

(No Model.)

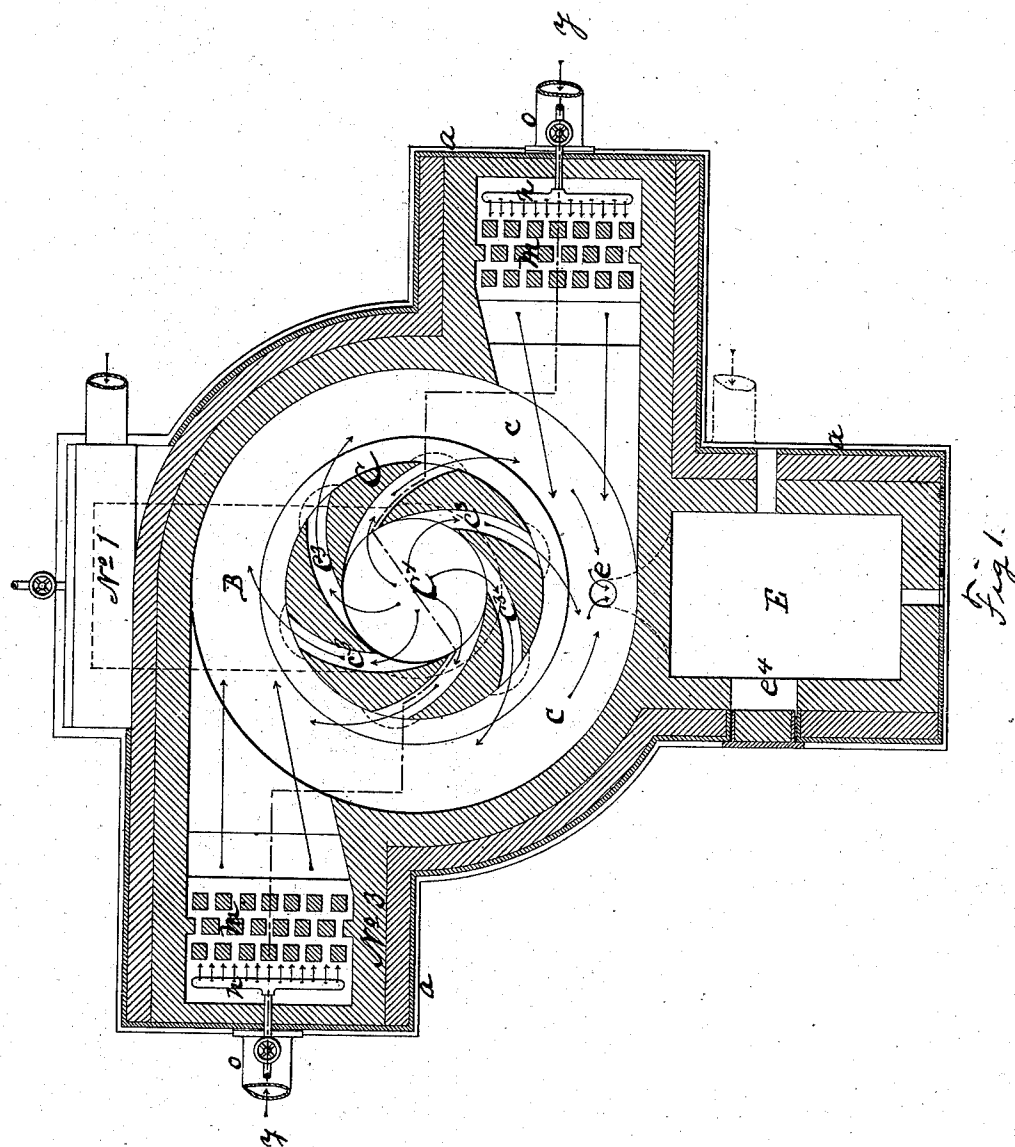
3 Sheets—Sheet 1.

J. T. MORGAN & H. F. HAYDEN.

GAS FURNACE.

No. 295,502.

Patented Mar. 18, 1884.



