4 Sheets—Sheet 1.

W. F. BROWNE.

COMBINED STEAM AND GAS GENERATING APPARATUS.

No. 195,088. Patented Sept. 11, 1877.

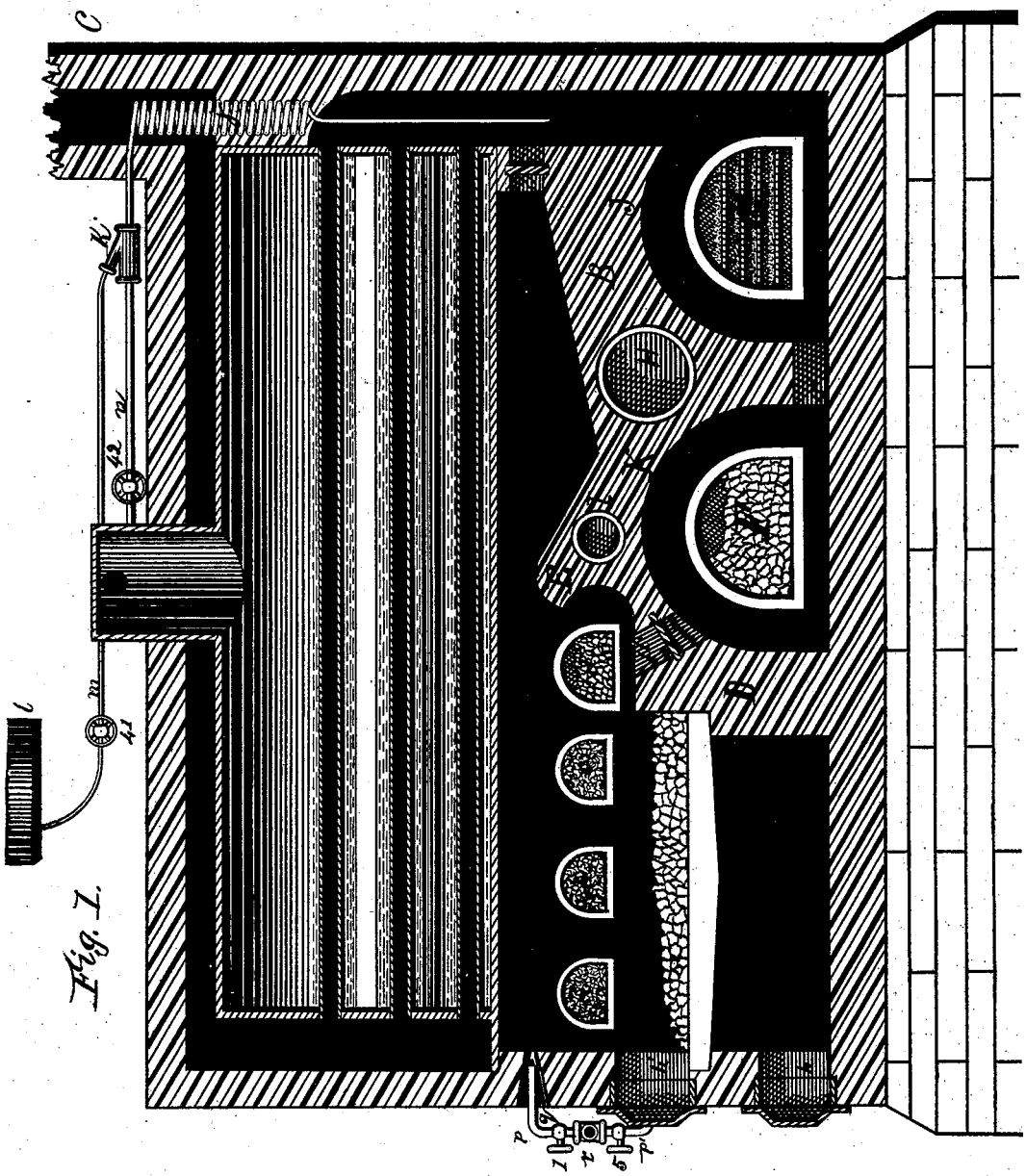

Fig. 1.

