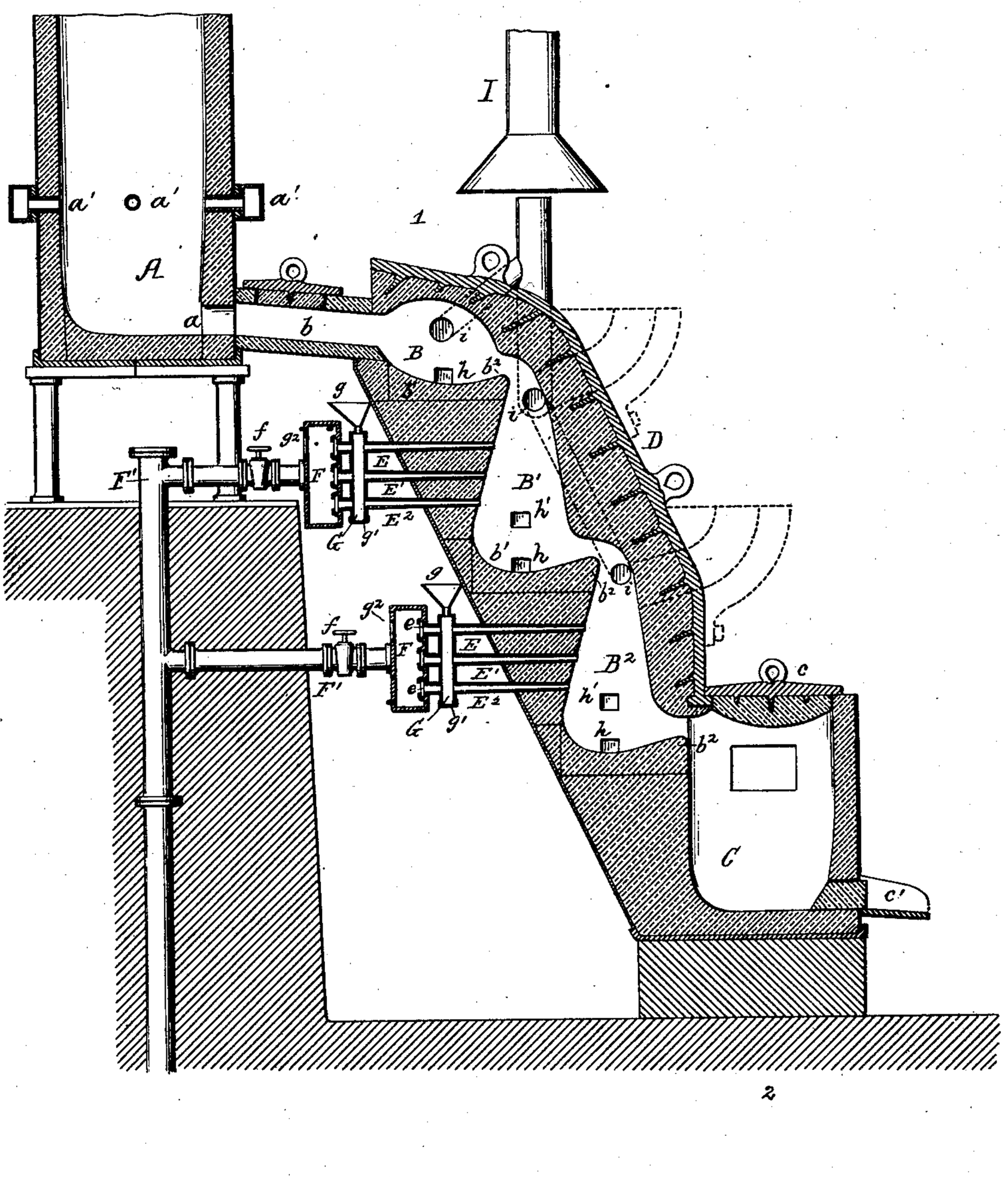
(No Model.) 2 Sheets—Sheet 1.

E. SAMUEL.

METHOD OF TREATING METAL.

