(No Model.)

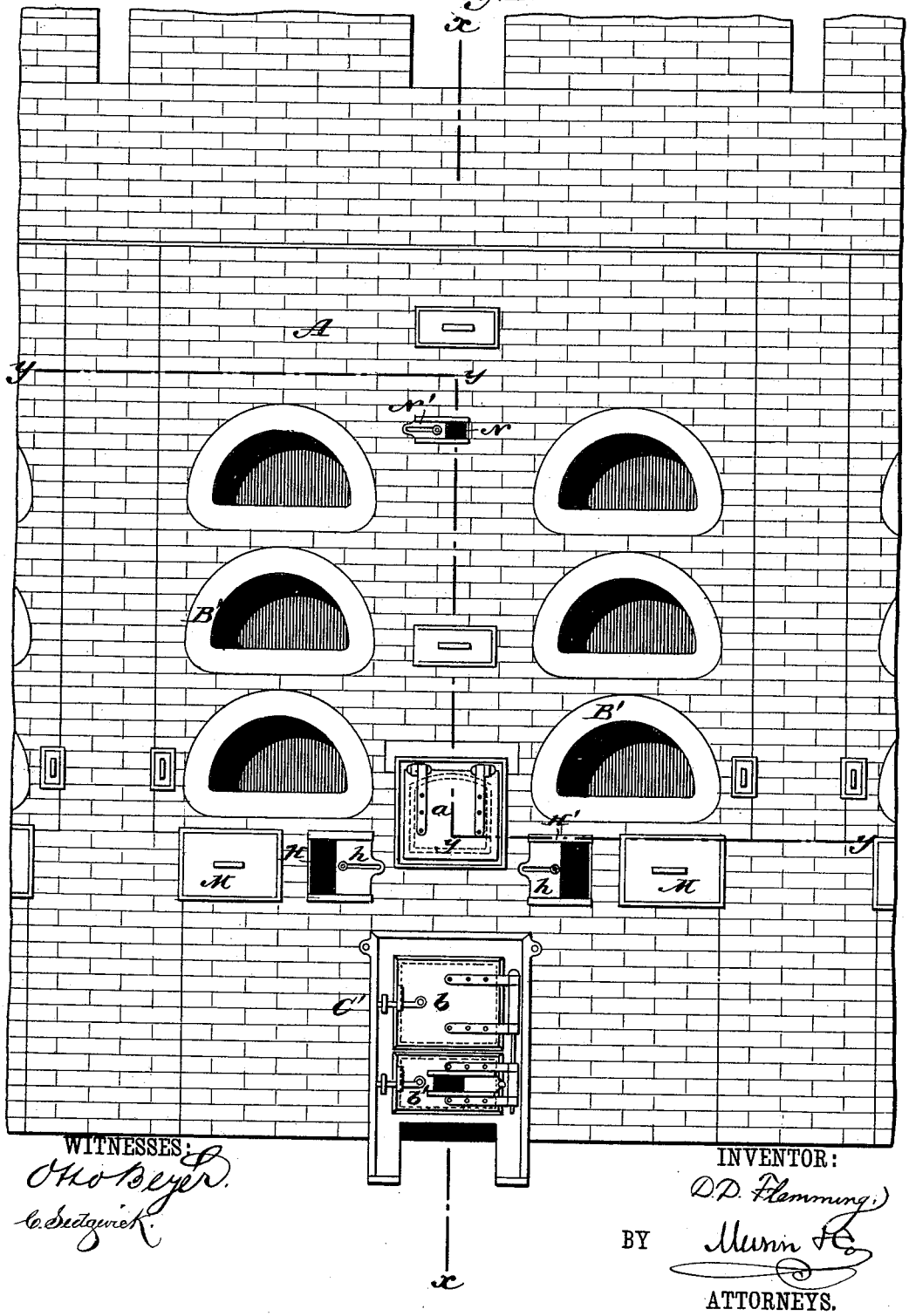
4 Sheets—Sheet 1.

# D. D. FLEMMING.

## RETORT GAS FURNACE.

No. 385,854. Patented July 10, 1888.

