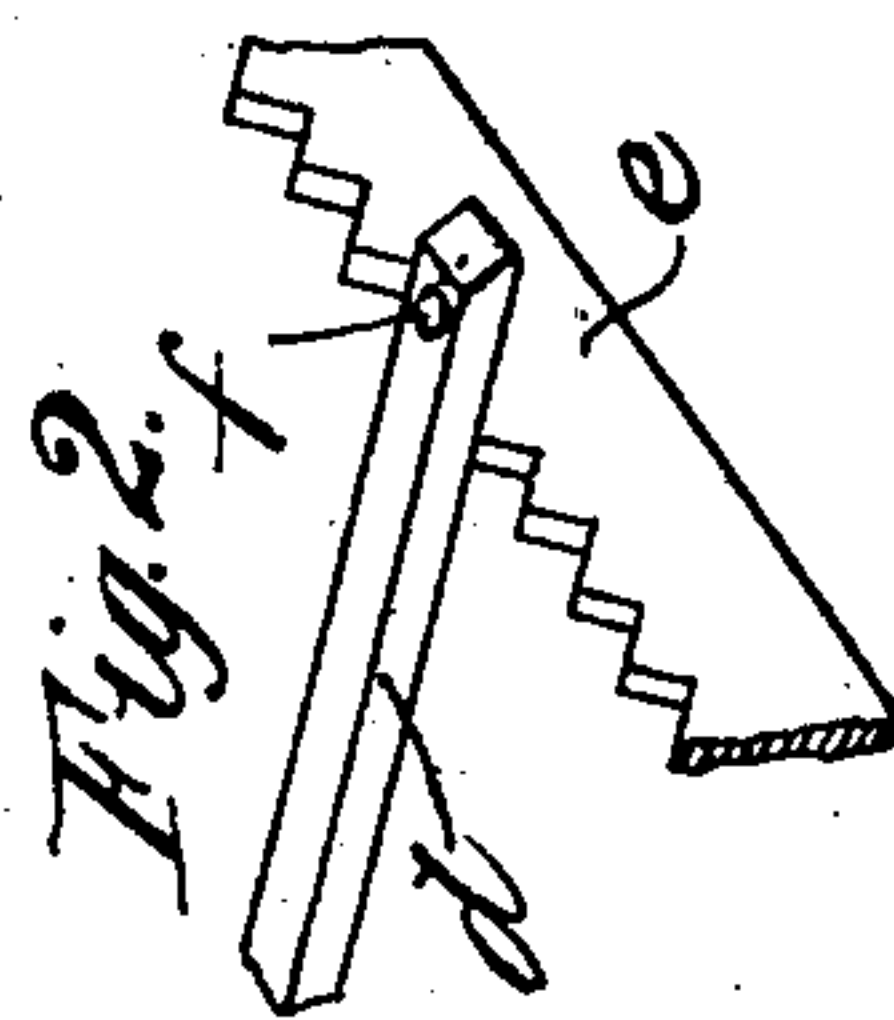
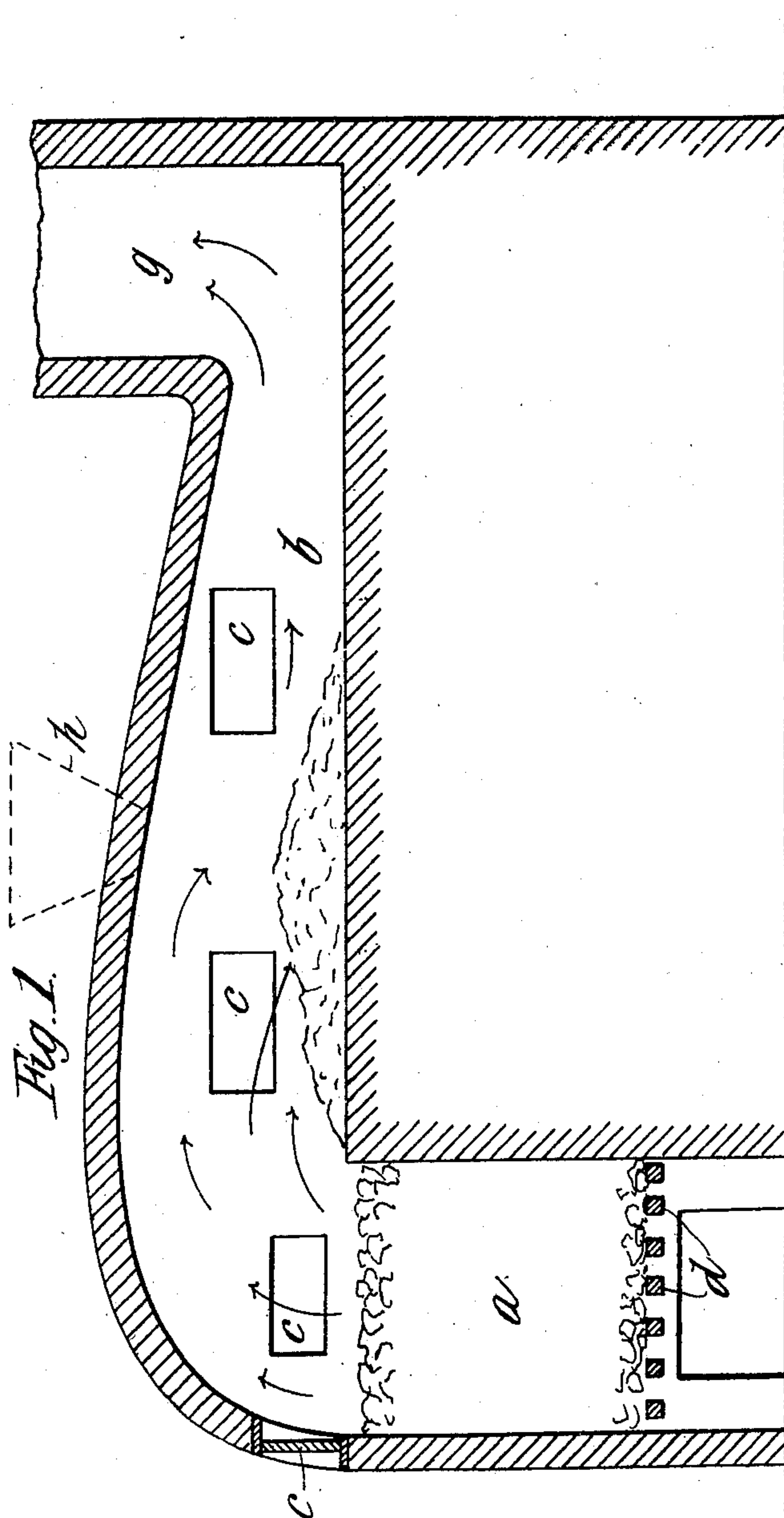