Witnesses

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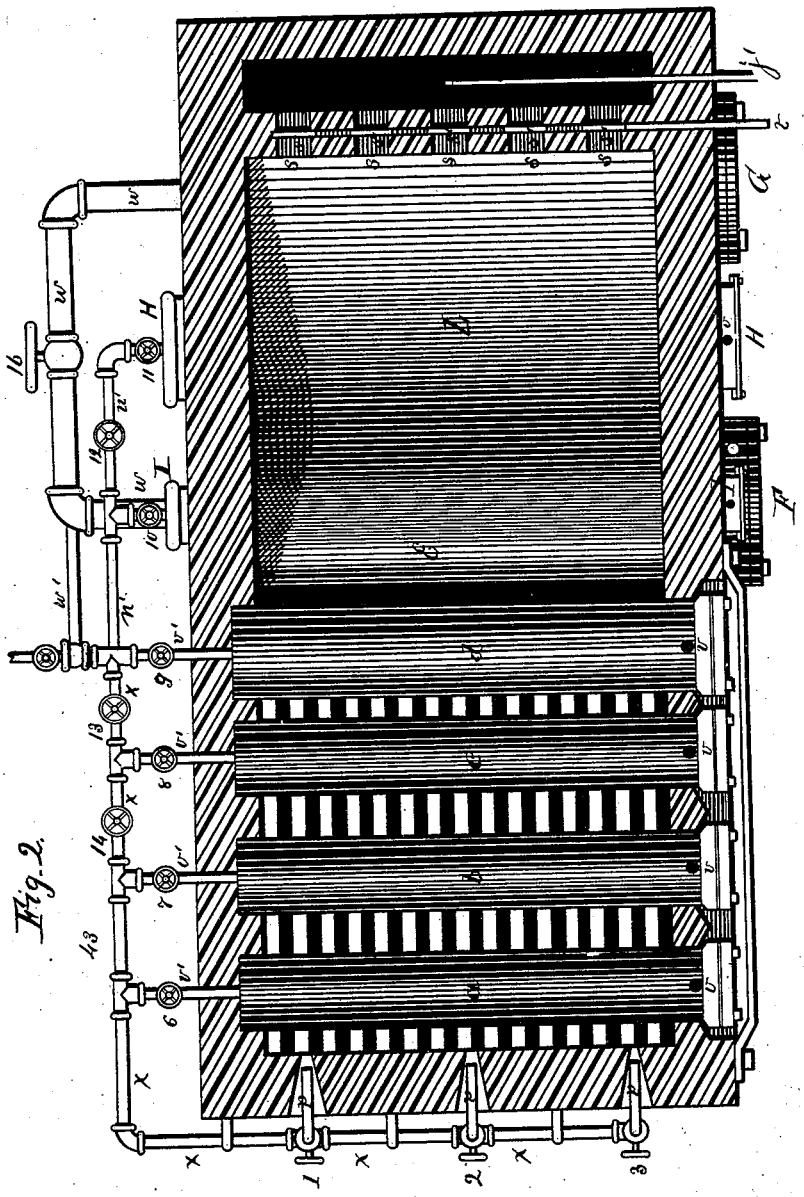

Fig. 2.

