

E. C. HEGELER & F. W. MATTHIESSEN.

Furnaces for Desulphurizing Ores.

No. 144,904.

Patented Nov. 25, 1873.

Fig. 1

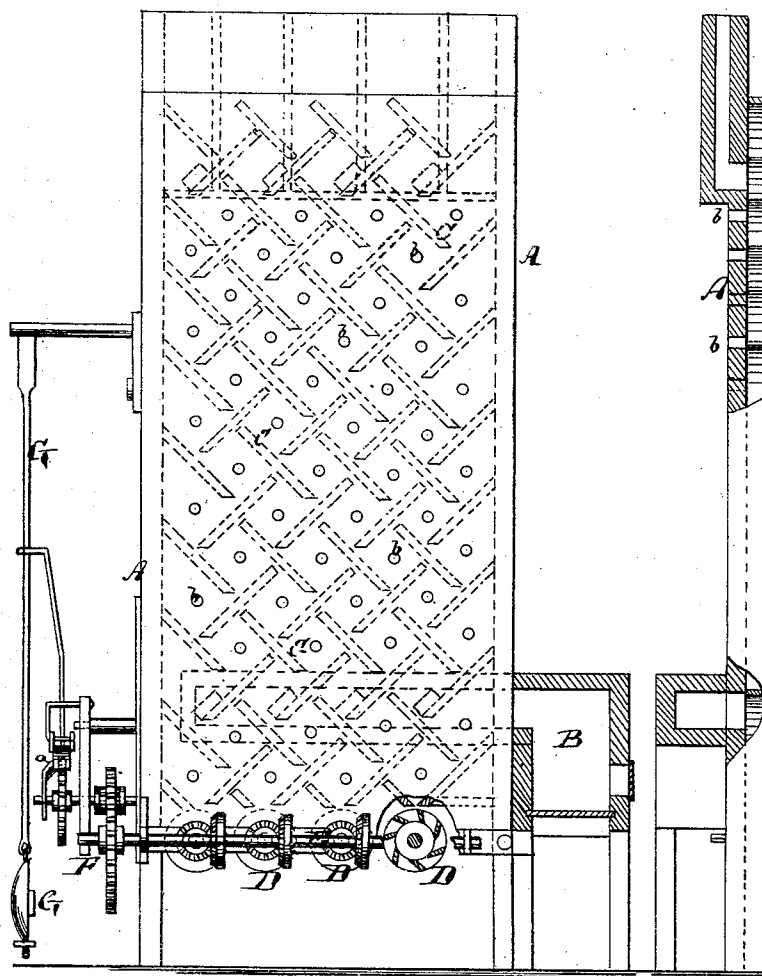
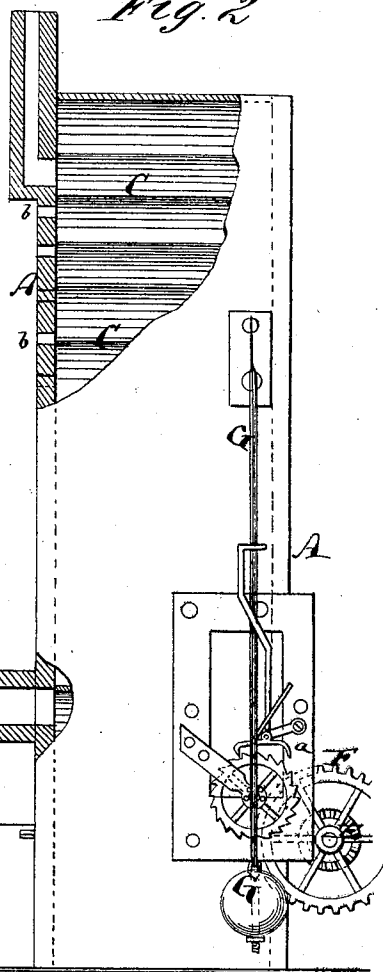


Fig. 2



Witnesses.