W. B. MIDDLETON.
TREATMENT OF ZINC OR OTHER ORES.

APPLICATION FILED DEC. 27, 1901.

NO MODEL.



Witnesses:

E. B. Bolton

Isabella Kaldron.

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UNITED STATES PATENT OFFICE.

WILLIAM B. MIDDLETON, OF LONDON, ENGLAND.

TREATMENT OF ZINC OR OTHER ORES.

SPECIFICATION forming part of Letters Patent No. 735,894, dated August 11, 1903.

Application filed December 27, 1901. Serial No. 87,412. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM B. MIDDLETON, mining engineer, a subject of the King of Great Britain, residing at 37 Walbrook, in the city of London, England, have invented certain new and useful Improvements in the Treatment of Zinc or other Ores, Chiefly for the Direct Production of Zinc-White, of which the following is a specification.

This invention relates to improvements in the treatment of zinc ores, mainly for the direct production of zinc-white therefrom.

According to the said invention the ore is treated first by a preliminary heating operation under the action of the fuel-gases and then when sufficiently heated is transferred directly to the fire, where it rests on top of the incandescent fuel, which forms a deep mass analogous to the charge in a gas-producer, a second fresh quantity of ore taking its place for the heating stage. The ore resting on the fuel immediately begins to give off zinc-fumes, which are collected in any suitable way. Then a further charge of fuel is added, and on its becoming incandescent the second quantity of ore above mentioned is raked onto it, the place of this ore being taken by a further charge ready for the heating, and so on.

The furnace for carrying out the process may be of the reverberatory type, the fuel-chamber being made deeper than usual, so as to form, as it were, a gas-producer, while the bridge is dispensed with, so that when the heating has taken place on the hearth the charge can readily be raked directly into the fire. The fire-bars may be arranged to be turned over to break up and free the clinker and ash.

The invention will be more readily understood by reference to the annexed drawings, in which—

Figure 1 is a longitudinal section of a furnace such as referred to; and Fig. 2 is a detail perspective view, illustrating a convenient arrangement of rotatable fire-bars.