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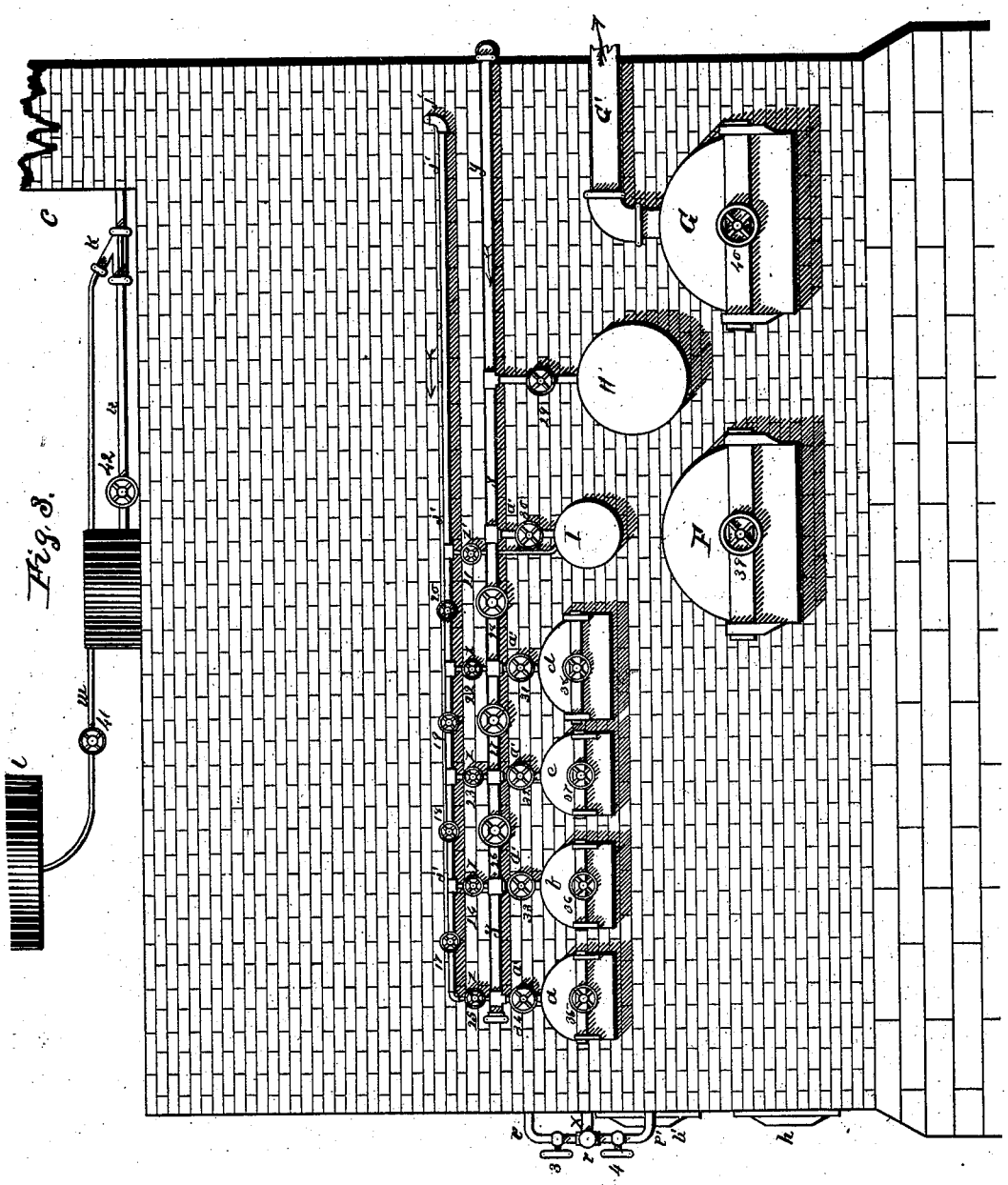

Fig. 3.