Witnesses:

John A. Svedberg  
Hedwig Svedberg

Inventor:

H. F. Hayden  
J. T. Morgan

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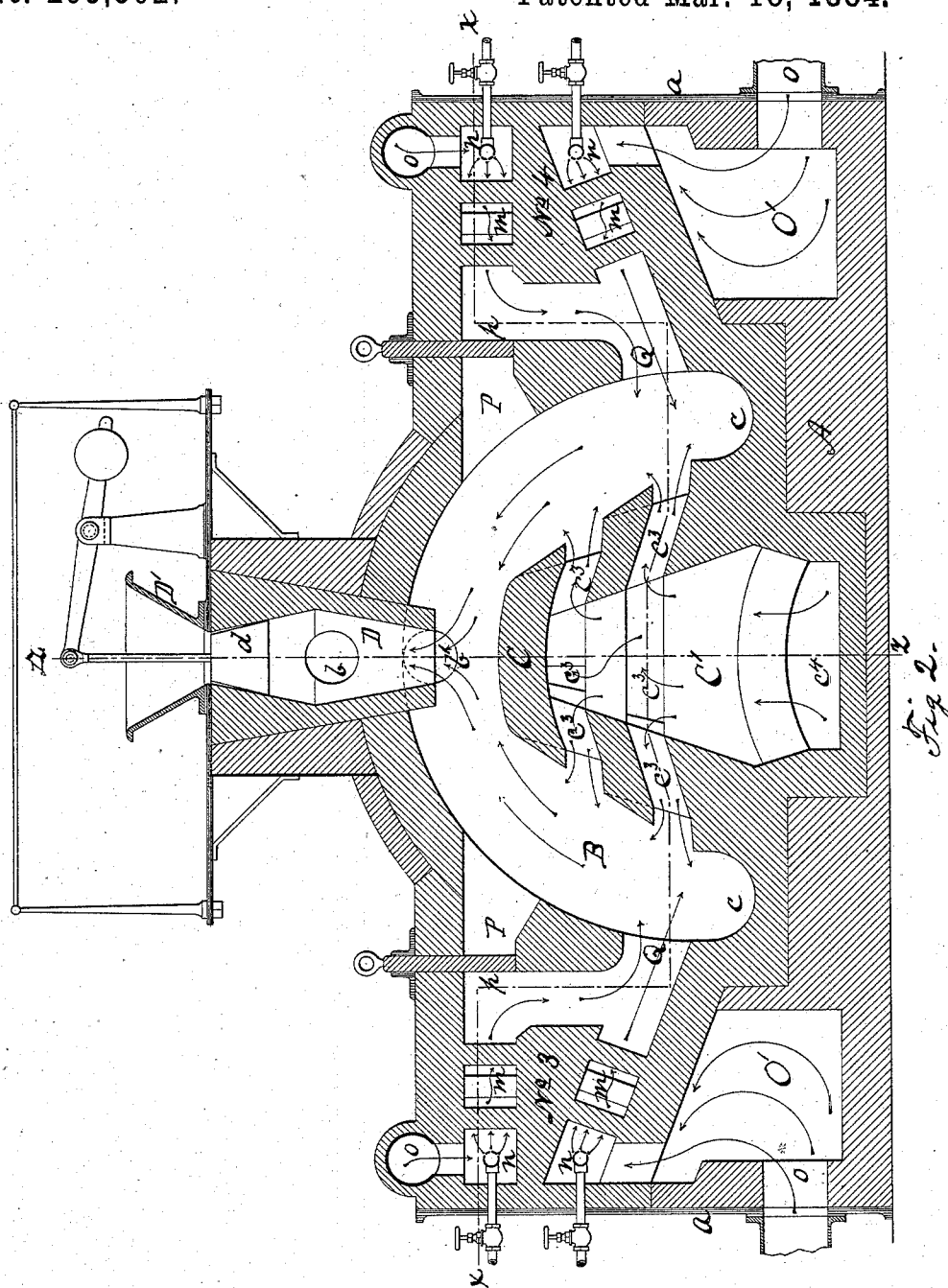