No. 336,439. Patented Feb. 16, 1886.

FIG. 1.



Witnesses:
Jos. H. Klein.
Henry Bossert.

Inventor:
Edward Samuel
by his Attorneys
Howson & Sons

(No Model.) 2 Sheets—Sheet 2.

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METHOD OF TREATING METAL.

No. 336,439. Patented Feb. 16, 1886.

FIG. 2.

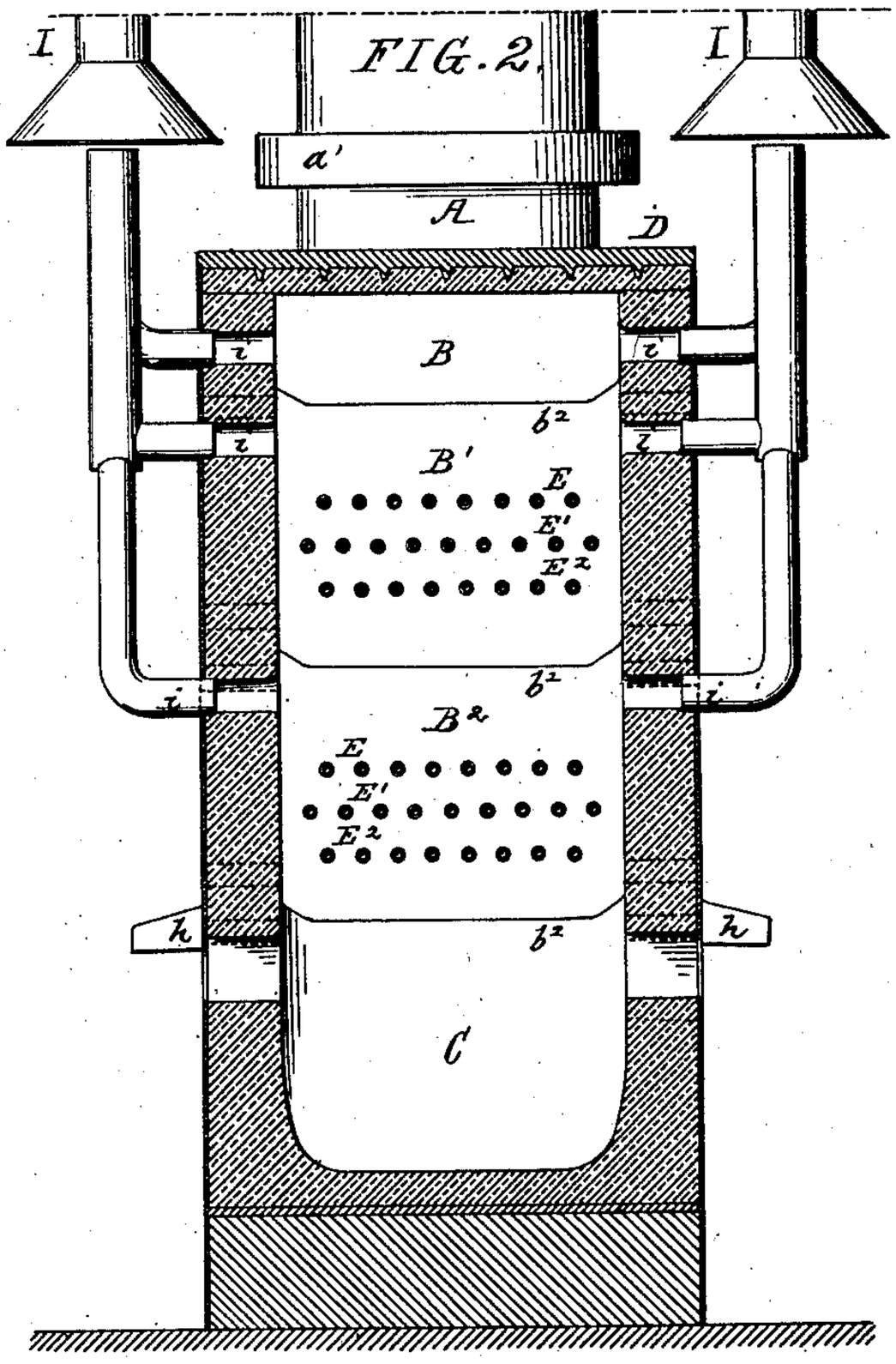
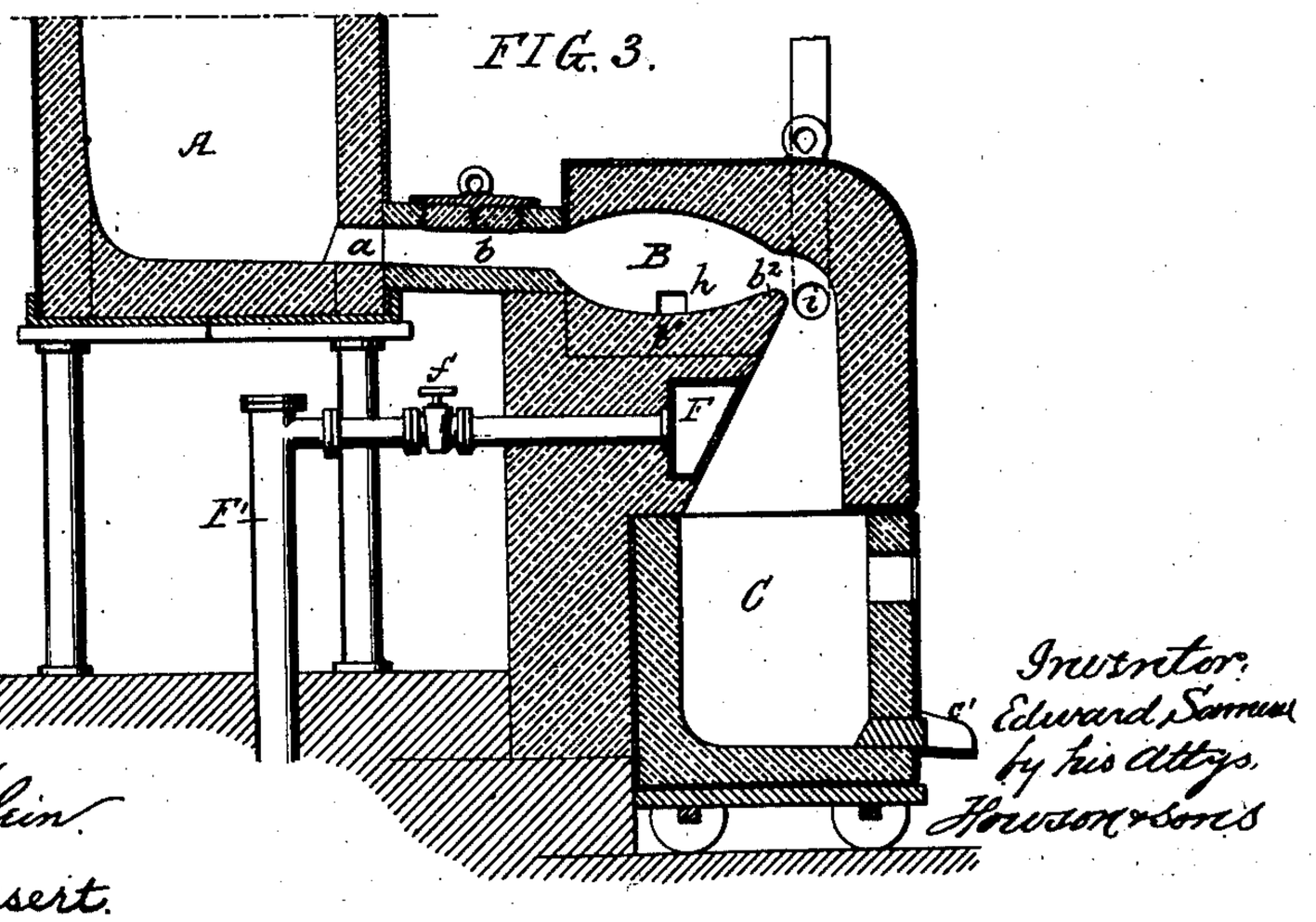


FIG. 3.



