil-gas is fixed in passing through the chamber B'. After the completion of this step of the process the valve a and the plunger-valve 8 are shut, the valve 7 is left shut, and the plunger-valves 3 and 4 are opened, and air under pressure is admitted by the pipes $b b'$ under the grates of the generating-furnaces, and the fuel therein is again brought up to incandescence, the products of combustion going, as heretofore expressed, through the fixing-chambers and pipes $f f' f^2$ and $g g' g^2$ into the retort-chambers around the retorts of the benches, heating the same with the high intermittent heat, as heretofore set forth. The next step in the process, the valve a is opened, the valves 3 and 4 are closed, and the valve 8 is left closed, and the plunger-valve 7 is opened, and superheated steam from the systems O and M is admitted by the pipes k' and 12 into the upper end of the generating-furnace A', and the same passes down through

the incandescent fuel in said furnace A', across past the valve *a*, and up through the incandescent fuel in the furnace A, where it reaches a very high heat and is completely transformed and fixed into water-gas. The water-gas is now met by the vapors of liquid hydrocarbons coming from the system O and admitted by the pipes *l* and 10, and the resultant gas passes through the throat *c* and down and up through the refractory-material fixing-chamber B, wherein said gas is completely fixed, the same thereafter passing by the pipes *f*, *h*, *h'*, *h*², and *h*³ to the main L, and therefrom through all or any desired number of the pipes *e'* and *e* into the coal-gas retorts during the process of making coal-gas, wherein the said gas takes up the light tarry materials and thereby becomes enriched and passes from said retorts by the pipes *d* *d'* and by hydraulic main to the common holder. These operations are thereafter repeated by the simultaneous blowing up of the generating-furnaces and heating of the fixing-chambers and the combined use of the generating-furnaces in alternate directions for the manufacture and fixing of water-gas and the combining therewith of oil-gas and the fixing of the same and the enriching of the resultant gas in transit to the holder by passing through the coal-gas retorts during the process of distilling bituminous coal and making coal-gas.

I would remark that the quantity of vaporized hydrocarbon oil admitted to the upper ends of the generating-furnaces by the pipes *l* and 10 or *l'* and 12 is to be under entire control, so that any desired quantity can be admitted, the oil-gas and water-gas commingling in a ratio controlled at will according to the desired candle-power of gas by the quantity of liquid hydrocarbon admitted in each run, the candle-power being lowest with strictly fuel-gas and highest with illuminating-gas.

In the aforesaid process there will be probably some oily deposits on the refractory material of the fixing-chambers B B', and the object of the steam-pipes *m m'* entering the pipes *f* and *g* is to be able, in case sufficient oily deposits are found to be present in either fixing-chamber, to clean the same out by forcing the steam through the fixing-chambers toward the generating-furnace and down and up through the fires of the generating-furnaces and so decompose the steam and cause the same to combine with the oily deposit and make additional water-gas, which thereafter passes away in the manner as does the water-gas hereinbefore described.

Because of passing the resultant gas through the coal-gas retorts and taking up thereby the light tarry matters I increase both the volume and candle-power of the gas and obviate the necessity of using so much liquid hydrocarbons in the generating-furnaces, and thus effect a saving both in the quantity of oil employed and by preventing these light tarry matters becoming tar in the hydraulic main.

The gases made by the process herein set forth and in the apparatus herein described combine and form a permanent compound gas. 70

The fuel in the generating-furnaces is to be periodically renewed, as is well known, by red-hot coke from the benches of coal-gas retorts, conveyed therefrom to the furnaces in any desired or convenient manner. 75

I claim as my invention—

1. The process herein described of making a permanent compound gas which consists of blowing up two beds of fuel to incandescence and simultaneously heating fixing-chambers and conveying the products of combustion into retort-chambers to assist by an intermittent heat the heat of steady retort-furnaces in heating coal-gas retorts for the production of coal-gas and coke, cutting off the air and admitting steam onto the top of one of the beds of fuel and causing the same to pass down through the bed of fuel, to, and up through the other bed of fuel to form water-gas, admitting vaporized liquid hydrocarbons above the second bed of fuel which commingle with the water-gas, conveying the resultant gas through a fixing-chamber and through retorts during the process of distilling coal to become enriched by taking up the light tarry matters therein and conveying the gases away through the hydraulic main to a holder, substantially as specified. 80 85 90 95

2. The process herein described of making a permanent compound gas which consists of blowing up two beds of fuel to incandescence and simultaneously heating fixing-chambers and conveying the products of combustion into retort-chambers to assist by an intermittent heat the heat of steady retort-furnaces in heating coal-gas retorts for the production of coal-gas and coke, cutting off the air and admitting steam onto the top of one of the beds of fuel and causing the same to pass down through the bed of fuel, to, and up through the other bed of fuel to form water-gas, admitting vaporized liquid hydrocarbons above the second bed of fuel which commingle with the water-gas, conveying the resultant gas through a fixing-chamber and through retorts during the process of distilling coal to become enriched by taking up the light tarry matters therein and conveying the gases away through the hydraulic main to a holder and again blowing up two beds of fuel to incandescence and repeating the gas-making operations alternately and in opposite directions, substantially as specified. 100 105 110 115 120

3. In an apparatus for the manufacture of gas the combination with companion generating-furnaces, of a pipe and a valve therein connecting the lower portions of said furnaces, two-part refractory-material fixing-chambers and throats connecting the same with the generating-furnaces, retort-chambers containing benches of coal-gas retorts and retort-furnaces, a hydraulic main and pipes to a holder, pipes for products of combustion passing from the fixing-chambers into 125 130

the retort-chambers adjacent to the retort-furnaces for admitting the products of combustion into said retort-furnaces, plunger-valves and water-jackets in the pipes for the products of combustion, other pipes passing off from the fixing-chambers for conveying away the gas and having therein plunger-valves, a pipe above the retort-chambers connected with the gas-pipes, pipes connecting the retorts of the benches with the pipe above the retort-chambers and pipes connecting the other ends of the retorts of the benches with the hydraulic main, substantially as set forth.

4. In an apparatus for the manufacture of gas, the combination with companion generating-furnaces, of a pipe and a valve therein connecting the lower portions of said furnaces, two-part refractory-material fixing-chambers and throats connecting the same with the generating-furnaces, retort-chambers containing benches of coal-gas retorts and retort-furnaces, a hydraulic main and pipes to a holder, pipes for products of combustion passing from the fixing-chambers into the retort-chambers adjacent to the retort-furnaces for admitting the products of combustion into said retort-furnaces, plunger-

valves and water-jackets in the pipes for the products of combustion, other pipes passing off from the fixing-chambers for conveying away the gas and having therein plunger-valves, a pipe above the retort-chambers connected with the gas-pipes, pipes connecting the retorts of the benches with the pipe above the retort-chambers and pipes connecting the other ends of the retorts of the benches with the hydraulic main, pipes in series in openings or pockets in the upper parts of the wall of the retort-chambers for superheating steam and for highly heating oil, and pipes for conveying the highly-heated oil or hydrocarbons and also for conveying the superheated steam to the pipes connected with the generating-furnaces for supplying thereto the superheated steam and the highly-heated liquid hydrocarbons for the gas-making processes, substantially as set forth.

Signed by me this 21st day of October, A. D. 1895.

H. M. PIERSON.

Witnesses:

GEO. T. PINCKNEY,
HAROLD SERRELL.