2 Sheets---Sheet 1.

F. J. SEYMOUR.

Separating Molten Metals.

No. 199,475. **Patented Jan. 22, 1878.**

Fig. 1.

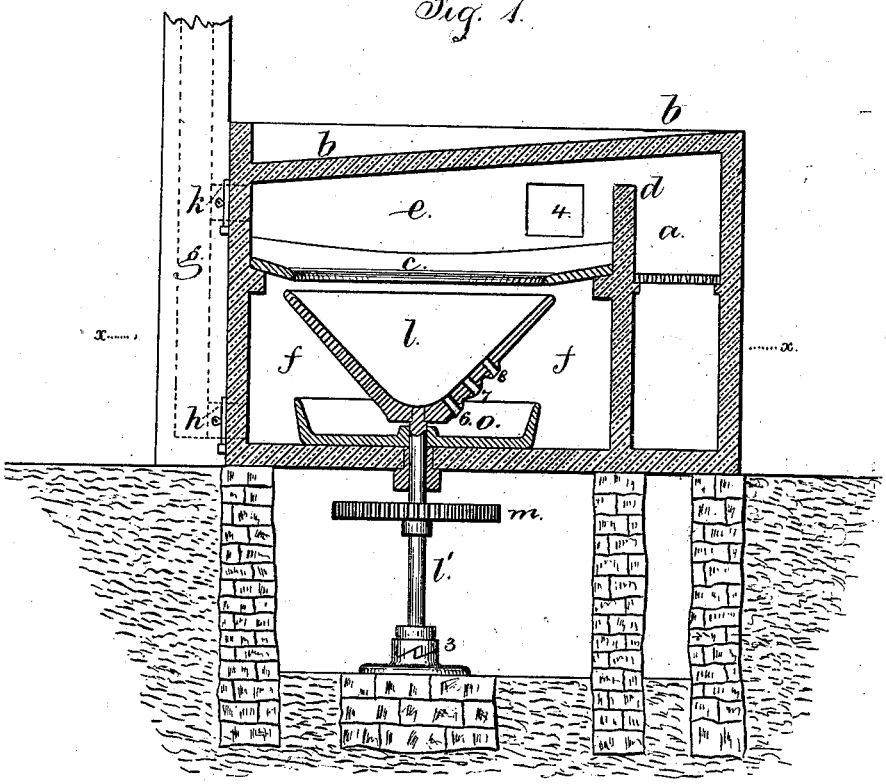
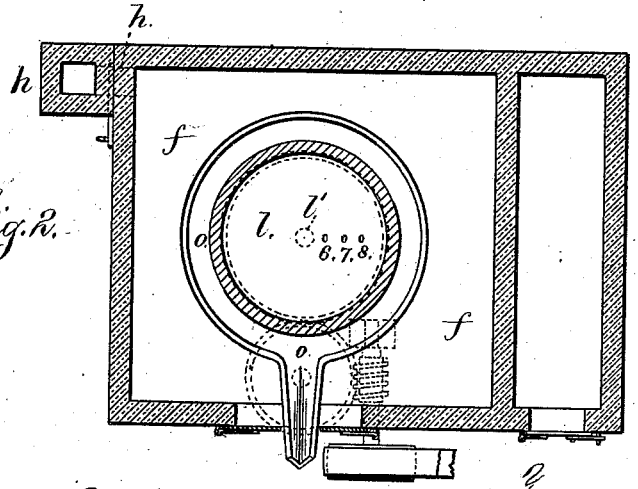


Fig. 2.



Witnesses

Chas. H. Smith

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per Lemuel W. Serrell

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2 Sheets—Sheet 2.

