2 Sheets—Sheet 1.

L. SCHANTL.

Ore Roasting and Smelting Furnace.

No. 220,434. Patented Oct. 7, 1879.

Fig. 1.

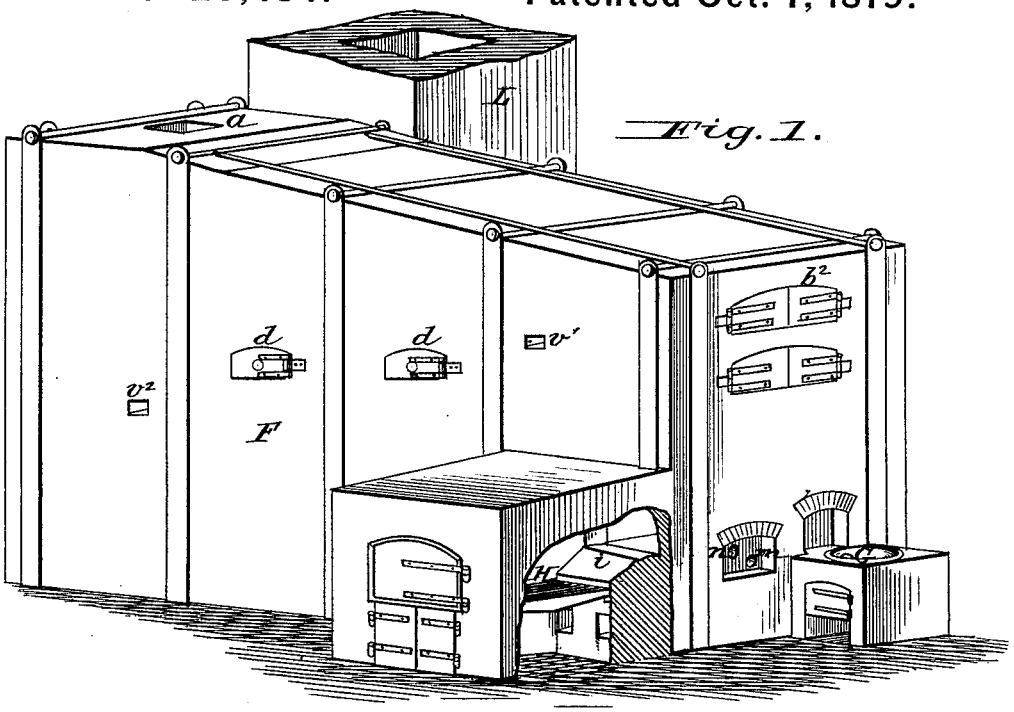

Fig. 2.

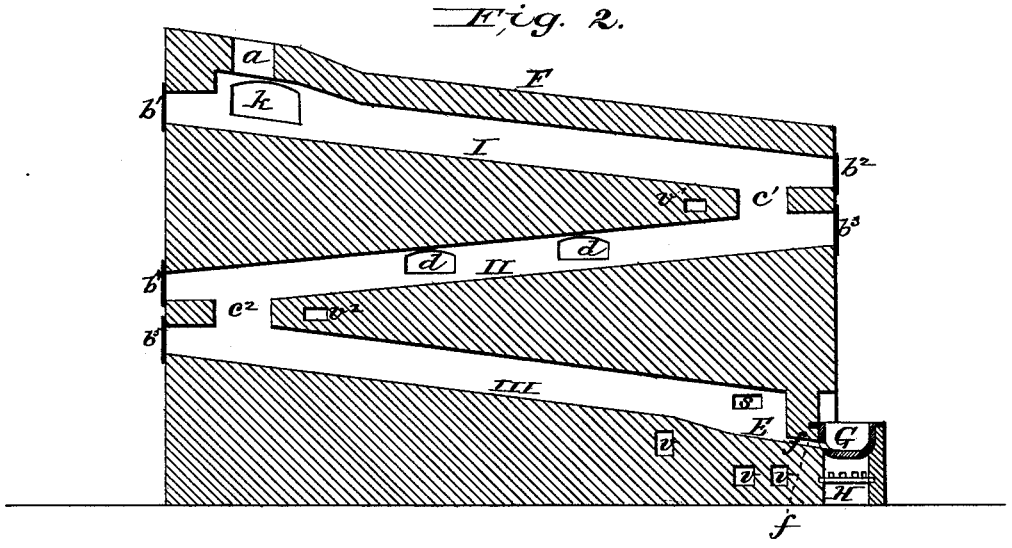

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Fig. 3.