Witnesses:
Jos. H. Klein.
Henry Bossert.

Inventor:
Edward Samuel
by his Attys.
Howson & Sons

UNITED STATES PATENT OFFICE.

EDWARD SAMUEL, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF TREATING METALS.

SPECIFICATION forming part of Letters Patent No. 336,439, dated February 16, 1886.

Application field April 20, 1885. Serial No. 162,809. (No model.)

To all whom it may concern:

Be it known that I, EDWARD SAMUEL, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented an Improved Method of Treating Metals, of which the following is a specification.

My invention consists of certain improvements in the treatment of molten iron, steel, or similar metals for converting, refining, or purifying the metal, as fully described and claimed hereinafter.

My method of treatment consists in causing the molten metal to flow from a cupola, smelting or reducing furnace, in a wide thin stream or sheet through an unobstructed chamber, and directing against the front or rear face of this sheet of molten metal a finely-divided blast of air or other gases, in order to cut through the metal at as many points as may be desired, in order to insure the subjection of the entire stream of metal to the action of the blasts of air or other gases.

My invention may be carried out in different forms of apparatus; but in the accompanying drawings I have illustrated constructions of apparatus which I prefer to use.

Figure 1 is a vertical section of one of the apparatus. Fig. 2 is a vertical section on the line 1 2, Fig. 1; and Fig. 3, a sectional view of a simpler form of apparatus for carrying out the invention.

Referring to Fig. 1, A is the cupola, melting or reducing furnace, in which the ore, pig, or metal in other form is reduced to a molten condition. This furnace may be of any desired or suitable construction, and in the drawings I have shown an ordinary cupola provided with tuyeres a' and an outlet, a, through which and the conduit b the molten metal may flow into the refining-furnace. This refining-furnace, as shown in Fig. 1, consists, essentially, of a series of pools, B B′ B²—three in the present instance—arranged one in advance of and below the other, and below the last one of the series is a receiving ladle or crucible, C, having a removable cover, c, and tapping or discharge outlet c'. This crucible or ladle may itself be movable and detachable from the furnace, as shown in Fig. 3.

Each pool B B′ B² forms the bottom of a chamber whose rear wall and side walls are a part of the body of the structure, while the inclosing or front wall I prefer to make in one or more removable parts, D, which can be lifted off the supports on the main structure by any suitable means, so that ready access may be had to the interior of the furnace for purposes of repair. In the present instance I have shown the entire front of all the refining-chambers as made in one piece, with a metallic frame lined with any proper refractory material

The bottom of each pool B E′ B² may be made of a separable tile or block of suitable material, which can be readily removed and replaced when burned out on lifting the inclosing-cover D; or it may be daubed up to its proper lines, in the manner usual in forming bridge-walls of furnaces. The front edge of each of these pools is formed into an overhanging ledge, b^2, from which the rear wall of the chamber below recedes, for the purpose explained hereinafter.

Into the rear wall of each chamber below the first one are built rows of tuyeres E E′ E², three rows for each chamber being illustrated in the drawings, and these three rows communicate with a common blast-box, F′, having a regulating-valve, f. Each row of tuyeres is provided with independent sliding gates e, to regulate or cut off the supply of air from any one or more of the tuyeres.

I prefer to combine with each set of tuyeres a device for supplying powdered material to be blown into the molten metal through the said tuyeres intermixed with the blast, and for this purpose the rows of tuyeres are interrupted in front of the blast-box by a common mixing-chamber, G, provided as its upper end with a valved hopper, g, and at its lower end with a door, g', for other device admitting of the removal of any material which may have dropped past the tuyere-openings, so that when desired the valve may be opened and the material be allowed to drop into the chamber G, where it is caught by the blasts of air and carried thereby through the tuyeres into the purifying-chamber.

