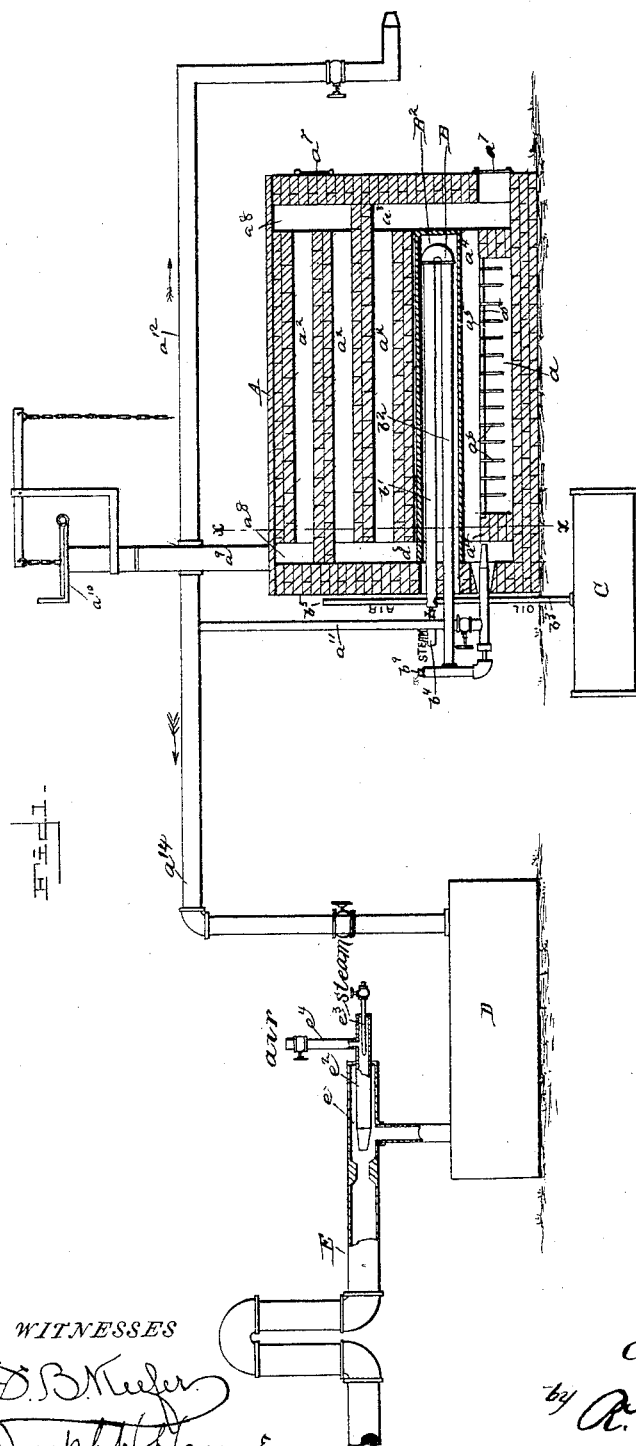


2 Sheets—Sheet 1.

APPARATUS FOR THE MANUFACTURE OF GAS.

Patented June 23, 1891.



WITNESSES

J. B. Keeler.
Joseph H. Hannen

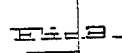
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2 Sheets—Sheet 2.

No. 454,531.

Patented June 23, 1891.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 454,531, dated June 23, 1891.

Application filed September 14, 1889. Renewed April 1, 1891. Serial No. 387,208. (No model.)

To all whom it may concern:

Be it known that I, CHARLES STILWELL, a citizen of the United States, residing at Trenton, in the county of Mercer and State of New Jersey, have invented certain new and useful Improvements in Apparatus for the Manufacture of Gas; and I do hereby 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.

This invention relates to the manufacture of illuminating and heating gas.

The object is in a ready and efficient manner and without the employment of coal even for heating the retorts or the plant to make a fixed gas suitable for illuminating and heating purposes, to be diluted as required for use or to be employed as an enricher of poorer gas.

With this object in view the invention consists in an apparatus heated by the combustion of hydrocarbon or hydrocarbonaceous substance, in which apparatus upon the attainment of an adequate degree of heat the combustion is arrested and hydrocarbon or hydrocarbonaceous substance is then supplied to make gas.

In the accompanying drawings, forming part of this specification, and in which like letters of reference indicate corresponding parts, Figure 1 is a vertical longitudinal section of an apparatus capable of carrying the invention into effect. Fig. 2 is a vertical cross-section of the generator or furnace, taken on the line *xx* of Fig. 1, showing the arrangement of the flues, the retort in its chamber, and the combustion-chamber with the bars and triangles; and Fig. 3 is a detail view showing the arrangement of the steam, air, and oil pipes, with the vacuum-chamber behind the end of the steam-pipe, into which the air and oil pipe open, forming a mixing and atomizing chamber.