Witnesses

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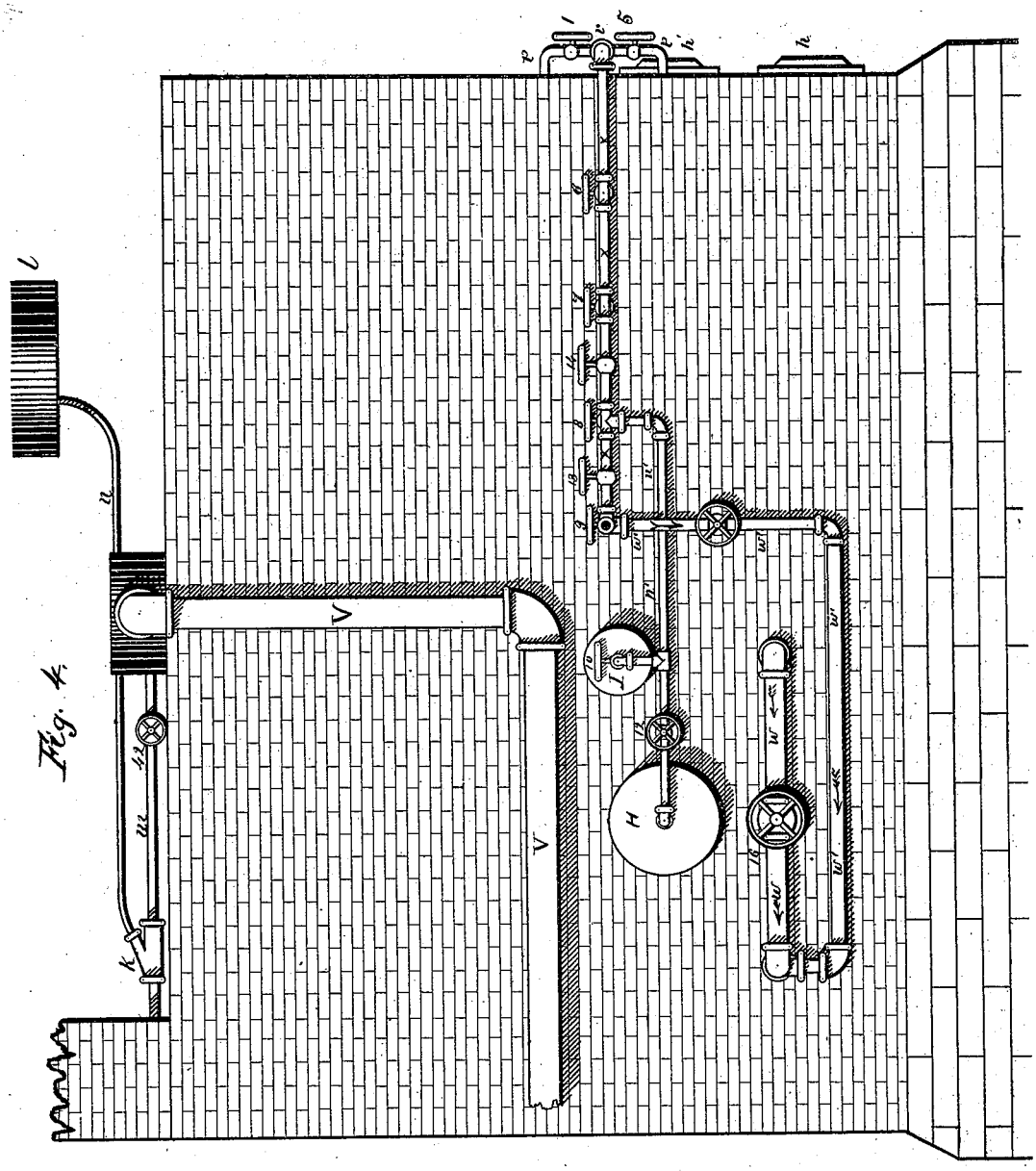

Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM F. BROWNE, OF NEW YORK, N. Y., ASSIGNOR TO HYDROCARBON STEAM GENERATING COMPANY.

IMPROVEMENT IN COMBINED STEAM AND GAS GENERATING APPARATUS.

Specification forming part of Letters Patent No. **195,088**, dated September 11, 1877; application filed December 27, 1876.

To all whom it may concern:

Be it known that I, WILLIAM FRANK BROWNE, of the city, county, and State of New York, have invented some new and useful Improvements in Combined Steam and Gas Generating Apparatus; and do declare that the following specification is a clear, full, and exact description thereof, the accompanying drawings forming an essential feature of said specification, and fully illustrating the improvements herein set forth.

The object of the above-named invention is to produce a cheap heat generating and illuminating agent from water and hydrocarbon gases.