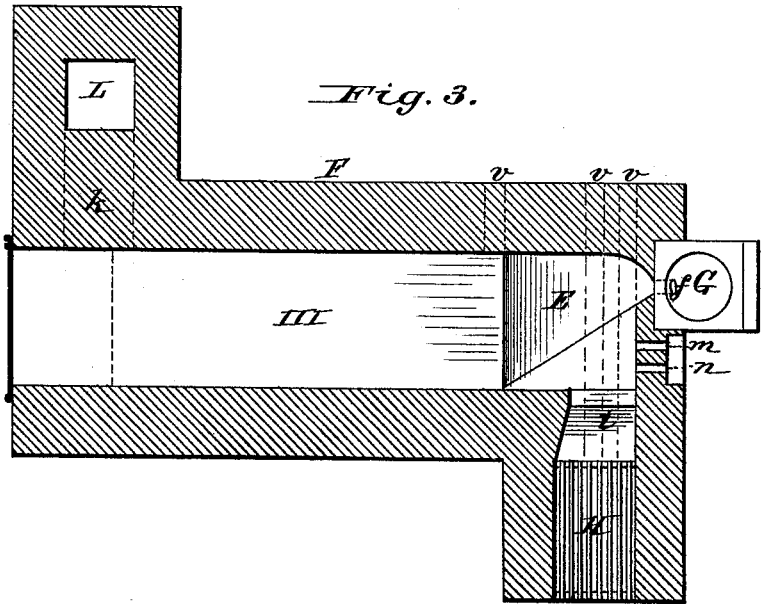
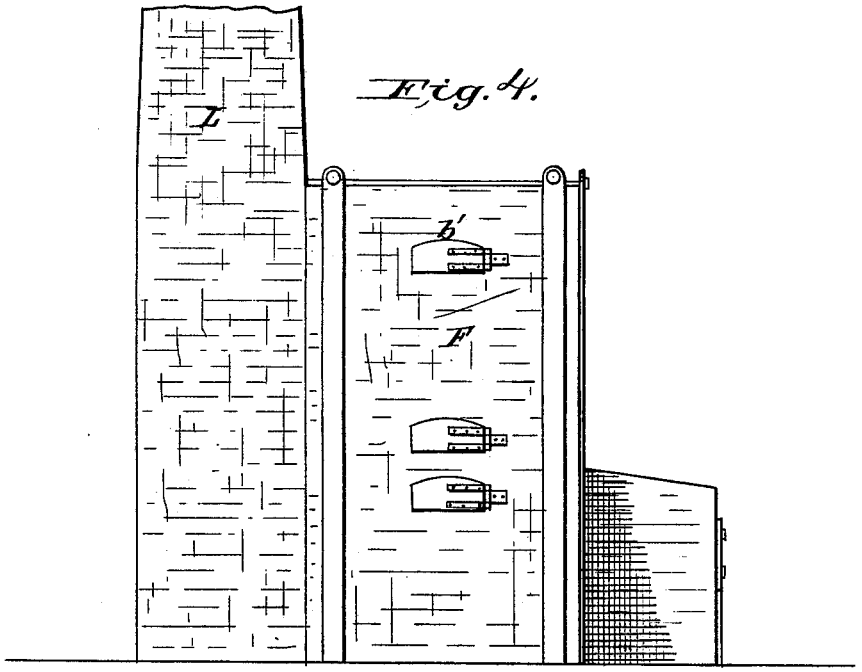


Fig. 4.



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UNITED STATES PATENT OFFICE.

LEWIS SCHANTL, OF SILVERTON, COLORADO.

IMPROVEMENT IN ORE ROASTING AND SMELTING FURNACES.

Specification forming part of Letters Patent No. **220,434**, dated October 7, 1879; application filed April 16, 1879.

To all whom it may concern:

Be it known that I, LEWIS SCHANTL, of Silverton, in the county of San Juan and State of Colorado, have invented a new and useful Improvement in Ore Roasting and Smelting Furnaces for the Smelting of Lead and Silver Ores, of which the following is a full and clear description, reference being hereby had to the annexed drawings, making a part of this specification, where—

Figure 1 represents a perspective of a furnace embodying my invention; Fig. 2, a vertical longitudinal section of the same; Fig. 3, a horizontal section, and Fig. 4 a rear end view.

