(No Model.)

W. B. DEVEREUX.

APPARATUS FOR HEATING BLAST FOR BLAST FURNACES.

No. 374,240. Patented Dec. 6, 1887.

Fig. 1.

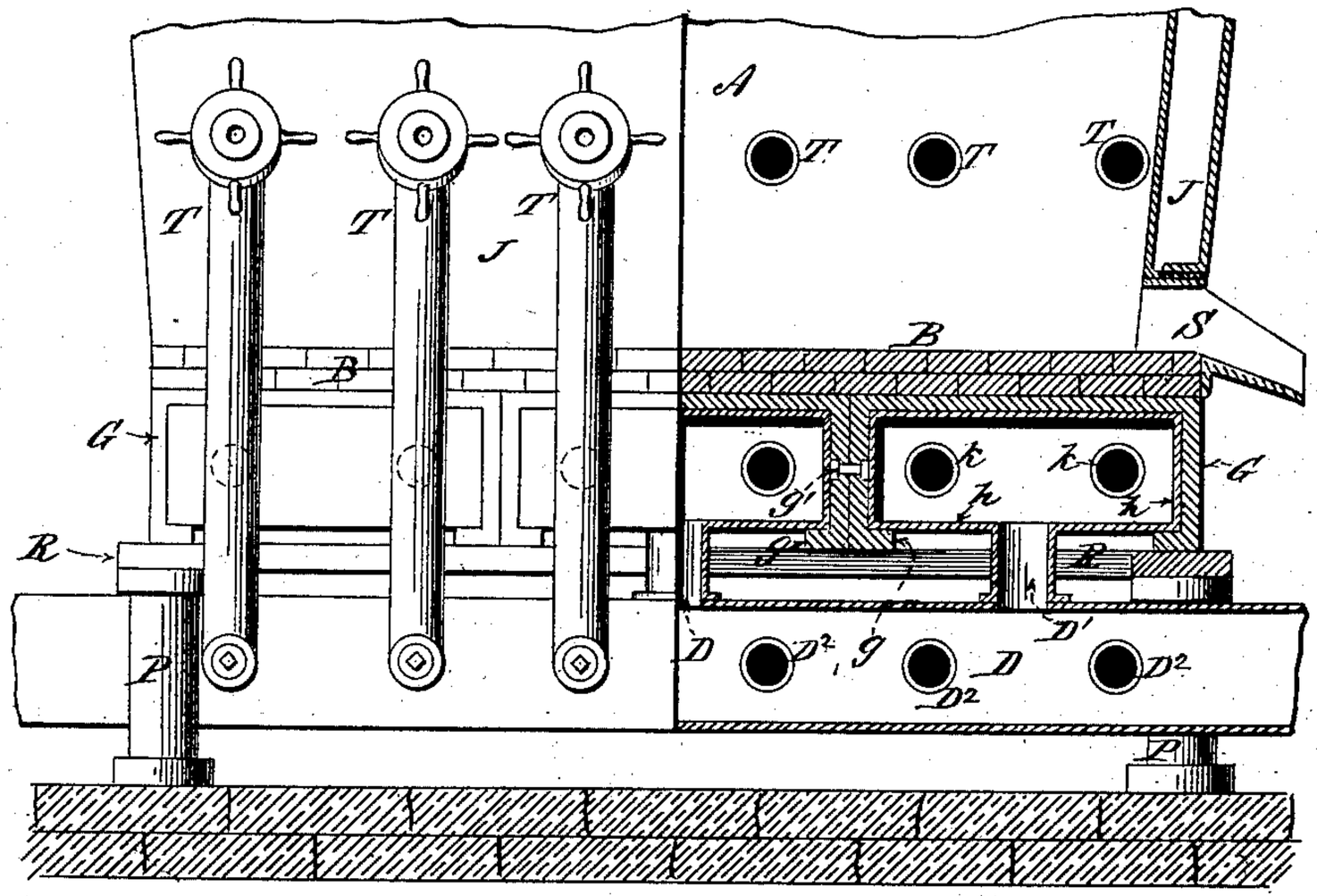


Fig. 2.