Fig. 1.

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# D. D. FLEMMING.

## RETORT GAS FURNACE.

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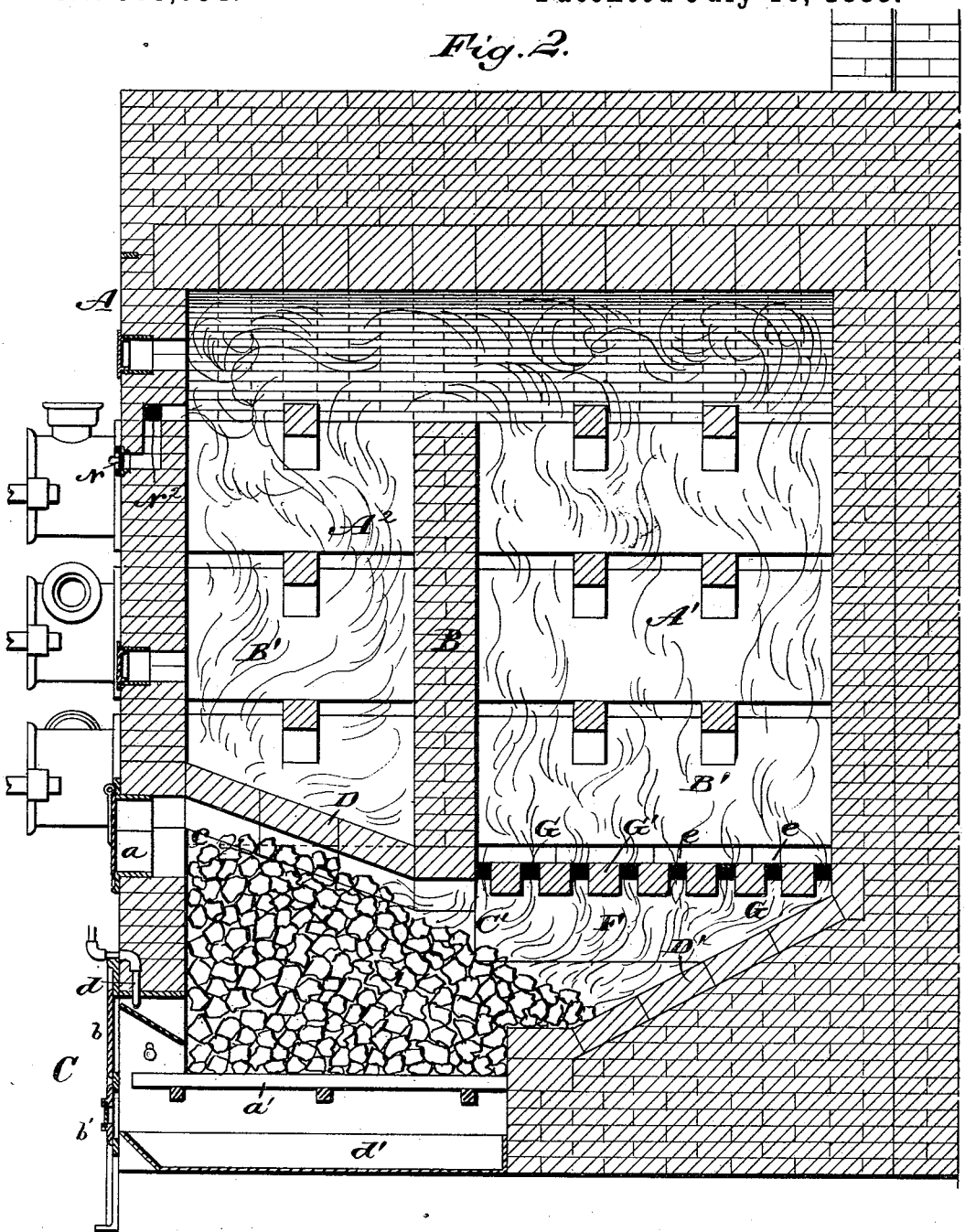
*Fig. 2.*

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(No Model.) 4 Sheets—Sheet 3.