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Fig. 3

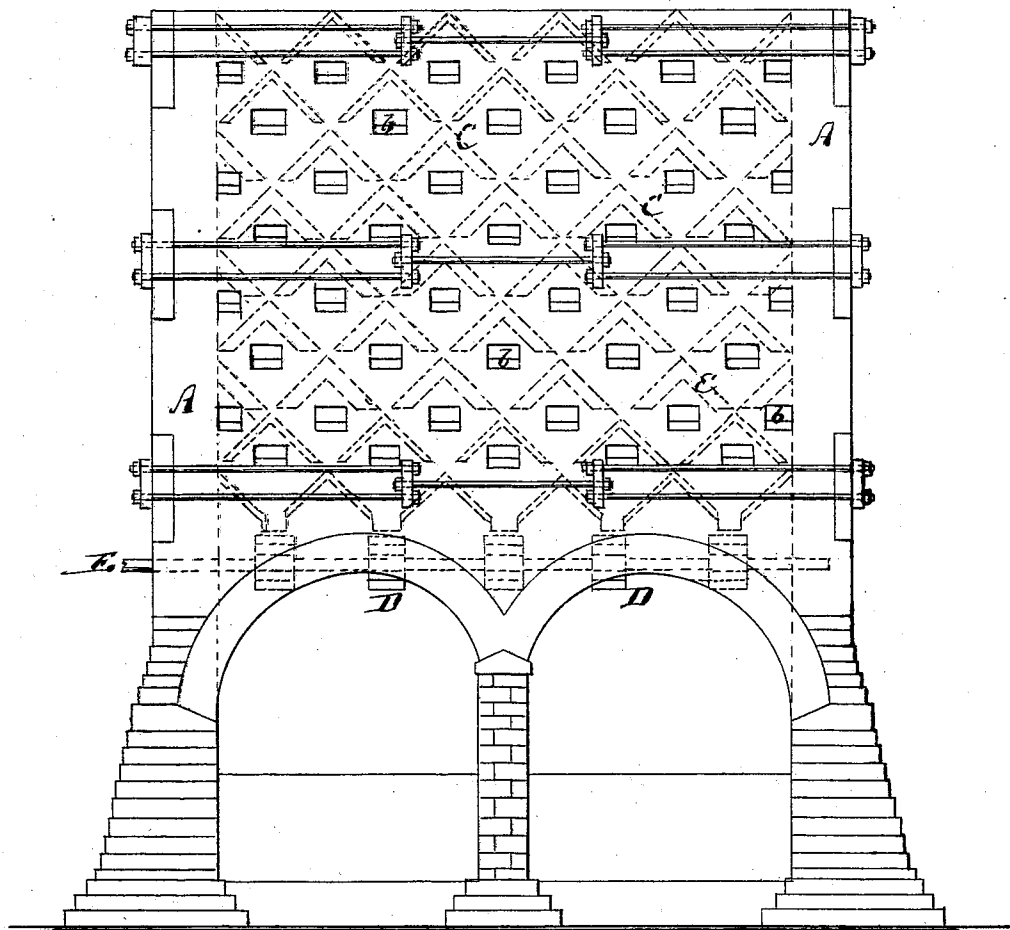
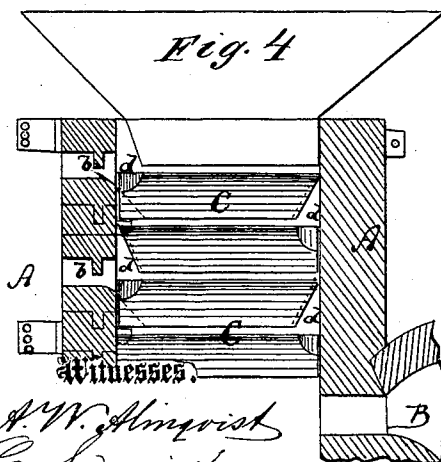
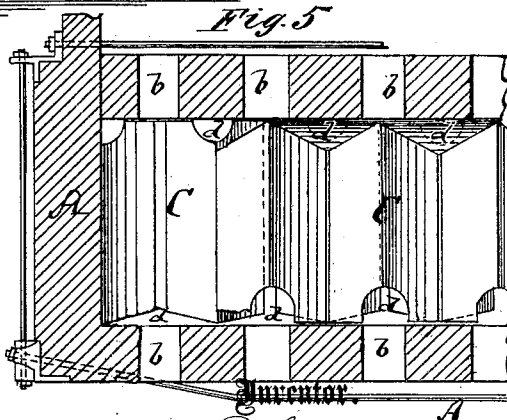