I have improved the smelting-furnace for treating ores of the precious metals.

In carrying out my invention I use the reversely-inclined arrangement of hearths as a mechanical power to effect the flow of the fused ore over a long surface, and to assist in the chemical changes—viz., to bring the carbonic-oxide gases created at the fire-box in direct contact with the liquid alloy running slowly down an inclined fusion-hearth of about sixteen feet long, which space I deem sufficient to reduce the metal oxides to a metallic state. The chemical affinity of carbon-oxide gas for more oxygen is so great that in passing up the incline it absorbs one more equivalent of oxygen from the oxides of the metals, and hence changes from CO into CO_2.

It is obvious that the refractory silex shares the same chance to form fusible compounds with lime, soda, oxide of iron, or other suitable chemicals, which are fed in proper quantities through side flux-openings in the desulphurizing-chamber. The fusion and desulphurizing chambers meet at a point farthest from the alloy-collecting basin, and the metal-bearing vapors evolved along the smelting-hearth are partially taken up as they pass through the fused ore dripping from the desulphurizing-hearth into the smelting-hearth, and are thus returned to the collecting-basin, and such vapors as may escape being absorbed at this point are condensed in passing through and over the cooler ore in the desulphurizing-chamber, and thus taken up and returned in the ore, so that a very small proportion of metal-charged vapors passes out of the chimney.

I regulate the heat in such manner that the point of fusion is placed at a point about three or four feet up the incline of the desulphurizing-chamber, and beyond the lower communicating opening of such chamber; but this fusion-point may be nearer or farther from the junction of said chambers.

The loss of silver in working argentiferous galena in the hitherto reverberatory furnaces is from twelve to eighteen per cent.

In the operation of my furnace the loss is reduced to about four per cent.

I make the hearths of the furnace about sixteen feet long, giving an ore-treating space of forty-eight linear feet, embracing an upper drying-hearth, a lower fusion-hearth, and an intermediate desulphurizing-hearth. The widths of the hearths are four feet, and their height sixteen inches; but these dimensions may be varied.

The frame extends into the lower part of the desulphurizing-hearth, so as to fuse the ore thereon and constantly maintain a drip flow of the reduced ore through the lower opening of the middle hearth.

The lower end of the lowest hearth terminates in a metal and slag collecting basin, which communicates at one side with an outside fire-grate, and by means of an end passage with an outside pot heated by a separate fire-grate, whereby the base bullion is kept in liquid condition both inside and outside the furnace.

I do not claim the hearths alternately inclined to each other and with communicating openings, as such form of hearths has been used in furnaces for roasting ores; but by my improvements such furnace is adapted for drying, smelting, and collecting the liquid alloy ready for shipment and subsequent refinement, and the escaping metal-bearing vapors are condensed, absorbed, and returned with the fused ore to the collecting-basins within and without the furnace, and thereby effect with the simplest form of furnace, and in the most economical way, what has been proposed by expensive and complicated furnaces having revolving desulphurizing and roasting cylinders in connection with a series of fusion or reducing hearths arranged to form baths, one lower than the other, the lowest one communi-

cating with an outside receiving-pot for the product, but in which the metal-charged vapors pass off with the products of combustion and are lost.

A very large per cent. of the vapors generated by the smelting and reducing operations is saved by causing the vapors on their passage from the smelting-hearth to pass over and in contact with the fresh ore during the process of desulphurizing and drying in an extended passage through a falling stream of molten desulphurized ore descending from the middle to the bottom hearth, and up over and through the fresh ore under a gradually-decreasing temperature, so that the vapors passing out in a direction opposite to the feed of the ore are absorbed, condensed, and returned with the ore in a metallic state to the collecting-basin on the reduction-hearth.

The long smelting-hearth terminates in a basin within the furnace, with a combustion-chamber at one side, a flux-feeding aperture at the opposite side, and a receiving-pot connected with said reducing-basin, and within which the reduced metal is maintained in a condition to be ladled and cast into ingots by an independent outside furnace.