F. J. SEYMOUR.

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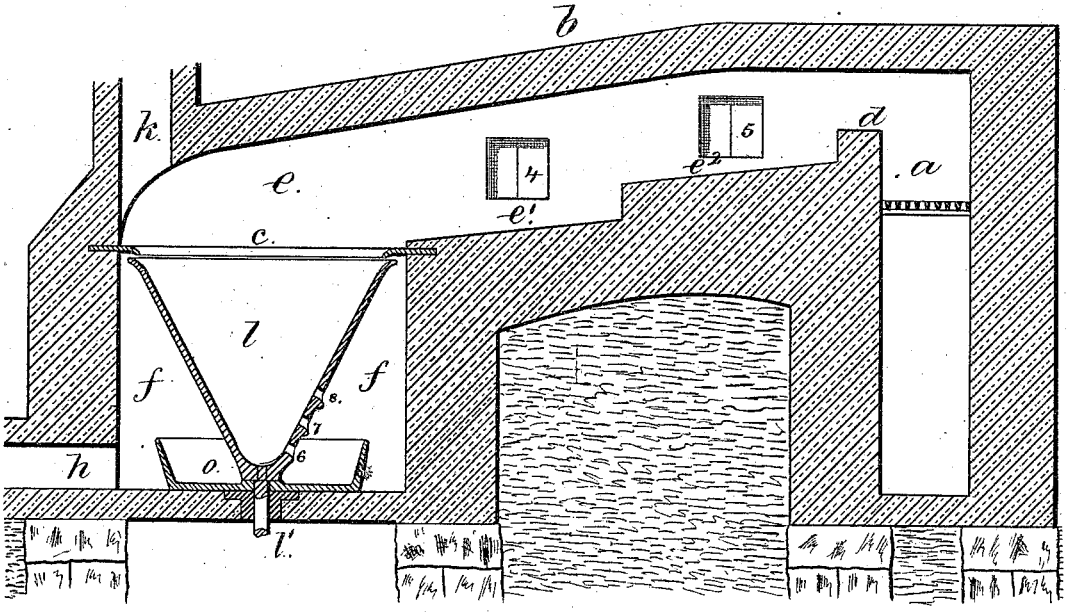
No. 199,475. Patented Jan. 22, 1878.

Fig. 3.



Witnesses

Chas. H. Smith

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Inventor

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UNITED STATES PATENT OFFICE.

FREDERICK J. SEYMOUR, OF WOLCOTTVILLE, CONNECTICUT.

IMPROVEMENT IN SEPARATING MOLTEN METALS.

Specification forming part of Letters Patent No. **199,475**, dated January 22, 1878; application filed April 16, 1877.

To all whom it may concern:

Be it known that I, FREDERICK J. SEYMOUR, of Wolcottville, in the county of Litchfield and State of Connecticut, have invented an Improvement in Smelting Metals, of which the following is a specification:

In the manufacture of zinc there is considerable dross formed, and it is difficult to restore it to a metallic state, and in the smelting of galena and silver there are present two or three metals of different specific gravities and different degrees of fusibility, and the separation of these has been effected by the oxidation and often the loss of the less valuable metal.

The object of this invention is to smelt the ores or the dross at such a temperature as will effect a separation of the different metals, and to receive these metals into a pot that is so constructed as to be heated with great uniformity to the proper degree of heat. The pot is further subjected to agitation, or a jigging motion, that effects a separation according to the specific gravities of the different kinds of metals that are contained in the pot; and I regulate the heat, preferably by a pyrometer, in such a manner that the most fusible metal can be drawn off in a melted state, while the other metals are in a semi-liquid or solidified condition. In this manner I find that metals of different specific gravities can be separated mechanically, while in a melted state, with such perfection that but little subsequent refining is necessary.

In the drawings, Figure 1 is a vertical section of the smelting apparatus. Fig. 2 is a sectional plan, and Fig. 3 is a vertical section of the smelting apparatus in a modified form.

The fire-space *a* is beneath the arch *b*, and the products of combustion pass over the bridge-wall *d* into the chamber *e*, and may go down through a circular opening between the hearth *c* and pot *l* into a chamber, *f*, thence to the chimney *g* by a flue, *h*. There is also a flue, *k*, to the chimney *g* from the chamber *e*.