Fig. 4



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Fig. 5



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN FURNACES FOR DESULPHURIZING ORES.

Specification forming part of Letters Patent No. **144,904**, dated November 25, 1873; application filed September 14, 1872.

To all whom it may concern:

Be it known that we, EDWARD C. HEGELER and FREDERICK W. MATTHIESSEN, of La Salle, in the county of La Salle and State of Illinois, have invented a new and useful Improvement in Vertical-Shaft Furnace for Desulphurizing Ores; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing forming a part of this specification, in which—

Figure 1 represents a front elevation, partly in section, of our improved vertical-shaft furnace. Fig. 2 is a side elevation, partly in section, of the same. Fig. 3 is a front elevation of the same, showing a modification in the form of the ore-supporting plates. Fig. 4 is a vertical transverse section of the same, and Fig. 5 a horizontal section.

This invention relates to a new construction of the vertical-shaft furnace for desulphurizing, calcining, and drying in the same, ores or other substances, when in a fine or powdered state.

The use of the vertical-shaft furnace for treating ores or other substances in contact with gases, when ores are in lumps, is well known, the common lime-kiln being an example. Such shaft-furnaces are vertical chambers filled with the ore or other material, in lumps, from bottom to top. Ready treated material is taken out from the bottom, which causes a descent of the whole column of ore in proportion to the amount removed, while the shaft is kept filled with fresh raw material at the top. At the same time hot gases pass through the spaces between the lumps of the material from the bottom to the top. If the ore is in fine or powdered state it does not allow the passage of such air or gases.

To make the passage of the gases through the fine ore in contact with same possible, while retaining all the features of the old known vertical-shaft furnace, as above specified, is the object of this invention.

Others have overcome the difficulty of the passage of the gases through the fine ore by letting the ore trickle or rain down the shaft, putting obstructions into the shaft to retard the fall. They place a feeding apparatus at the top of the shaft to cause this trickling. As

soon as the feeding ceases the shaft will be emptied of ore in a few moments, the passage of the ore from the top to the bottom lasting only that long. The ore cannot be kept stationary in said shaft in contact with the gases. By our invention the ore rests stationary on inclined zigzag plates arranged in the shaft, gradually settling only when ore is removed or allowed to flow out from the bottom plates. An apparatus controlling this outflow is placed at the bottom.

This hitherto-unused process is effected in our invention by forming and supporting a column of ore or other material in a zigzag form or line, and maintaining it stationary as long as may be necessary to subject it to the action of heated gases, and causing it to descend when required.

We construct vertical series of inclined plates, forming troughs, from the bottom of the furnace to the top. When the inclined plate or trough at the bottom of the column is empty, the ore of the trough next above it flows down into it until it is filled, and this process takes place along the whole column of inclined plates or troughs to the top of the furnace, where the reservoir is placed. The removal of the ore from the bottom trough causes a simultaneous movement of the ore from each trough above to the one below, and a sliding of the ore takes place along the whole column to the top reservoir of the furnace, and from the reservoir into the uppermost trough, and this movement is arrested or made continuous, just as the bottom trough is allowed to remain full or be emptied. The inclined plates are also so constructed as to allow the passage of the ascending heated gases under and next to the column of ore, where the heat is applied most effectually in contact with the ore in the trough. Finally, the invention consists in a modification of the position of the plates with the use of conducts or pockets along the inner walls of the furnace for conveying the gases from one horizontal passage to the other around and over the several layers of ore.