The improvements hereinafter specified consist in combining and arranging a retort or retorts, drying and heating chambers, with or without purifiers contained therein, in the furnace or fire-box, and beneath the combustion-chamber, of a steam, gas, or a combined steam and gas generating apparatus, in combination with the conducting, induction, and eduction pipes and tuyere-pipes connected thereto, and within the openings of the walls surrounding said apparatus, for the purposes hereinafter specified; also, the connecting-pipes leading to and from said retorts and steam-boiler to the heating and drying chamber, and the purifiers contained therein, which are heated by heat radiated from the combustion-chamber, and by heat passing through flues connecting the fire-chamber with said drying and heating chambers, said combination of parts being for the purpose of generating carbonic-oxide and hydrogen gases for heating, and carbureted-hydrogen gas for illuminating, purposes, said illuminating-gas to be conducted to and purified within the purifiers beneath the combustion-chamber, after which it is conducted to a gasometer or other receiver and stored for use.

Another improvement consists in locating a retort in the uptake of the chimney, for the purpose of utilizing the escaping heat, in combination with the decomposing-retorts within the furnace and tuyere-pipes, as hereinafter specified.

Figure 1 represents a vertical longitudinal section of an improved combined steam and gas generating apparatus. Fig. 2 is a horizontal longitudinal plain section of the above-named invention. This view is represented as being cut through the fire-box and combustion-chamber just below the crown-sheet of the boiler, showing the retorts in position. Fig. 3 is the right-hand side elevation of the apparatus, showing the front ends of the retorts and their necessary pipe-connections. Fig. 4 is a view of the left-hand side of the combined steam and gas apparatus. This view shows the eduction or gas pipes and connections leading from the rear of the retorts to the furnace within the apparatus.

The following description will describe the construction of the improvements; also their application, uses, and advantages.

Like figures, letters, and signs designate corresponding parts in the several diagrams.

In Fig. 1, *a*, *b*, and *c* represent retorts, in which water or hydrogen and hydrocarbon gases can be generated from superheated steam and all carbonaceous products which can be volatilized by heat. The gases herein produced are to be conducted to the furnace and burned therein. The retort *d* is made somewhat larger than the retorts *a*, *b*, and *c*, for the purpose of making illuminating-gas. This gas is to be made in the usual manner of making coal-gas in large works; also, this retort is located where it serves a double purpose: it forms the top of the bridge-wall of the furnace, with an intervening flue-space between the bottom of the crown-sheet of the boiler and top of the retort, and between the bottom of the retort and top of the bridge-wall, thus allowing the heat to pass over and under the retort. The heat that passes under the retort strikes an auxiliary concave deflecting bridge-wall, E. This wall deflects the heat back upon the opposite side of the retort, thereby causing it to be completely enveloped in flame. I represents a volatilizing-retort, built within the auxiliary bridge-wall, with one or both of its ends projecting outside of the walls of the apparatus. H is a volatilizing retort or vessel, for utilizing the radiating heat. The space beneath the combustion-

chamber can be divided into a chamber or chambers, as shown in the drawings. These chambers can be provided with doors and then used for drying-chambers and other purposes.

A retort is shown in one of the chambers, as will be seen by referring to Fig. 1. This retort can be used for drying and heating coal by radiated heat. After it becomes heated it can be transferred to retort *d*, where its gases are readily expelled and conducted off by means of pipes to the purifier G, thence to a gasometer or a condensing apparatus.

a' represents a flue-space beneath the retort *d*, for the purpose of conducting heat from the furnace into and through the chambers beneath the combustion-chamber, where it makes its exit into and through the uptake of the chimney. When it is found desirable to cause the draft to descend beneath the combustion-chamber it will be necessary to close the damper *o* and open *a'* beneath the retort *d*. *j* is a coiled-pipe retort located within the rear wall and flue-space. This retort is heated by radiated and escaping heat. The pipe leading from the lower end of the coil communicates with the retorts *a*, *b*, *c*, *d*, I, and H, while the pipe extending from the upper end communicates with the steam-drum through the pipe *n*, and with an oil-tank, *l*, by means of the pipe *m*. Through these pipes *m* and *n* steam and oil are conducted into the coiled retort, where it becomes converted into gas, or nearly so, on its passage through the coil.

p p' are tuyere-pipes, which conduct gases into the furnace. The pipe *p* discharges its gas into the space between the crown-sheet of the boiler and the top of the retorts, while the pipe *p'* discharges its gas between the bottom of the retorts and the grate-bars *g*. 1 and 5 are stop-cocks for regulating the flow of gas.