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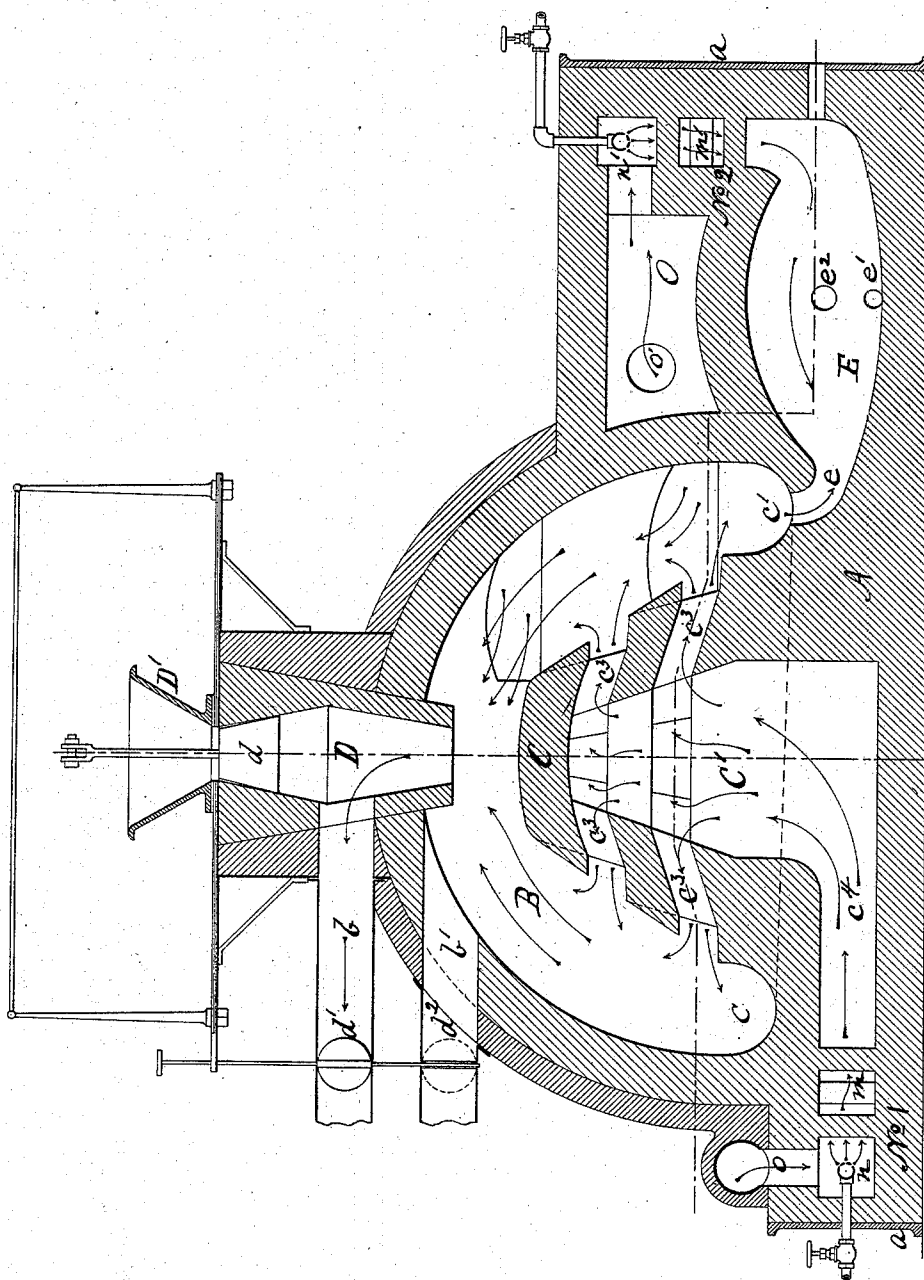
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# UNITED STATES PATENT OFFICE.