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## RETORT GAS FURNACE.

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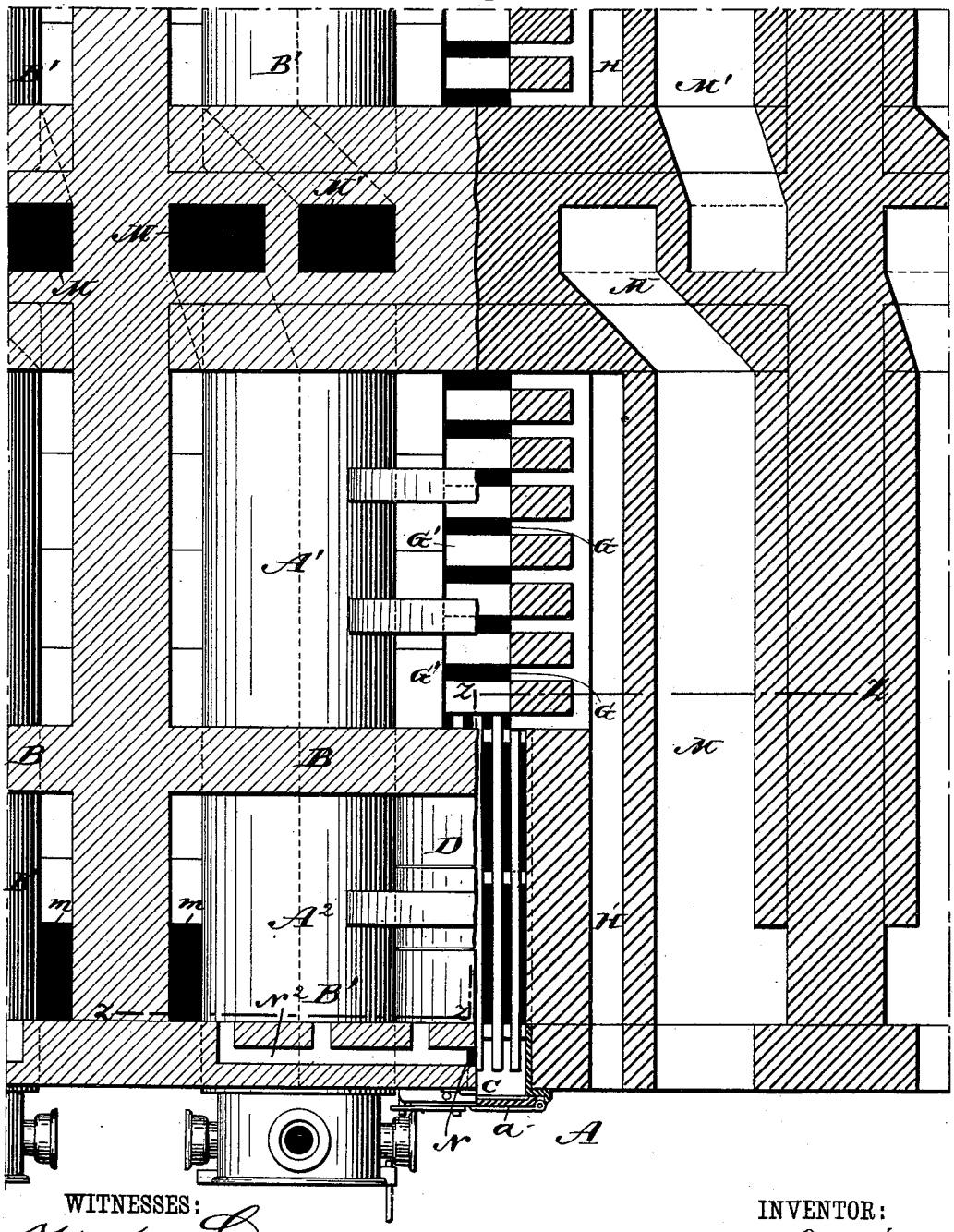
*Fig. 3.*