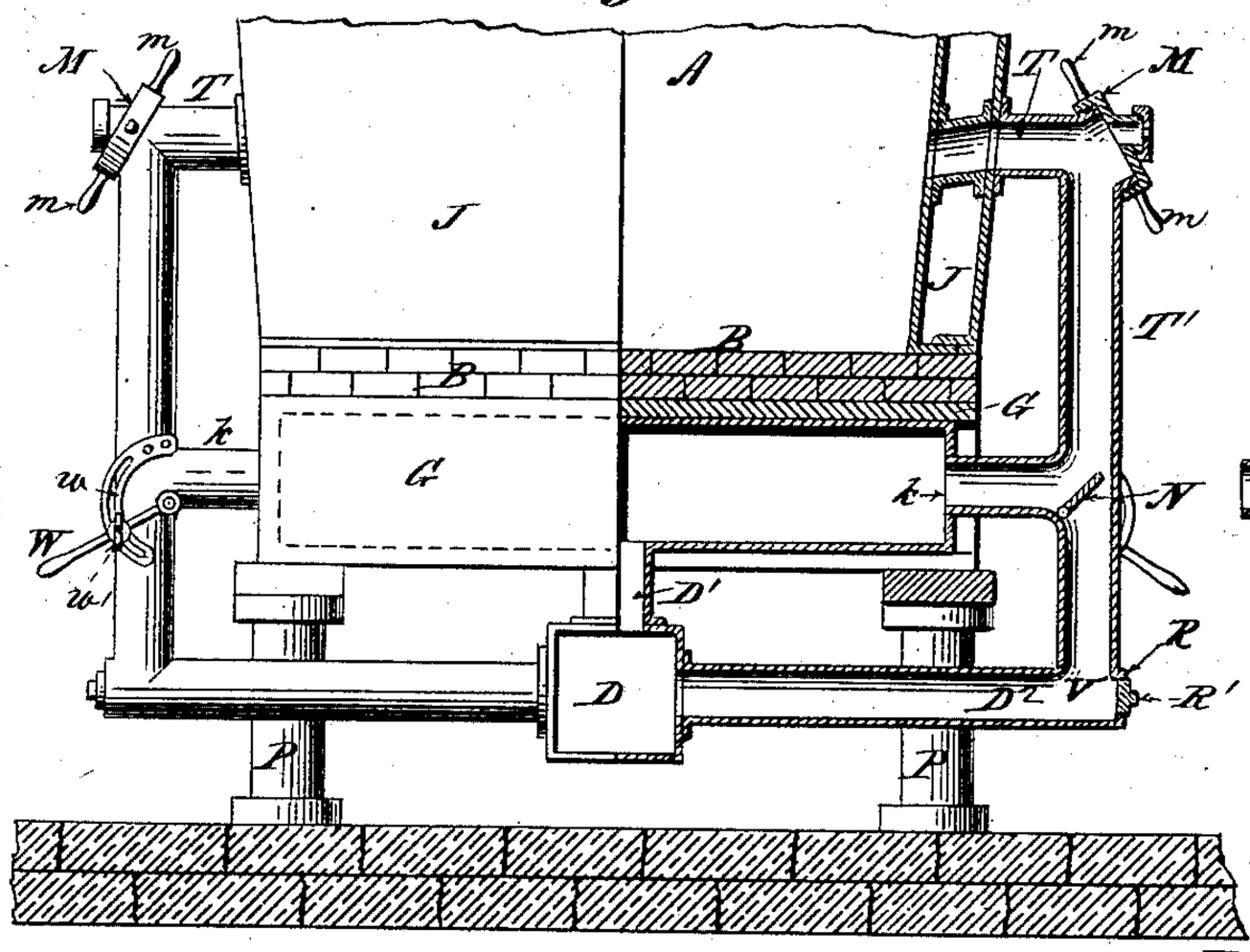
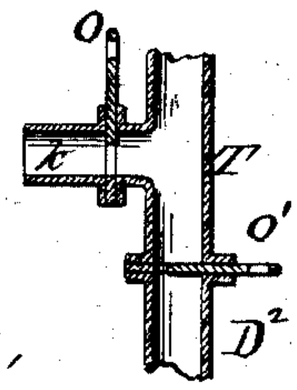


Fig. 3.