In Fig. 2, *a*, *b*, *c*, and *d* represent the retorts as extending across the furnace, with their ends resting within the left-hand wall of the furnace, while their front ends project through the opposite wall, as shown in the figure. *v v* represent orifices for inducting-pipe connections.

E is the deflecting bridge-wall, as shown in Fig. 1; L, combustion-chamber; *s s*, flue-spaces between the combustion-chamber and the uptake to the chimney. *s' s'* are dampers, which close the flues *s s*, and *t* the handle operating the same.

v' v' v' v' are discharging-pipes, which convey the gases from the retorts *a b c d* to a pipe, *x x*, which conducts the gases to the tuyere-pipes, and thence to the furnace.

1 2 3 6 7 8 9 13 14 represent stop-cocks regulating the flow of gas within the pipes enumerated. *n' n'* is a pipe for conveying the volatile products from the retorts H and I to the main pipe *x x*. 10 11 12 are cocks regulating the flow of gas from said retorts.

w w is a pipe, conducting gas from the retort F to the purifier G, 16 being the regulating-cock for the same. *w'* is a pipe for conveying gas from retort *d* to the purifying-chamber G.

In the side elevation, Fig. 3, F and G represent the ends of the retort and purifier beneath the combustion-chamber. G' is a pipe for conducting purified gas to a receiver or holder.

I and H are retorts located within the masonry for receiving radiated heat.

a, *b*, *c*, and *d*, represent the front ends of the hydrogen and hydrocarbon retorts, which are located within the furnace or fire-box.

y y is a steam-pipe conveying steam to the retorts *a*, *b*, *c*, *d*, I, and H. *a' a'* are short pipes connecting the steam-pipe with their respective retorts. The cocks 29 30 31 32 33 34 are for regulating the flow of steam to the retorts.

j j is a continuation of the pipe leading from the bottom of the coiled retort within the stack, whereby the volatile products within said retort are conducted to the retorts *a*, *b*, *c*, *d*, and I H. 17 18 19 20 21 22 23 24 25 are stop-cocks used to regulate the flow of gas to the various retorts.

Fig. 4 is a view of the opposite side of the apparatus seen in Fig. 3. In this view the rear connections to the retorts are seen. *x x* is the main pipe, which receives all of the gases from the retorts *a*, *b*, *c*, I, and H, after which it passes through the tuyere-pipes to the furnace. 6 7 8 9 10 12 are cocks regulating the flow of gases generated within their respective retorts.

w w is a pipe conducting gas from the retort F to the purifier G. V is a steam-pipe leading from the steam-drum, &c.

The operation of this combined apparatus is as follows: In the first place the boiler is supplied with its requisite amount of water; secondly, the retorts should be charged with some carbonaceous substance; after which build a fire upon the grate within the furnace, for the purpose of heating the retorts to nearly a white heat, and to generate steam to or nearly a super heating-point within the boiler. After these two results are obtained the apparatus is ready for generating gas, which is accomplished as follows: Steam is admitted into the steam-pipe *y y*, and is let into the hydrogen-retorts *a*, *b*, and *c* by opening their respective stop-cocks 32 33 34. The steam, on being admitted into the retorts, becomes decomposed on its passage through the incandescent carbonaceous substance, which absorbs the oxygen and allows the hydrogen to pass off, through the pipe-connections in the rear of the retorts, to the main pipe *x x*, which conducts the gas to the furnace. By this means pure hydrogen, that is within water, can be converted into an element of combustion; but as this element will not be sufficient to generate the requisite amount of heat, it becomes necessary to introduce another element, which is carbon gas. This gas may be obtained from the products of petroleum or solid

carbons, which may be made liquid, or volatilized by heat or by a chemical process. This product is made to pass through the hydrogen-retorts, where it will receive a high degree of heat, and become united with the hydrogen, and form a fixed hydrocarbon gas, which becomes a powerful heating agent within the furnace.