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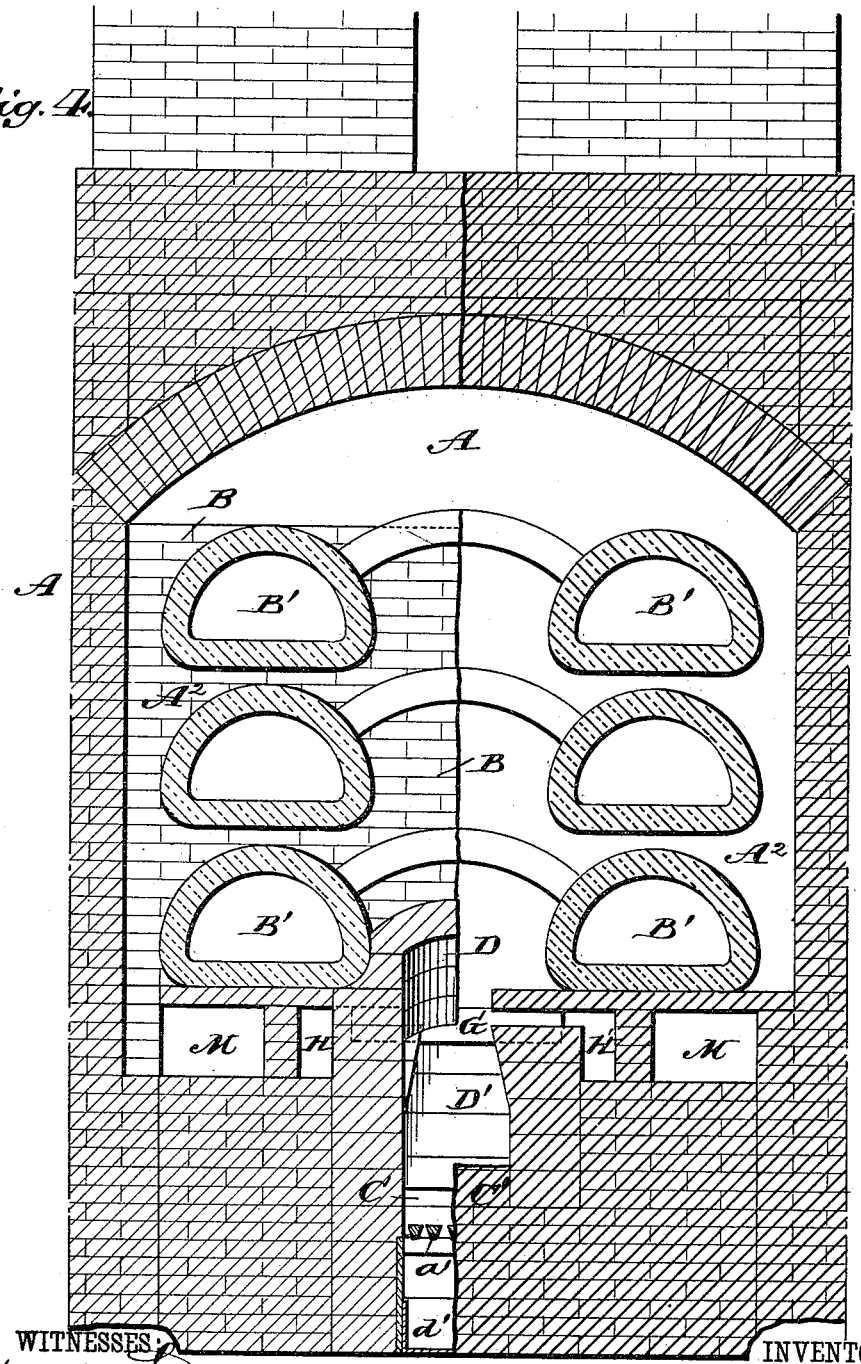
(No Model.) 4 Sheets—Sheet 4.

# D. D. FLEMMING.

## RETORT GAS FURNACE.

No. 385,854. Patented July 10, 1888.

Fig. 4.

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# UNITED STATES PATENT OFFICE.