The purpose is to do away with the use of coal and to make gas direct from hydrocarbonaceous substances, as from petroleum, heating the furnace, the retort, and the plant generally from the hydrocarbonaceous substances, as well as employing them to make the gas.

In the drawings, A represents a furnace, preferably of brick or other highly-refractory material, having a combustion-chamber *a* and horizontal flues *a*², preferably of brick or the like. Extending the length of the fire-box from cross-bars *a*³, resting upon piers *a*⁴, are bars *a*⁵, and upon these bars are hung rods or figures, such as triangles *a*⁶. At the end of the furnace opposite to fire-box and flues are doors *a*⁷ to enable cleaning. Suitable upright flues *a*⁸ lead to and from the horizontal flues *a*². From the top of the furnace leads an uptake or stack *a*⁹, provided with a damper *a*¹⁰. Within the furnace between the fire-box and the flues and in a brick arch or chamber B² is located a retort B, preferably in the form of a tube bent upon itself at one end, forming two branches *b*¹ and *b*², and at the other end having one or both branches extending beyond the front wall of the furnace. One branch, preferably the upper branch *b*¹, connects by a pipe *b*³ with any suitable source of supply of hydrocarbon, such as the oil-tank C, conveniently located, and into the same branch also open a steam-pipe *b*⁴ and an air-pipe *b*⁵. These pipes are provided with suitable valves to open or close them. Toward the end of the branch where the steam-pipe enters the same is constricted, leaving a chamber *b*⁶ between the constriction and the end. The nozzle of the steam-pipe is in the constricted or narrowed part, and oil and air pipes open into the chamber. The other branch of the retort, preferably the lower branch *b*², extends to a pipe *b*⁷, which in turn leads to a nozzle-pipe *b*⁸, which enters the combustion-chamber *a*. The retort is set through the front wall of the furnace or generator into the arch air-tight, as by luting, and the nozzle-pipe *b*⁸ is also set air-tight through the front wall into the combustion-chamber. The pipe *b*⁷ extends upward a short distance above the connection with the branch *b*² of the retort, and is sealed at the top, forming an air-chamber *b*⁹, serving to regulate the flame at the end of the burner. Extending laterally from the uptake *a*⁹ is a pipe *a*¹⁴, which connects with a wash-box D, and this opens into a pipe or conduit E, constricted and forming a chamber *e*, similar to the chamber *b*⁶. A pipe *e*² enters the chamber just in

advance of the constriction, and this pipe is entered by a steam-pipe e^3 and an air-pipe e^4 . Leading downward from the horizontal part of the pipe a^{14} and connecting with the burner-pipe e^8 is a pipe a^{11} . Also leading from the uptake a^9 and to another furnace or to any suitable place to be heated is a pipe a^{12} .

All the steam and air pipes, as well as the oil-pipe and pipes a^{14} and a^{11} , are provided with suitable valves to open and close them.

The operation of the apparatus is as follows: The damper on the stack being open and the valves in the pipes a^{14} and a^{12} being closed with some waste or other suitable material, a fire is started in the combustion-chamber. As soon as the fire is well started the door to the combustion-chamber is closed and the valves in the oil and air pipes are opened, and the valve in the steam-pipe being then opened oil, with an adequate supply of air to cause it to burn, is forced through the retort and through the burner-pipe into the combustion-chamber, where it is ignited, and the hot products of combustion circulated about the brick arch, highly heating it and heating the contained retort, and also passing through the flues, highly heating them. From the flues the products of combustion pass out through the stack. As soon as the generator has been adequately heated the supply of air is cut off, so that the fire will be gradually extinguished, and when the last of the products of combustion have escaped and gas begins to form the damper in the stack is closed and the valves will be opened to let the gas pass onward through and beyond the wash-box. As the pipe a^{11} enters a chamber outside an injector in the burner-pipe, when its valve is opened gas formed in the generator will be drawn up the pipe a^9 and down the pipe a^{11} to be forced again into the combustion-chamber, causing a circulation. This is to supply gas for fuel to reheat with gas; also if the damper on top of the stack is open the injector on the burner will draw part of the gas down through pipe a^{11} and return it to the combustion-chamber, at the same time helping to make a draft for the furnace, and if the damper be closed a certain portion of gas will be drawn through pipe a^{11} to aid the fire to burn, especially where there is a slow or smothered fire. The valve in the pipe a^{11} may be opened and closed at any time desired before proceeding further. The valve in the pipe a^{11} then being closed, the valve in the pipe a^{14} is opened, and steam is turned on by opening the valve in the pipe e^3 . This causes the gas to be dragged through the wash-box, and beyond this it is passed to a gasometer. To dilute the gas when it is too rich, provision is made to supply air by opening the valve in the air-pipe e^4 .