Witnesses:
Geo. H. Hiatt
Wm. Gardner

Inventor:
Walter B. Devereux
By his attorney
Willard Parker Butler

UNITED STATES PATENT OFFICE.

WALTER B. DEVEREUX, OF ASPEN, COLORADO, ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-HALF TO THE ORFORD COPPER COMPANY, OF NEW JERSEY.

APPARATUS FOR HEATING BLAST FOR BLAST-FURNACES.

SPECIFICATION forming part of Letters Patent No. 374,240, dated December 6, 1887.

Application filed May 6, 1886. Serial No. 201,262. (No model.)

To all whom it may concern:

Be it known that I, WALTER B. DEVEREUX, a citizen of the United States, and a resident of Aspen, in the county of Pitkin and State of Colorado, have invented certain new and useful Improvements in Apparatus for Heating Blasts for Blast-Furnaces, of which the following is a specification.

My invention relates to an apparatus for heating the blast used in blast-furnaces by means of certain waste heat which is generated in the operation of smelting, and which in most cases is allowed to be lost.

The object of my invention is to accomplish the above purpose with the greatest possible economy in space and in furnace construction, and at the same time to provide convenient means for readily regulating and controlling the temperature of the heated blast by the introduction, if desired, of a current of cold blast before the hot blast reaches the furnace-tuyeres.

In the smelting of lead, silver, copper, and other ores it is often advisable to provide some ready means of heating the air-blast; but in practice hot blast is seldom or never used, for the reason that no economical and easy means have hitherto been devised for heating the same. In the smelting of all classes of ores in shaft-furnaces a very high degree of temperature is generated in the lower portion of the furnace below the fusion-zone.

My invention consists in providing devices for applying the heat generated in the operation of smelting to the purpose of heating blast; and I accomplish this by entirely doing away with the ordinary form of crucible usually employed in blast-furnaces, in placing bottom of the furnace close up to the fusion-zone, and in causing the currents of air before entering the tuyeres to pass through hollow spaces directly under the bottom of the furnace.

My invention will be best understood by reference to the accompanying drawings, in which—

Figure 1 represents a sectional elevation of the furnace on a line at right angle to the tuyeres, and Fig. 2 a sectional elevation of the furnace on a line through the tuyeres.

Similar letters refer to similar parts in both views.

In the views, A represents the ordinary form of shaft-furnace, which is ordinarily either rectangular or round in cross-section, but which may be of any shape, according to circumstances. The number of tuyeres employed will vary according to the size of the furnace. In the furnace shown in the drawings twelve tuyeres are used, six being placed on each side on the longest side of the furnace.

J J represent the ordinary water-jacket walls which compose the furnace, through which the tuyeres pass, as shown in the views. Any desirable form of tuyeres may be used that may be found convenient.

B represents the bottom of the furnace, which may be made of fire-brick or other heat and fire resisting material, and may be made flat, as shown, or made to incline toward the tap-hole.

S is the ordinary form of furnace tap hole or spout, which may be placed at both sides in cases of large furnaces, thus affording two points for tapping.

The furnace is supported upon four or more iron or stone pillars, P P P P, resting upon masonry or other substantial foundations. Across the top of the pair of pillars standing upon the side of the furnace along which the tuyeres are placed is bolted or attached a flat plate of wrought or cast iron, R, of sufficient tensile strength and dimensions to support the weight of the furnace. Two of these plates are used, as shown in the views, one over each pair of pillars. The bottom B of the furnace is supported upon one or more hollow U-shaped girders, G, the ends of which are supported, as shown in the views, upon the plates R. The outer ends of the girders G are formed with the inner flanges, *g g*, &c., for the purpose of supporting the sheet-metal boxes *h h*, which are inserted in their hollow interior. These boxes, as will be seen from Fig. 2, are of the same length as the girders G, but have their ends closed.