When the products of petroleum are used they can be injected into the coiled retort *j* by a jet of steam, or otherwise. On the passage through the coil the products will become volatilized, and be conducted, through the pipe *j'*, to the retorts *a b c d* I, as occasion requires. The pipes *z z* convey the carbon vapor to their respective retorts.

If it becomes necessary to enrich the illuminating-gas which is being made within retort *d*, petroleum-gas can be introduced by opening stop-cock 22 in the small pipe *z*. The requisite amount can be ascertained by a test-light.

If it should be found that the steam is not sufficiently decomposed by passing through one retort, it can be made to pass through the second retort simply by closing stop-cock 26 in the steam-pipe *y* and opening cocks 8, 14, and 7, and closing 43 in gas-pipe *v'*, *v'*, and *x*, thus causing the gas to return in retort *b;* thence making its exit, through the pipe *a'*, into the steam-pipe *y;* thence, by opening stop-cock 34, it enters retort *a*, and makes its exit, through the gas-pipe *v'*, to main pipe *x*, from which it escapes to the furnace. The retort I can be used to still further expand the carbon gas before allowing it to enter another retort; or it may pass directly to the furnace through the main pipe *x x*.

If there is a surplus amount of gas made in the retorts *a b c*, it may be conducted off to a gasometer or receiver, and afterward used to start the fire within the furnace; and also it can be used for heating purposes about a factory or building, or wherever this apparatus may be erected; also, the illuminating-gas can be stored in gasometers, and afterward compressed into small receivers and delivered to patrons for lighting houses, &c.

I am aware that retorts have been located within the furnace of a steam-generating apparatus for the purpose of manufacturing gas which is burned in such furnace. This feature of the combination, heretofore specified, I disclaim; but what I do claim is those parts and combinations particularly set forth in the claims. I am aware, also, that those parts and combinations may be varied by slight modification of the parts and combinations herein shown and specified without departing from the essential principle and features of my invention, whereby similar results may be produced.

What I do claim as new, and desire to secure by Letters Patent, is—

1. In combination with a steam-generating furnace, a retort or retorts, with their induction, eduction, and tuyere pipes connected thereto, said tuyere-pipes terminating in openings within the walls of said furnace, whereby the gases are discharged from the tuyere-pipes directly into the fire-chambers in which the retorts are located.

2. In combination with the furnace of a gas-generating apparatus, a combined bridge-wall and retort, in combination with the flues beneath said retort and the deflecting bridge-wall, as and for the purpose set forth.

3. The heating or drying chambers in the rear of the bridge-wall and beneath the combustion-chamber of a steam and gas apparatus, in combination with said apparatus, substantially as and for the purpose specified.

4. A purifier, *g*, placed in a chamber beneath a combustion-chamber of a steam and gas generator, the chambers being connected by the flues *a' o*, for conducting heat to and from said purifier, for the purpose specified.

5. A gas-generating retort in the uptake of a chimney, for utilizing the escaping heat, in combination with decomposing-retorts within the furnace or fire-chamber of a steam and gas generating apparatus, and eduction and tuyere pipes for conducting gases from said retorts into the fire-chamber in which said retorts are located.

6. A tuyere pipe or pipes, *p*, opening above the retorts and discharging their gases between the tops of the retorts and crown of the fire-chamber of a gas-generating apparatus, in combination with the retorts in which the gas is made, and furnace of said gas-generating apparatus.

7. The tuyere-pipes *p'* opening below the retort, and discharging their gases into a furnace beneath the bottom of the retorts *a b c*, in combination with the tuyere-pipes *p*, retorts *a b c*, and furnace of a gas apparatus.

8. The main pipe *x*, for conducting gas from retorts to and through the tuyere-pipes *p p'*, and within the furnace in which the retorts are located, in combination with said retorts, tuyere-pipes, and furnace.

9. In combination with a steam-generating apparatus, retorts for manufacturing, heating, and illuminating gases by the decomposition of steam, hydrocarbon, and carbonaceous substances, and the purifier beneath the combustion-chamber of said apparatus, as shown, for purifying said gases.

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