I. M. PHELPS.

Improvement in Furnaces for Oxidizing Ores.

No. 115,769. Patented June 6, 1871.

Fig 1.

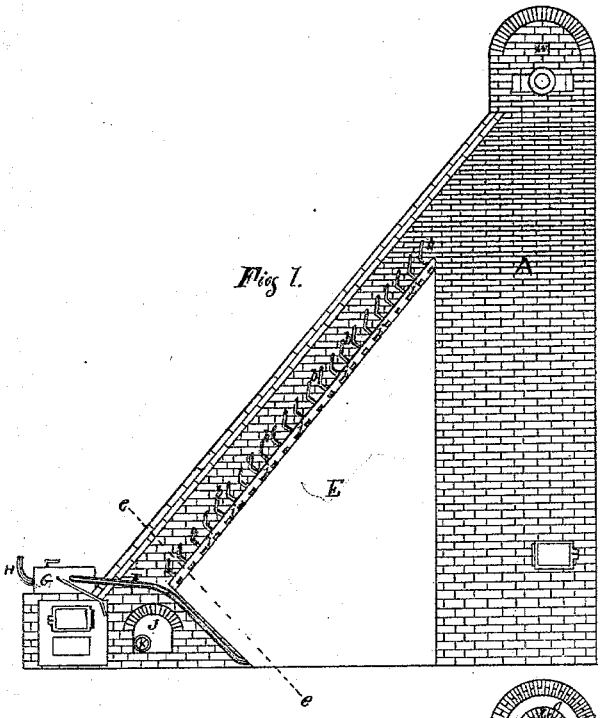


Fig 2

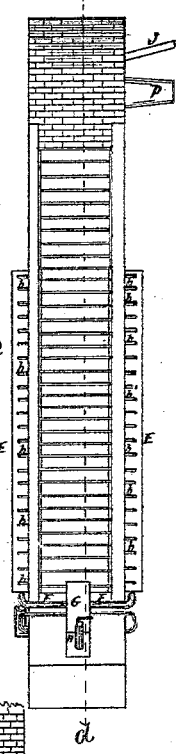
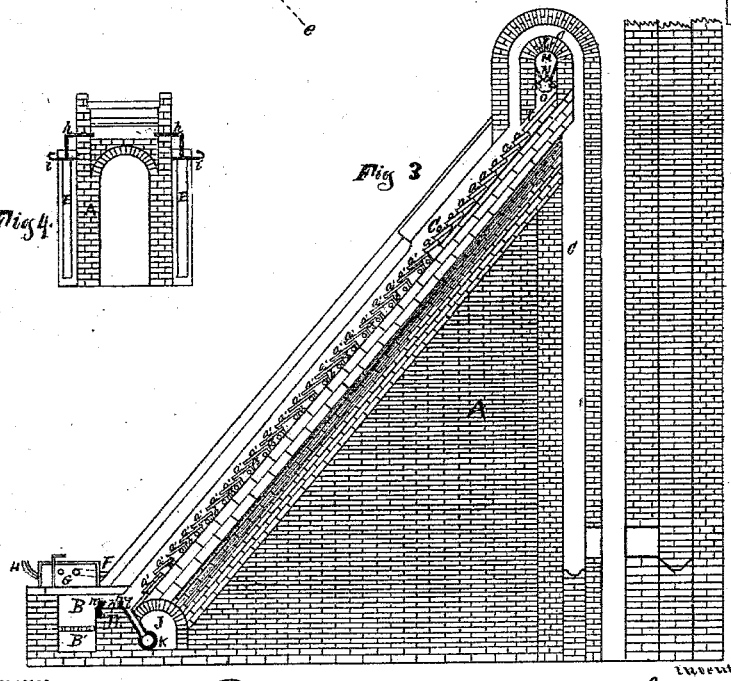


Fig 4.

Fig 3



Witnesses
N. H. Shepherd
N. C. Smiley

Inventor
Ira M. Phelps
By Darwell Tho
his attys

UNITED STATES PATENT OFFICE.

IRA M. PHELPS, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN FURNACES FOR OXIDIZING ORES.

Specification forming part of Letters Patent No. 115,769, dated June 6, 1871.

To all whom it may concern:

Be it known that I, IRA M. PHELPS, of Chicago, in the county of Cook and State of Illinois, have invented a new, useful, and Improved Oxidizing-Furnace; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which my invention appertains to make and use the same, reference being had to the accompanying drawing forming part of this specification, in which—

Figure 1 is a side elevation of an oxidizing-furnace embodying my improvements. Fig. 2 is an end view of the same. Fig. 3 is a vertical longitudinal central section taken on a line, *d d*, drawn vertically through Fig. 2; and Fig. 4 is a vertical transverse section taken on line *e e*, drawn obliquely across Fig. 1.

Similar letters of reference indicate like parts in the several figures of the drawing.

My invention relates to that class of furnaces employed in the separation of gold and silver metal from the sulphureted ores containing the same; and the improvement consists in providing the flue of the furnace with a system of sub-terrace air-chambers, with inter-terrace air-slots, so arranged as to introduce oxidizing currents into the flue in a reverse direction to that of the draft-current, whereby a greater supply of oxygen is obtained without liabity of carrying away the finer particles of metal by force of the draft-current. It also consists in the arrangement of a system of oxidizing-pipes connecting the sub-terrace air-chambers with atmospheric reservoirs, in connection with a system of cut-off valves, whereby the supply of air from the fan is graduated; also in the arrangement of a feed-hopper in connection with a fluted feed-roller, whereby the ore is introduced into the flue beneath the draft-current.