It will be observed that the air-pipe and the oil-pipe enter a chamber, in the nature of a vacuum-chamber, behind the steam-nozzle. This causes very intimate admixture of the air and oil, the oil being finely broken up and afterward atomized by the steam. A similar

arrangement is employed for the air and gas upon the wash-box. By the hanging rods or triangles in the combustion-chamber a very fine state of division of the oil is obtained, by the forcible projection of the same in contact with them. By the employment of this device the use of delaying devices in the tubular retort, which are apt to become foul and tend to clog the same, is avoided.

By the inclosure of the tubular retorts within a brick arch or chamber the retort is not so highly heated as the flues where the gas is fixed, and as the retort is not so highly heated there is not danger of the formation of carbon, as where oil is injected against a too highly heated surface.

When it is desired to use the gas for heating purposes, the valve in the pipe a^{14} being closed, the same may be conducted off by the pipe a^{12} by opening the valve in this pipe.

By this apparatus the heating of the generator and the making of the gas go on alternately, and by having a number of generators side by side the production of gas will be made continuous.

The method of producing gas incident to the use of the present apparatus is not herein claimed, the same forming the subject-matter of another application for patent.

By my process and apparatus the following among other highly valuable results are obtained: The operation of heating the incandescent surfaces and the subsequent operation of producing gas for consumption are performed with oil obtained from the same supply and introduced through the same pipe. This affords great simplicity in the construction of the apparatus and renders the conduct of the process more easy and more readily controlled. Furthermore, after the initial combustion by the use of shavings or the like, the several refrirings for the purpose of renewing the heat in the incandescent passage may be accomplished entirely by admitting air with the oil or with the oil and steam, opening the damper in the chimney, and closing the damper in the gas-discharge pipe a^{14} , and without the employment of a further quantity of waste or shavings.

A further advantage, and one of noticeable importance, lies in the fact that the gas is fixed during the same operation that produces a generation. It is found, also, that a scarcely noticeable portion of residuum is formed when reasonable care and discretion are exercised in carrying out the process.

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

1. In an apparatus for producing gas, the combination, with the fixing-chamber, of a retort below the fixing-chamber, a combustion-chamber arranged below the retort and communicating with the fixing-chamber, an injector leading into the combustion-chamber, an injector arranged to discharge into the retort, valved oil, steam, and air pipes connected

with the last-named injector, a pipe affording communication between the retort and the injector leading into the combustion-chamber, and a gas-outlet leading from the fixing-chamber, substantially as described.

2. An apparatus for producing gas, comprising, in combination, a furnace provided with an interior convolute heating-passage for the rising gas, a retort-chamber below the heating-passage, a retort-tube within said chamber, a combustion-chamber below the retort, a mixed oil, steam, and air injector communicating with the retort-tube, and valved air, oil, and steam pipes leading thereto, a pipe communicating with the retort-tube and leading into the combustion-chamber, a pipe leading out from the furnace, and a return-pipe connecting said last-named pipe with the injector leading into the combustion-chamber and arranged on the outside of the furnace, substantially as described.

3. An apparatus for producing gas, comprising, in combination, a furnace provided with horizontally-arranged partitions producing a convolute heating-passage, a retort-chamber below the said partitions and out of communication therewith, a combustion-chamber below the retort, a tubular retort in the form of a return-pipe within said retort-chamber, an air, steam, and oil injecting device communicating with the retort-tube, a pipe leading from the opposite end of the retort-tube to the combustion-chamber, a gas-conveying pipe leading from the top of the furnace, a return-pipe arranged outside of the furnace and connecting the gas-conveying pipe with the pipe leading to the combustion-chamber, an oil-supply for the oil-pipe, a valve in the air-pipe, and a disintegrating device in the combustion-chamber,

comprising transverse rods carrying downward-hanging bars, substantially as described.

4. In an apparatus for producing gas, the combination, with the furnace, having interior heating-surfaces, the retort-chamber, and combustion-chamber, of a retort-pipe leading into and returning out of the retort-chamber, a steam, air, and oil mixing chamber on the inner end of the retort-pipe, and a steam, an oil, and a valved air pipe leading thereto, a pipe leading into the combustion-chamber, communicating with the retort-pipe, and provided with a gas-mixing chamber, a gas-discharge pipe, and the mixing-chamber in the pipe leading into the combustion-chamber, substantially as described.

5. The apparatus for producing gas herein described, comprising, in combination, the furnace A, having the interior convolute heating-passages a^2 and chimney a^9 , the retort B^2 , passing in and out through the wall of the furnace and sustained within the latter below the heating-surfaces, a combustion-chamber a below the retort, the air, oil, and steam mixing and injecting device entering the retort-pipe, the pipe b^3 , leading into the combustion-chamber and communicating with the return-pipe b^2 of the retort B^2 , the valve a^{10} in the chimney, the valved gas-conveying pipe a^{14} leading from the chimney, and the gas-circulating pipe a^{11} , leading from the gas-pipe a^{14} to and communicating with the pipe b^3 , substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES STILWELL.

Witnesses:

THOS. M. FERROLL,
H. M. PROUD.