DUDLEY D. FLEMMING, OF JERSEY CITY, NEW JERSEY.

## RETORT GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 385,854, dated July 10, 1888.

Application filed March 22, 1887. Serial No. 231,954. (No model.)

*To all whom it may concern:*

Be it known that I, DUDLEY D. FLEMMING, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Gas-Retort Furnace, of which the following is a full, clear, and exact description.

My invention relates to an improvement in gas-retort furnaces, and has for its object, by a simple and inexpensive alteration of furnaces now used for direct firing, to attain all the advantages of the costly and elaborate regenerator-furnaces.

The invention consists in the construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

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

Figure 1 is a front elevation of a furnace having my improvements attached. Fig. 2 is a central vertical section of the same on line *x x* of Fig. 1. Fig. 3 is a horizontal section on line *y y* of Fig. 1, and Fig. 4 is a vertical transverse section on line *z z* of Fig. 3.

In carrying out the object of this invention the following advantages are sought to be attained: first, the use of gaseous fuel for heating retort-benches, or rather the first conversion of the solid fuel or carbon to the gaseous state (carbonic oxide) by the proper regulation of the primary air-supply, and, second, the conversion of this carbonic oxide to carbonic acid by a secondary air-supply.

The system of regenerator-furnaces in which the foregoing principle is carried out necessitates a radical change in the construction of the bench, and also requires much additional space or cellar under the retort-house, which is unattainable in many gas-works.

In all the systems of regenerator-furnaces yet introduced the end sought is to superheat the secondary air-supply, which secondary air is claimed to be superheated by the escaping waste products of combustion. This is followed out by Didier, Schilling and Bronte, Oeckelhauser, Livesey, Hasse and Vocherot, and others, of Europe, and in Stanley and Steadman, McIlhenney, and Dieterich, of this country.

In my improvement I discard all methods of superheating the secondary air, from the fact that dry air has little capacity for absorbing heat, and though expanded by contact with red-hot surfaces does not deliver any useful effect when brought in contact with hot combustible gas that is not attained by air of the normal temperature.

In constructing the improved gas-retort furnaces, each bench A is formed into two combustion-chambers, A′ $A^2$, by means of a vertical partition-wall, B, which is carried up to about the level of top of the upper retorts, B′, the said retorts being of the ordinary construction and held in the benches in any well-known or approved manner.

A generator, C, for producing the gaseous fuel (or carbonic oxide and hydrogen) is provided by constructing a deep furnace, C′, beneath the retorts B′, so that a depth of fuel of about four feet is attained. Over the top of this furnace, and extending from the base of the vertical partition-wall B to the front wall of each bench, an arch or horizontal partition, D, is built, separating the furnace C′ from the second or front combustion-chamber, $A^2$.

The furnace C′, at the rear of the bench, is provided, preferably, with an upwardly and rearwardly sloping floor, D′, and at the front with a hopper, *a*, whereby solid fuel is supplied the furnace, a grate, *a′*, and a fire and draft door, *b b′*. A drip-pipe, *d*, is also provided, as shown in Fig. 2, entered at the front of the furnace, whereby water is allowed to trickle upon the fuel mass down in the ash-pan *d′*.

The primary air enters through the draft-door *b′* below the grate, and is made to pass laterally through the fuel mass, insuring a more complete conversion than is attained in the ordinary upright generators. The duct F, for conveying the gaseous fuel from the generator to the first or rear combustion-chamber, A′, is formed by dividing the space from the partition-wall B to the rear of the bench into a series of spaces or channels, G, produced by tile or bars G′, extended transversely the bench at equidistance apart, their ends being rigidly secured in the side wall or by equivalent means. Into each of these channels, about two and one-half inches below the

point of escape, *e*, the secondary air is made to combine with the gases from the generator, which air enters through the flues H H′. By this form of construction a positive and intimate union of the secondary air with the gaseous fuel is effected for the combustion.