The girders G may be fastened together laterally in any convenient manner; but in practice it will be found most convenient to bolt

them together at their outer extremities by means of the bolts *g' g'*, which are inserted and made fast before inserting the boxes *h h*. As will be seen from the views, the bottom of the furnace rests directly on top of the girders G G, as also the water-jackets which compose the furnace-sides. The tuyeres are connected with the interior of the sheet-metal boxes *h h* by means of metal pipes *k k*, entering the end walls in the manner shown in the drawings.

The girders G G may be of any desired lateral width or height. In cases where the furnaces are very small it will be found convenient in practice to construct the bottom of a single hollow girder, instead of in small sections bolted together in the manner shown in the views. In the case of large furnaces it will be found most convenient to make them of such dimensions and proportions that they will each surround an air-box from which either two or four tuyeres may be heated. In the furnace shown in the views three supporting-girders are used, each of which supplies four tuyeres, two of which are connected at each end of the boxes.

The cold blast is supplied to the tuyeres T T, &c., from the blower through the central distributing-pipe, D, from which a pipe, D', leads into the interior of each of the sheet-metal boxes *h h* at or near the center. Each tuyere is provided with a cold-air-blast pipe, D^2, whereby it is connected with the main distributing-pipe D in the manner shown. The amount of cold and hot air supplied to the tuyeres may be regulated by means of any convenient form of valve or by two valves in each supply-pipe.

In Fig. 2 of the drawings a hinged valve, N, is shown at the junction of the hot-air pipe *k* with the cold-air pipe D^2. By raising or lowering the handle W, attached to the axis of the valve upon the arc *w*, it is possible to regulate the amount of cold air as well as hot air admitted to the tuyere at pleasure. The handle W may be held in any desirable position on the arc *w* by means of the thumb-screw *w'*.

In Fig. 2 a modified form of cut-off valve is shown. Here the pipes *k* and D^2, which supply the tuyere with hot air and cold air, respectively, are provided each with independent valves or gates O O', which slide in seats in the pipes. By sliding these valves in any desired direction the amount of air supplied to the tuyeres may be regulated at pleasure, and, in cases where it is deemed advisable, by shutting both valves one tuyere may be completely cut off, which is often a decided advantage when the passage of the blast becomes obstructed by a mass of cool slag. In such cases the complete stoppage of the blast from that particular tuyere allows the heat from the opposite tuyere to melt away the accretion.

Any convenient form of tuyere may be used; but in practice I have found it preferable to make use of the form patented to me upon the 26th day of May, 1885, by Letters Patent No. 318,604. The drawings show the furnace arranged with such tuyeres, each tuyere being provided with a movable screw-bonnet, M, with the handles *m m*, whereby access is obtained to the interior of the tuyere, and whereby the size and direction of the nozzle can be altered at pleasure.

The pipe D^2 is provided with an opening, V, covered by a movable screw-cap, R', or other convenient cover, by means of which access can be had to the pipes D^2 and the tuyere-pipes T' for the purpose of removing any slag that may overflow from the tuyeres and run down the pipe T'.

The method of operation of the invention is substantially as follows: as is well known, that portion of a smelting-furnace which is below the fusion-zone will be the hottest portion, and where the crucible or hearth is dispensed with and a flat bottom is used close up to the fusion-zone that bottom will during the operation of smelting become intensely hot. In some form of furnaces now in use an iron bottom is used having a crucible of sufficient depth to collect a small amount of metal below the slag, which metal is tapped off at intervals separate from the slags. The invention may be applied to this form of furnace in substantially the same manner and with equally good effect. If, now, the air which is supplied to the tuyeres is caused to traverse the bottom of the furnace on its way to the tuyeres, the air will become heated and its efficiency in smelting increased.