I provide the side walls of the middle hearth with lateral apertures, through which suitable fluxes or chemicals are inserted to assist in the desulphurizing action of the ores. These lateral wall-openings are important in giving access to particular points of an extended reversely-inclined passage, at the lower end of which the pure metal collects at the bottom and passes out into the outside heating-pot, while the slag and mat floating on the metal are drawn out through apertures arranged at different heights at one side of the pot-communicating duct. In this way I add certain features or elements to what is known as the "Bartlett Roasting-Furnace" to carry out my plan of reducing ores of the precious metals with a single reducing-basin at the end of a long ore-feeding and fusion passage provided with a supplemental heating-pot.

The furnace F is constructed of brick or other refractory material, and provided with three chambers, I II III, which I prefer to make with flat arches located one above the other, and inclined upward alternately in reverse directions. The upper chamber, I, connects by means of a flue, *k*, with a chimney, L, located at one side of the furnace, near the upper end of the chamber I. The upper end of said flue is also connected by an aperture, *a*, with a suitable hopper, through which the ore is fed into the furnace. The said chambers I II III are provided at their respective ends with apertures b^1 b^2 b^3 b^4 b^5, for the insertion of a hoe or other implement for manipulating the ore to transfer it successively from one chamber to another.

The openings c^1 and c^2 connect the chambers I II III, and *d d* are two lateral openings leading through the walls of the furnace into the chamber II, by means of which chemicals or fluxes can be supplied to assist in the desulphurization of the ores.

An opening, *s*, is made through the wall of the furnace above the smelting-chamber, through which fluxes or chemicals may be supplied to said smelting-chamber E.

The openings b^1, b^2, b^3, b^4, b^5, *d d*, and *s* should all be provided with suitable doors for closing them.

The smelting chamber or box E is located at the lower end of the chamber III, and inclines from its rear and one side to a conduit, *f*, leading into a receiving pot or kettle, G, mounted in an independent furnace outside of the furnace F.

The smelting-chamber E communicates at its elevated side with the combustion-chamber H and its fire-box by means of an aperture directly above the fire-bridge *i*, said combustion-chamber and fire-box, for convenience, forming an extension of said furnace F at one side of the same.

A series of flues, *v* v^1 v^2, extend through the walls of the furnace F, contiguous to those portions of said furnace where the heat is greatest. These flues communicate with the open air and serve to keep the walls of the furnace cool and prevent injury to the same from excessive heating.

Openings *m n* lead from the smelting-chamber at different elevations, and at one side of the conduit *f*, for drawing off the slag and mat.

The operation of my furnace will be readily understood in connection with the above description. The fire is started in the fire-box H and in the furnace of the receiving pot or kettle G. The ore is then fed in through the opening *a* in the chamber I, and is worked gradually forward by means of a hoe or other implement inserted through the opening at either end toward the aperture c^1. In this chamber I the moisture is expelled from the ore. The ore is then fed forward in a similar manner through the chamber II, in which it is desulphurized, proper chemicals being supplied through the openings as desired. The ore in this chamber is gradually fused and drips through the aperture c^2 into the chamber III, in which it is reduced, the products passing downward into the smelting-chamber E, from which the alloy of lead and silver or base bullion passes through the conduit *f* into the receiving pot or kettle G, where it accumulates and may be ladled out and run into ingots for shipment or subsequent refinement, while the slag and mat are drawn out from said chamber through the respective openings *m n* at one side of the kettle-conduit. In this operation the escaping vapors are reoxidized or absorbed by the descending ores, the ores being submitted to a gradually-increasing heat, and the escaping vapors to a gradually-decreasing heat.

I claim—

1. In a furnace provided with reversely-inclined drying, desulphurizing, and smelting hearths, the combination of a reduction-basin

located at the lower end of the smelting-hearth, a combustion-chamber and furnace communicating therewith to supply the heat for reducing, desulphurizing, and drying the ore, a receiving-pot connected with said reduction-basin, and an independent outside furnace for maintaining the reduced metal in a condition to be ladled and cast into ingots, substantially as specified.

2. A furnace for treating ores of the precious metals, consisting of the reversely-inclined drying, desulphurizing, and smelting hearths, the middle hearth having the lateral apertures *d d* between the end openings, c^1 c^2, the lower hearth terminating in the basin E, on one side of which is the combustion-chamber H, on the other the apertures *s*, the receiving-pot G, in line with and communicating with the inclined basin-bottom, and the apertures *m n* at one side and above the pot-channel *f*, all constructed and arranged for operation substantially as shown and described.

LEWIS SCHANTL.

Witnesses:

WILLIAM TEAL,

JOHN MITCHELL.