Two secondary air-flues are provided each bench H and H′, one to the inner side and below each tier of retorts B′, as shown in Figs. 1, 3, and 4. The said flues are adapted to extend from the face of the furnace, where they are provided with suitable valves, *h*, horizontally rearward beneath the bars or tile G′.

In substantial horizontal alignment with the secondary air-flues H H′, and below the outer side of the under retort, B′, of each tier, rearward-extending take-off flues M are provided, having connection at *m* with the second or front combustion-chamber, $A^2$, through which flues the waste products of combustion are adapted to pass up and out of the furnace. Each bench is provided with two take-off flues, one for each tier of retorts, as shown in Fig. 3, in which figure positions of duplicate benches are represented at the side and to the rear of the one above described, M′ being the respective take-off flues for the several adjoining benches.

Between the upper retorts of each bench an opening, N, is made in the face of the furnace, controlled by a suitable slide or valve, N′, the said opening being adapted to communicate with second or front combustion-chamber, $A^2$, by means of a series of ducts, $N^2$, radiating from said opening N, and leading into said second combustion-chamber, $A^2$, above the upper retorts, B, as shown in Figs. 1, 2, and 3. Through the opening N and ducts $N^2$ a supplementary or third air-supply is admitted in the second or front combustion-chamber, for the purpose of consuming any of the gaseous fuel which might escape before entering the offtake-flues.

In operation, the solid fuel is fed into the generator C through the hopper *a*. The primary air for converting this fuel to the gaseous state (carbonic oxide) is admitted through the draft-door *b′* under the grate *a′*. Passing through the mass and uniting with the carbon, it is converted to oxide. Water is allowed to trickle on the fuel mass through the pipe *d* and into the ash-pit *d′*, where, being vaporized, it passes up through the fuel, and there being decomposed by contact with the carbon results in the formation of gas, (hydrogen carbonic oxide oxygen.) The combined gaseous fuel now passes through the channels G, where it unites with the secondary air admitted through the flues H H′. At this point, *e*, the combustion takes place, and expanding into the rear or first combustion-chamber, A′, the heated gases pass up around the rear of the retorts B′ over the partition-wall B into the front or second combustion-chamber, $A^2$. Here the supplemental air-supply is met and any unconsumed escaping gases are ignited and burned. The gases, after imparting their useful effects to the retorts, pass through the opening *m* into the offtake-flues M, whereby the products of combustion are carried off in the usual manner.

It will be observed that the arch or horizontal partition D, whereby the generating-chamber is cheaply formed, admits not only of a more advantageous and economic use of fuel, but compels the first products of combustion to be brought in contact with the rear of the retort, where their action is most beneficial.

It will also be observed that not only a great advantage is attained by the arch or horizontal partition D, whereby a very effective generator or gas-producer is provided and the gases forced for combustion at the rear of the retorts, but that by means of the supplemental air-supply to the second or front combustion-chamber, $A^2$, I am enabled to effect a substantially complete combustion, and also to more completely control the working of the benches.

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

1. In a gas-retort furnace, the combination, with the bench A, divided into a front and rear compartment by a vertical partition, of an arch dividing the front compartment from the fuel mass, substantially as shown and described, whereby a generating-chamber is formed and the first products of combustion compelled to pass around the rear of the retorts, as set forth.

2. In a gas-retort furnace, the combination, with the bench A, divided into a front and rear compartment, A′ $A^2$, by a vertical partition, B, and an arch or horizontal partition, D, integral with said vertical partition and the front wall of the furnace, whereby a generating-chamber, C, is formed, of a series of channels or openings, G, in the upper rear end of said chamber and flues H H′, adapted to supply air above said channels, substantially as shown and described, and for the purpose herein set forth.

3. In a gas-retort furnace, the combination, with the bench A, divided into a front and rear compartment, A′ $A^2$, by a partition, B, an arch, D, uniting said partition and the forward wall of the furnace, whereby a generating-chamber, C, is formed, and supplemental air-ducts $N^2$ above the retorts, of a series of channels or openings, G, intervening the retorts at the rear, and the generating chamber and flues H H′, adapted to supply air above said channels, substantially as shown and described, and for the purpose herein set forth.

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