There are dampers in the flues *h* and *k*, by means of which the heat is so directed that the temperature of the chambers *e* and *f* may be regulated to whatever degree is desired for the operations that are to be performed, as hereinafter set forth.

In the chamber *f* there is a pot, *l*, beneath the circular opening in the hearth *c*, and of larger diameter, so that any metal that may melt upon the hearth *c* will run into the pot, said hearth being inclined toward the opening; and this pot *l* is upon a vertical axis, *l'*, that extends down through the bottom of the chamber *f*, and is sustained in suitable bearings, and there is a wheel, *m*, upon the axis *l'*, by means of which the axis and pot are revolved, the special objects being to insure uniformity of heat by presenting all parts of the pot equally to the action of the heated products of combustion. There may also be an elevated grate around the lower part of this pot *l*, upon which fire may be built within the chamber *f* and around the pot. This pot *l* has a sudden dropping or jigging movement given to it periodically by any suitable means. I have shown cam-teeth at 3 that run up the inclines of similar reverse teeth, and then drop as the teeth clear each other during the revolution of the pot *l*.

Within the chamber *e* there may be one or more shelving hearths in addition to the inclined hearth *c* around the pot. In Fig. 3 I have shown the wide shelves e^1 e^2 as interposed between the hearth *c* and the bridge-wall *d*, and there are openings in the side walls of the furnace, as at 4 and 5, to give access to the different parts for stirring the ore or dross, and for the other operations. There are doors to close these openings, to exclude the atmosphere.

The dross or ore, mixed with a suitable material, such as carbon or sal-ammoniac, is laid upon the shelves, and the temperature of the chamber *e* raised to a point to melt the most fusible metal in the ore or dross. The mass is stirred from time to time. I find green birch poles preferable to metal stirrers. The metal that is melted runs into the pot, and is retained until ready for separation; or it may be drawn off by either of the taps or vents 6 7 8, and run by the gutter *o* to a pot or receptacle outside the furnace.

In all instances the metal is separated from the dross, or the slag that may pass into the pot, by means of the jigging or dropping motion shaking the metal to the bottom, and in cases where zinc and lead, or silver and lead, or other metals of differing specific gravities are in the pot, the constant jigging and jar-

ring motion causes the heavier particles to pass down and the lighter to pass up, so that the metal will be in layers according to their relative specific gravities.

By regulating the temperature of the chambers *e* and *f* by the dampers to the flues *h* and *k*, or by the use of a fire around the pot, the proper temperature will be obtained, according to the metals under treatment, and it is preferable to lessen the temperature after the melted metals have assumed their relative positions according to gravity, so that only the easiest melted metal will remain in a melted condition, and can be drawn off; then the temperature is raised, and the metal next in order of fusibility is melted and drawn off, and so on, whereby an almost perfect separation is effected.

In this reverberatory furnace the heat of the two chambers is entirely under the control of the attendants, so that any sulphur or other volatile impurities may first be driven off through the upper flue *k*, and then the heat raised to the desired point, and the chambers closed, or nearly so, to exclude atmosphere, and act like a retort in deoxidizing and reducing the ores or dross.

I claim as my invention—

1. The described method of separating metals, which consists in subjecting a molten mass of the combined metals in a containing-vessel to a jigging or settling motion, whereby the metals are arranged according to their relative specific gravities, and may be separately drawn off, substantially as set forth.

2. The combination, with a pot for melted metals and a shaft for sustaining the same, of the gearing for rotating the pot, and the cam-teeth 3 for raising the pot and allowing it to drop, substantially as set forth.

3. The inclined hearth of the reverberatory furnace, having a bottom outlet or opening, in combination with a collection-pot located beneath said opening, a chamber beneath the hearth containing said pot, and flues and dampers, substantially as set forth, whereby the furnace-flame is either conveyed over the hearth to the chimney or down through said hearth and around the pot, as set forth.

Signed by me this 10th day of April, A. D. 1877.

FREDK. J. SEYMOUR.

Witnesses:
H. C. SPENCER,
CHAS. P. NETTLETON.