In my invention the cold blast enters the pipe A from the blower, and from this pipe is distributed to the heating-boxes *h h*. The iron girders G G, being on top in direct contact with the bottom of the furnace, become extremely hot, and in turn impart their heat to the sheet-metal heating-boxes. The iron girders may form the bottom of the furnace without any superimposed layer of refractory material, in which case a portion of the charge will be allowed to cool upon the bottom of the furnace, and thus form of itself a refractory layer. Owing to the fact that the girders are made in sections and are not confined at either end, being simply bolted each to the other in the manner shown, they are free to expand in either direction. Any leakage of matter or metal through the bottom of the furnace will escape through the crevices between the girders without doing any damage, and will fall upon the foundations, whence they may be removed at any time. As the girders are open at the bottom and the heating-boxes rest simply upon the interior flange and are in no way attached to the girders, they are free to expand in every direction. The blast as it emerges from the heating-boxes passes through the pipe D' to the tuyeres and is mixed at the point D^4 with any desired amount of cold air that will enable the best effect to be produced in working.

I am aware that it is not new to pass air under the bottom or bed of reverberatory furnaces, either for the purpose of heating the

air or for the purpose of cooling the bed. I believe, however, that it is new to eliminate the crucible in the bottom of a shaft-furnace and to replace it with a hollow bottom composed of removable hollow sections through which the air or blast is passed under pressure for the purpose of heating the same.

Where large furnaces are used, if the hollow bottom be cast or otherwise constructed in one piece, the same will inevitably become cracked, thereby allowing easily-fusible metals to run through into the air-chamber, and where the bottom is constructed of sections to obviate this cracking it will still be impossible to prevent such metals from running through as above.

By constructing the bottom in sections substantially as described and by constructing the air-chambers independent of each other and of the sections which compose the bottom any leakage of metals, &c., will take place without entering or obstructing the air-chambers and without doing any damage. It is also possible and practicable by means of this construction from time to time to remove or replace any one section of the bottom without removing or in anywise materially disturbing the other sections. The sections being quite independent of each other, if one of them becomes cracked or corroded by the leakage of metal through the furnace-bottom it may be removed and replaced by loosening the bolts *g' g'*, which tie the structure together, and providing any suitable support for the furnace during the operation of shifting. This arrangement is of great practical value, especially in the case of small furnaces, where, by making the bottom out of a number of small sections, the latter may be readily renewed with the least possible labor and expense.

I claim as my invention—

1. In a system of heating blast for shaft-furnaces by means of the waste heat of the furnace, the combination, substantially as hereinbefore set forth, of a furnace having a metal bottom composed of hollow sections placed together so that each section forms an air-chamber, one or more pipes connected with said sections, whereby the cold blast is supplied thereto from the blower, and a series of pipes whereby the tuyeres are supplied with hot blast from said hollow sections.

2. In a system of heating blast for shaft-furnaces by means of the waste heat of the furnace, the combination, substantially as hereinbefore set forth, of a furnace having a metal bottom composed of hollow sections placed together so that each section forms an air-chamber, one or more pipes connected with said sections, whereby the cold blast is supplied thereto from the blower, a series of pipes whereby the tuyeres are supplied with hot blast from said hollow sections, and means for supplying blast at ordinary temperature to the tuyeres, substantially as described.

3. In a system for heating blast for shaft-furnaces, the combination, substantially as hereinbefore set forth, of a furnace having a hollow metal bottom composed of hollow sections placed together, one or more pipes connected with said sections, whereby the cold blast is supplied thereto from the blower, a series of pipes whereby the tuyeres are supplied with hot blast from said sections, a second series of pipes whereby cold blast is supplied from the distributing-pipe to the tuyeres, and means for regulating and controlling the amount of air supplied to the tuyeres, substantially as described.

4. In a system of heating blast for shaft-furnaces by means of the waste heat of the furnace, the combination, substantially as hereinbefore set forth, with a shaft-furnace, of a hollow metal bottom composed of a series of hollow sections so constructed and arranged that they may be removed separately for heating the blast supplied to the tuyeres.

Signed at New York, in the county of New York and State of New York, this 23d day of February, A. D. 1886.

WALTER B. DEVEREUX.

Witnesses:
EDWIN T. RICE, Jr.,
WILLARD P. BUTLER.