JOHN T. MORGAN, OF SELMA, ALABAMA, AND HENRY F. HAYDEN, OF WASHINGTON, DISTRICT OF COLUMBIA.

## GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 295,502, dated March 18, 1884.

Application filed June 4, 1883. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN T. MORGAN, of Selma, in the county of Dallas and State of Alabama, and HENRY F. HAYDEN, of Washington city, in the District of Columbia, citizens of the United States, have invented certain new and useful Improvements in Gas-Furnaces for Metallurgic and other Purposes; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a horizontal section on the line X X, Fig. 2. Fig. 2 is a vertical section on the line y y, Fig. 1. Fig. 3 is a similar section on the line z z, Fig. 2.

Like letters refer to like parts wherever they occur.

Our invention relates to the construction and operation of gas-furnaces adapted to the reduction and smelting of ores generally, and to various processes in the arts where high temperatures and perfect control of the furnace are desirable.

In general construction the devices are somewhat analogous to our former inventions, but embody certain characteristics which distinguish them from all that have preceded them, both in construction and operation. First, the fires deliver tangentially into the reducing or ore chamber and whirl or rotate therein, so as to intensify the action of the flame and products of combustion on the centrally-arranged ore or like material to be reduced; secondly, the ore-mound is hollow and perforated, so that the molten material, as it flows from the mound, may be treated with a flame of any desired quality to assist in the refining of the metal; thirdly, provision is made for trapping the molten metal from the reducing or smelting chamber and submitting it to subsequent treatment before it is finally drawn from the furnace, whereby the character of the flame used in the final treatment of the metal may be varied, if desired, from that used in reducing and smelting the ore.

Besides these main features there are other points of invention which will hereinafter more fully appear.

We will now proceed to describe our inven-

tion more fully, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates the brick-work of the furnace, which may be supported by the usual boiler-plate jacket or casing, *a*. The main or reducing chamber B of the furnace is preferably of a circular or elliptical form in cross-section, and is provided with a central mound, C, surrounded at its base by a gutter or channel, *c*, which inclines from all directions to the point *c'*.

In the arch of the furnace, and directly over the mound C, is a feed-flue, D, preferably in the form of two conical frusta arranged base to base, so that the upper portion may be closed by a conical plug, *d*, of refractory material, and its lower walls will serve to deflect the material charged therethrough and deliver it on the mound C in the form of a pyramid. The feed-flue D is surmounted by a hopper, D', and is preferably constructed of fire-clay or other refractory material divisible longitudinally, so that the conical plug *d* can be inserted and withdrawn when desired. We prefer the lower end of feed-flue D should project below the arch of the furnace, as shown. The conical plug *d* is suspended by a rod from a counterbalanced lever, so as to be easily operated.

Leading from the reducing-chamber B are two flues for waste products, the one, *b*, opening into the feed-flue D, and the other, *b'*, below the arch of the furnace or reducing-chamber B, and these two flues are guarded by two dampers, *d'* *d'*, arranged at right angles upon a single stem, so that when one of the flues is open the other is closed, and so that by a proper manipulation of the dampers each flue can be partially opened and the course of the waste products divided. The lower flue, *b'*, is usually used when charging the material to be treated, or when a cross-draft is desired, and the upper flue, *b*, when an upward sweeping draft is desired. The two flues may deliver into a suitable regenerator or regenerators to heat the incoming air required to support combustion in the furnace. The mound C has a central flue, C', and its walls are perforated, as at *c''*, said perforations or channels being preferably curved, (see Fig. 1,) so as to

give circular motion to the products of combustion, &c., escaping therethrough, the flue C' connecting by a suitable throat,  $c'$ , with a fire-chamber, No. 1, which in the present instance is shown as a checker-work or mixing chamber,  $m$ , a gas-supply pipe and burner,  $n$ , and an air-supply pipe,  $o$ .

Directly opposite fire-chamber No. 1, within the brick-work of the furnace, is arranged a refining-hearth, E, which communicates with the lowest point of the gutter  $c$ , surrounding the mound C, by a throat or channel,  $e$ . This refining-chamber is provided with a tapping-hole,  $e'$ , slag-port  $e''$ , a working-door,  $e'$ , and fire-chamber No. 2. The fire-chamber in the present instance is a checker-work or mixing chamber,  $m'$ , burner and gas-supply pipe  $n'$ , and air-supply pipe  $o'$ , which delivers into an air-well, O, located directly over the refining chamber or hearth E.

We will next describe the arrangement of the main fires, Nos. 3 and 4, used with the reducing-chamber B, referring for this purpose to Figs. 1 and 2. As shown, each of said fire-chambers consists of two separate sets of checker-work or mixing chambers  $m$ , burners and gas-supply pipes  $n$ , and air-supply pipes  $o$ , arranged one above the other, those of the lower set delivering into air-wells O', and said fires arranged to deliver, by flues P Q, either directly upon the material on the mound, (as, for instance, ore to be reduced,) or with an upward spiral motion over the surface of the molten material as it runs from the mound.  $p$  indicates dampers by means of which flues P can be closed when it is desired to pass all of the products through flue Q. These fires, or whatever fires may be employed, are arranged to deliver tangentially to the reducing and smelting chamber B, so that the flame or products of combustion shall take a rotary motion around the mound C before rising to the waste-flues  $b' b''$ .