In Figs. 1 and 2 of the drawing, which we will first proceed to describe, the letter A represents the furnace-shaft of suitable size and material. B is the fire-place formed at the

lower part of the shaft for the supply of calcining, desulphurizing, or drying gases, which are to permeate the ore in the shaft. C C are troughs formed of inclined plates, arranged throughout the shaft A in horizontal rows of alternating slope, as is clearly indicated by the dotted lines in Fig. 1. The bottom of the shaft is formed by bucket-wheels D D, whose horizontal shafts E E are geared together and in connection with a clock-work, F. G is the pendulum for the clock-work. It is connected with a suitable escapement, *a*, to detain the rotation of the wheels D, which would become very rapid without such detaining devices. In place of the pendulum, a spring connection with the escapement may be established.

The ore to be treated is dumped on the top row of inclined plates in the shaft A, the top of which forms a reservoir, and gradually works its way down to the wheels D, resting meanwhile in thin layers in the troughs of inclined plates C C. Above every layer of ore is ample air-space for the passage of the gases which ascend from the furnace B, and act upon the ore in the desired manner. The ore resting on the buckets of the overshot-wheels D, constitutes the motive power of the clock-work, and tends to turn those wheels, and thereby effects its liberation. The velocity of discharge is regulated by the pendulum and escapement. The ore, after having been exposed to the gases, is thus formally discharged from the buckets of the wheels D. The plates C C being arranged in independent vertical columns, several kinds of ore or material can be passed through the furnace-shaft independent of each other, or several kinds of gases may be allowed to ascend, independent of each other, to affect the columns of ore or other matter in different manner. *b b* are openings in the sides of the shaft A for the admission of stirring-tools, or for the admission or escape of air or gases, as may be found convenient.

The modification shown in Figs. 3, 4, and 5 consists chiefly in the substitution of inverted V-shaped plates C in place of the plain inclined plates C, above described. There are also shown pockets *d d* applied at the ends of the gas-passages for conducting the gas from one passage to the next above, and thus letting it pass through the shaft in zigzag course. We close the openings *b* by fine ore in place of using doors in the same.

Considerable difficulty was experienced in constructing the pockets which convey the gases from one horizontal row of V-shaped

plates to the next upper row of sufficient size, and at the same time the stirring-openings in the side of such a shape that all parts of the V-plates could be reached. This problem was solved by supporting one end of one row of plates on projections on one of the side walls, and the other end of the same row of plates not on the other side wall, but on the next lower row of plates, giving the plates at the same time a diamond shape. Alternate rows of plates have their wall-support on alternate side walls.

We do not claim desulphurizing ores by letting them fall through a shaft, where they meet the products of combustion; neither do we claim a series of terraces arranged in the shaft to retard the fall of the ores.

We claim as our invention—

1. The furnace-shaft A, provided with zig-zag columns of troughs C C containing and supporting the ore, with sufficient opening at the bottom of each trough to allow the ore to slide through to the trough below, as described above, for the purposes therein set forth.

2. The modified form of the troughs, as shown in Figs. 3, 4, and 5, for same purposes, as in claim 1.

3. The provision or arrangement, in the shaft A, of the gas-passages, through which the desulphurizing-gases pass under and in close contact with the column of ore, stationary or in movement, as above described.

4. The air passages *d d*, as shown in Fig. 3, in connection with the modified form of the troughs, shown in Figs. 3, 4, and 5, the descent of the material on which is caused by an apparatus removing said material at the bottom of said furnace.

5. The revolving overshot-wheels D, arranged in relation to the bottom troughs of each ore-column, as and for the purpose specified.

6. The overshot-wheel D, for the purpose specified, revolved by the weight of the ore which it receives into its buckets, and controlled in its revolutions by the pendulum G.

7. A desulphurizing, calcining, heating, or drying shaft-furnace for fine ore or other fine materials, arranged, as above specified, to subject the ore or other materials to the action of the heated gases for a longer or shorter time, as may be necessary.

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