In the back part of each blast-box I provide a glazed opening, g^2, in line with one of the rows of tuyeres, for the purpose of enabling the operator to watch the entire process with-

out danger, and I also provide openings with suitable covers, whereby any one or all of the tuyeres may be cleansed.

At the bottom of each of the pools B B′ B² are provided in one of the side walls tapping-holes *h*, for testing the metal at different stages, or drawing it off, and at suitable distances above the bottom are other openings, *h′*, for the purpose of introducing spiegel, ferro-manganese, or other material without disturbing the top covering.

Each purifying-chamber is provided near its upper end with an exit-flue, *i*, for the escape of the gases and impurities incident to the process; and in order not to interfere with the free removal of the inclosing-front D, I make these exit-openings *i* in the side walls of the permanent structure, as shown in the drawings, although, as shown by dotted lines, the openings for this purpose may be made in the top cover at any convenient part thereof. These exit-flues *i* may communicate with or open into chimneys I or flues, as is common in the ordinary Bessemer process.

The molten metal from the cupola, melting or reducing furnace A, flows into the first pool, B, where it collects until it flows over its front ledge, *b*², in a wide thin stream or sheet, into and through the first purifying-chamber to the pool at the bottom thereof. In the passage of the sheet of metal through this chamber, which is unobstructed, divided blasts of air or gas from one or more of the rows of tuyeres, at any desired pressure, are directed against the rear face of the sheet or stream of metal, so that these divided blasts will cut through the sheet of molten metal at as many points as may be found necessary for the desired effect. These divided blasts thus directed against the face of the sheet of falling metal will permeate the latter in a way which cannot be effected by an undivided blast, or one directed against the edge of the sheet of metal, or where the metal itself is divided. The character of the gases introduced through the tuyeres will vary with the nature of the metal to be treated and the result to be produced. In some cases carbonic acid or carbonic oxide or hydrogen or atmospheric air, or any of the gases commonly employed in the treatment of iron and steel may be employed. In order that the metal which may be blown against the front wall of the chamber shall fall into the pool of that chamber, this front wall is within the line of the pool, or, in other words, is behind the overhanging edge of the pool into which it falls, as shown in Fig. 1. The metal thus treated in the first chamber, and which collects in the pool B′, then begins to flow in a similar wide thin sheet or stream over its front edge down into and through the first purifying-chamber, where further divided blasts of air or gases are directed against the rear face of the sheet of molten metal, if found necessary, and thence the metal flows into the collecting-chamber C, from which it may be tapped in the usual way, or the vessel itself may be removed and the metal poured directly into molds provided.

Owing to the construction of the chambers with inclined or recessed rear walls, as shown, so that the front edge of the pool immediately above overhangs the rear wall, the tuyeres are not liable to be impaired by the molten metal coming in contact with them.

Referring to Fig. 3, I have shown an apparatus of simpler form, A being the cupola, and *b* the conduit. *b*² is the edge over which the metal flows in a thin sheet into the ladle or crucible C, the blast-box F being under the edge *b*², and having a series of perforations. I have also shown the ladle C removable in this view.

The method of treatment as carried out in this apparatus also is similar to that above described—that is to say, the metal flows through an unobstructed chamber in a wide thin sheet, and divided blasts of air are directed against the face of the sheet to insure the effective treatment of the molten metal.

I am aware of the patent of Martien, No. 16,690, dated February 24, 1857; but in the apparatus there shown the metal is allowed to flow along the perforated bottom of an inclined trough, so that the blast has not proper access to the metal, as in my process, and the bottom of the trough becomes burned out and its perforations choked up.

I claim as my invention—

The method herein described of treating molten metals to convert, refine, or purify them, said method consisting in causing the molten metal to fall in a thin sheet through an unobstructed chamber, and directing against the front or rear face of this sheet of falling molten metal divided blasts of air or gases, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWD. SAMUEL.

Witnesses:
W. J. BURNS,
HARRY SMITH.