The construction of the furnace being of the general character described herein, it will operate as follows: The gas being turned on and ignited at the burners in fire-chambers Nos. 1, 2, 3, and 4, and the air admitted through the supply-pipe, the products of combustion will pass through the respective works or mixing-chambers  $m$ , and enter the reducing-chamber B, as follows: That from fire-chamber No. 1 will enter central flue, C', of mound C, and escape through the curved channels  $c''$  in the walls of the mound, having acquired a rotary motion. That from fire-chambers Nos. 3 and 4 will be delivered directly into the reducing and smelting chamber B, either above or below, according to the arrangement of damper  $p$ , and will also circulate around mound C, while that from fire-chamber No. 2 will first perform its work in refining chamber or hearth E, and then escape by throat  $e$ , to mingle with the products of combustion from the other fires, the entire waste product passing off through flues  $b' b''$ , as hereinbefore specified.

When the furnace has been raised to the de-

sired temperature, ore or other material to be treated is charged through feed-flue D, and falls in the form of a pyramid or cone on mound C, where it is exposed to the reducing and smelting action of the flame or products of combustion from the several fires; and as the molten metal flows from the mound its surface is acted on by the spirally-rotated products from fires Nos. 3 and 4, while those from fire No. 1 pass through the mass and assist in the preliminary refining of the metal. The molten metal which collects in gutter  $c$ , surrounding mound C, runs thence through throat  $e$  into refining-chamber E, where it may be treated, and whence it is subsequently withdrawn.

As the several fires are each independent of the other, it is evident the character of the flame from each can be regulated so as to obtain a neutral, an oxidizing, or a reducing flame in the refining-chamber or the reducing-chamber, as desired.

It is evident, first, that the tangentially-arranged fires need not necessarily be of the class shown (gas-furnaces) in order to obtain the rotary motion of the products of combustion and an operative combination with the reducing-chamber and central ore-mound, but may be of any of the many well-known forms—such even as the ordinary grate-fires—nor is it essential that the mound be hollow and perforated;—secondly, it is evident that the fires need not be arranged tangentially from the hollow perforated central mound; and, finally, it is not essential that the refining chamber or hearth E be located within the main walls of the furnace; but the construction, combinations, and arrangements shown and described herein are, in our opinion, the best practical manner of carrying out the entire invention.

We do not herein claim the combination of two crucibles and an interposed ore-mound.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The combination, with a reducing or smelting chamber having a central mound for the reception of the material to be treated, of one or more fires arranged to deliver tangentially into the reducing-chamber, substantially as and for the purposes specified.

2. The combination, with a reducing-chamber having one or more fire-chambers delivering into the same, of a hollow perforated central mound for the reception of the material to be treated, substantially as and for the purposes specified.

3. The combination, with a reducing-chamber having a centrally-arranged hollow perforated mound, of a fire-chamber which delivers into the central flue of the perforated mound, and one or more fires arranged to deliver tangentially into the reducing-chamber, substantially as and for the purposes specified.

4. In a reducing and refining furnace, the combination of a reducing-chamber having a central mound, an inclined metal channel sur-

rounding the same, and its own fire-chamber or fire-chambers, delivering into the reducing-chamber, and a refining-chamber which connects with the inclined metal channel of the  
5 reducing-chamber, and is provided with its independent fire-chamber, so as to receive the molten metal therefrom, substantially as and for the purpose specified.

10 5. The combination, with a reducing-chamber having a central ore-mound, of one or more double fire-chambers arranged tangentially to and connecting with the reducing-chamber by an upper and a lower flue, substantially as and for the purposes specified.

15 6. A reducing-chamber provided with a central ore-mound having a hollow central and curved discharge-flues, substantially as and for the purposes specified.

7. In an ore reducing and refining furnace, the combination of a reducing and smelting 20 chamber having a central ore-mound and a series of fires arranged to deliver tangentially thereinto, with a refining hearth or chamber, which communicates with and receives the molten metal from the reducing and smelting 25 chamber, substantially as and for the purposes specified.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN T. MORGAN.  
HENRY F. HAYDEN.

Witnesses:

H. B. MOULTON,  
C. W. HAYES.