In the drawing, A represents the wall of the furnace, which is constructed of masonry in the usual manner and in the form shown. B is the fire-box, and B′ the ash-pit, which are arranged across and within the lower portion of the wall. C is the oxidizing-flue, which is arranged within the walls upon an angle of fifty degrees to the plane of its base, and communicates with the fire-box, as shown in Fig. 2. Firmly affixed to the upper portion of the floor of the said flue is a system of terraces, *a*, which is so arranged as to allow the lower edge of one terrace to rest upon the upper edge of the other. Firmly secured to that portion of the floor between the rear side of the bridge-wall D and lower edge of the system of terraces *a*, and extending across the same, is a system of walls or partitions, *b*, upon which is firmly fixed a second system of terraces, *a′*, which is so arranged as to form a series of sub-terrace air-chambers, *f*, between the floor of the flue and lower side of the terraces. The terraces *a′* are so arranged or fitted within the walls as to form a series of air-slots, *g*, between the upper edge of one terrace and the lower edge of the other, which communicate with the said air-chambers *f*. Affixed to each outer side of the walls are atmospheric reservoirs E E, to which are connected air-pipes F F, extending forward to and connected with an air-box, G, secured firmly upon the upper surface of the roof of the fire-box. Secured within and through the upper edge of each atmospheric reservoir, and communicating with the separate sub-terrace air-chambers, are pipes *h*, which pass through the walls of the furnace, and are firmly secured therein. Affixed within and through the upper edge of the said atmospheric reservoirs, and extending across the same under the ends of the respective air-pipes, are cut-off valves *i*, which are each so arranged as to admit of a sliding movement, by which means the cavity in each of said pipes is opened or closed, thus graduating the supply of air discharged from the reservoirs into the sub-terrace air-chambers. Secured to and passing through the end of the said air-box G is a pipe, H, communicating with a suitable fan, (not shown,) by which means the required amount of air is obtained. Within the front portion of the furnace-walls, and extending across the same beneath the lower end of the flue, is an arched opening, J, within which is secured a hot-ore pipe, K, extending across the entire width of the furnace-wall, and is provided with a longitudinal slot which communicates with the flue through an opening, *l*, in and through the floor of said flue. Affixed upon the upper surface of the lower bridge-wall D, and extending across the same, are partitions *m m*, which are so arranged as to form a triangular-shaped air-chamber, *n*, communicating with the said air-

box G through pipes *p p* firmly affixed thereto, and which said chamber also communicates with the flue; the object being to furnish a current of air which passes upward from the crest of the bridge-wall, thus preventing the sulphurous gases from descending into the fire-box as the door is opened. The inner arch-wall L of the upper portion of the flue is made hollow so as to form a chamber, M, extending across the entire width of the flue, and within which chamber is firmly secured a hopper, N, the lower portion of which is provided with a longitudinal slot, *r*, beneath which is arranged a feed-roller, O, which is supported in boxes affixed to the outer walls of the furnace, said roller being provided with a series of longitudinal grooves or channels, *s*, extending its entire length. The said arch-wall L is so arranged as to have an open space, *t*, between its lower end and the upper surface of the floor of the flue, and through which the ore is discharged from the feed-roller into the flue under the draft-current. Firmly affixed upon the shaft of the feed-roller is a cone-pulley, P, around which is passed a belt from any suitable machinery, by which the required rotary motion is imparted to the said roller. Affixed to the upper portion of the wall is a conducting pipe or spout, U, extending through an opening, W, formed in the wall.

The ore, after being properly pulverized, is discharged into the hopper through the said spout U, and thence into the flue through opening *t* by the rotation of feed-roller O.

In using my invention, as the ore passes down the flue over the terraces a current of air is discharged from the sub-terrace air-chambers in a descending direction, which current comes in contact with the ascending or draft current, thus producing a series of atmospheric eddies immediately over the terraces and in the path of the ore, which effectively prevents the carrying out of the fine particles of the metal by force of the draft-current. The ore passing down the inclosed surface of the terrace becomes heated, and thereby the sulphur is expelled and the base metal becomes oxidized. To accomplish this the ore must be heated gradually—that is, the temperature should be comparatively low when the ore is introduced, and gradually increased as the quantity of sulphur diminishes, in order to prevent slagging, (partial fusion,) the object being not to smelt, but to desulphurize and oxidize, as above stated.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The system of terraces *a'*, so arranged as to form a series of sub-terrace air-chambers, *f*, and inter-terrace air-slots *g*, whereby the separate currents of air are introduced into the flue in a descending direction and in a reverse direction to the draft-current, substantially as and for the purpose described.

2. The combination of the feed-hopper N and the fluted feed-roller O with the hollow arch-wall L', all arranged within the furnace and at the upper portion of the flue, whereby the ore is discharged into the flue beneath the draft-current, substantially as and for the purpose described.

3. In combination with the atmospheric reservoirs E E, the air-pipes *h* and cut-off valves *i*, the whole arranged to operate substantially as and for the purpose described.

4. The partitions *m m*, so arranged as to form a triangular-shaped air-chamber, *n*, substantially as and for the purpose specified.

The foregoing specification signed by me this 26th day of April, A. D. 1871.

IRA M. PHELPS.

Witnesses:
N. C. GRIDLEY,
N. H. SHERBURNE.