The fire-chamber *a* of the furnace is made of such a size that it will hold a body of fuel, say, three feet in depth. The hearth *b* of the furnace extends, say, horizontally or at a slight upward inclination from the upper edge

of the furnace, there being no fire-bridge, such as usually used to separate the two. At convenient positions in the walls of the furnace doors *c* are provided for the charging of the ore and fuel and for the insertion of the rakes for transferring the ore from the hearth onto the fuel. The door shown in section on the left greatly facilitates the raking forward of the charge onto the fire. In some cases one or more hoppers may be arranged, as indicated in dotted lines, to facilitate the charging of the furnace.

The grate-bars *d* may conveniently be arranged, as shown in Fig. 2, so that they can be turned around on their axes from time to time to enable them to free themselves from clinker and gangue. For this purpose they may be square, round, or other suitable section and be seated in shallow V-shaped recesses or notches in bearer-bars *e*, beyond which their extremities extend, as shown. Each bar is adapted to be turned around on its axis from time to time by means of a suitable lever applied to its extremity, the arrangement shown for this purpose consisting of a transverse hole *f*, in which the end of the lever can be inserted. Obviously when the bars are thus turned their edges tend to break up any matters adhering to them. The distance between the bars can be adjusted, say, according to the amount of gangue in the ore, by placing them in different recesses or notches of the bearer-bars. This can be done while the furnace is at work without removing the bars simply by forcing their ends, say, into the recess next or next but one to that in which they may happen to be.

The furnace-roof is substantially like that of an ordinary reverberatory furnace and the hot gases from the fire follow the direction indicated by the arrows in the usual way; but the flue *g* instead of passing directly to the chimney leads first to a suitable condensing-chamber (or chambers) for the deposit of the fume and the collection of the zinc-white.

In working the process the furnace is first charged with coke, anthracite, or a mixture of the two to the full depth of, say, three feet and is brought to a full white heat or incandescence. Meanwhile a charge of ore, such as roasted blend, oxidized ores, or calamin, is

placed on the hearth in the position indicated, and when it has been heated by the burning gases from the fuel-chamber it is raked forward onto the fire and a fresh quantity is placed on the hearth. The zinc-fumes are produced immediately and pass through the furnace to the flue *g* and the condensing-chamber, where the zinc-white collects and whence it is removed at intervals. As soon as the emission of zinc-fumes begins to slacken a further quantity of fuel is thrown onto the fire. When this reaches incandescence, which it does very quickly, the charge of ore from the furnace is raked onto it and is replaced by a fresh charge in the manner referred to. The gangue and waste matter from the ore descend through the fire and fall out naturally or are removed by rakes or by rotating the bars in the manner described. The great depth of fuel constitutes, in effect, a gas-producer, and the gases therefrom besides having a strong reducing action on the ore burn with a perfectly clear smokeless flame in the furnace, and hence while they heat the incoming charge efficiently they do not in any way contaminate the zinc-white or impair its purity. The character of the flame can be varied at will by regulating the amount of air admitted to the furnace. The draft employed is preferably simply a natural one, due to the chimney, and it is kept as light as possible to avoid the drawing over of any fine dust or ash from the fuel.

It will thus be seen that the furnace is capable of being continuously charged with fuel and the gangue or clinker continuously discharged without withdrawal of the fire-bars or in any way impeding the operation, while the hearth can also be continuously charged with ore. The quantity of air necessary for the oxidation of the zinc-fumes can be regulated by means of the doors, and these fumes burning above the ore on the hearth natu-

rally assist in heating it, and thereby effect a saving in fuel.

Although in the foregoing description reference is made almost exclusively to the treatment of zinc ores, yet it is to be understood that the invention is applicable to the treatment of various other ores capable of yielding a volatile fume which can be recovered by condensation for industrial purposes.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In the treatment of zinc (or other) ores, the process which consists in first heating the ore by means of the fuel-gases, then volatilizing the zinc in the form of zinc-fumes by transferring such ore directly onto the fuel, and then condensing and recovering the said fumes, substantially as described.

2. In the treatment of zinc ores to produce zinc-white, the process which consists in heating the ore, transferring the said ore in a layer onto the top of the fuel previously ignited till it burns clear, reducing it directly in contact with such fuel, adding a fresh layer of fuel when the ore is spent, heating a fresh quantity of ore and transferring it to the fresh fuel and so on, substantially as described.

3. The treatment of zinc ore by reducing the ore in a layer on top of the fuel, heating the next charge of ore by the flames and burning zinc, adding a fresh layer of fuel when the ore is exhausted, transferring the newly-heated ore onto the top of the fresh fuel, and so on and condensing the burning-zinc fumes, substantially as described.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 13th day of December, 1901.

WILLIAM B. MIDDLETON.

Witnesses:

C. BARNARD BURDON,
WALTER J. SKERTEN.