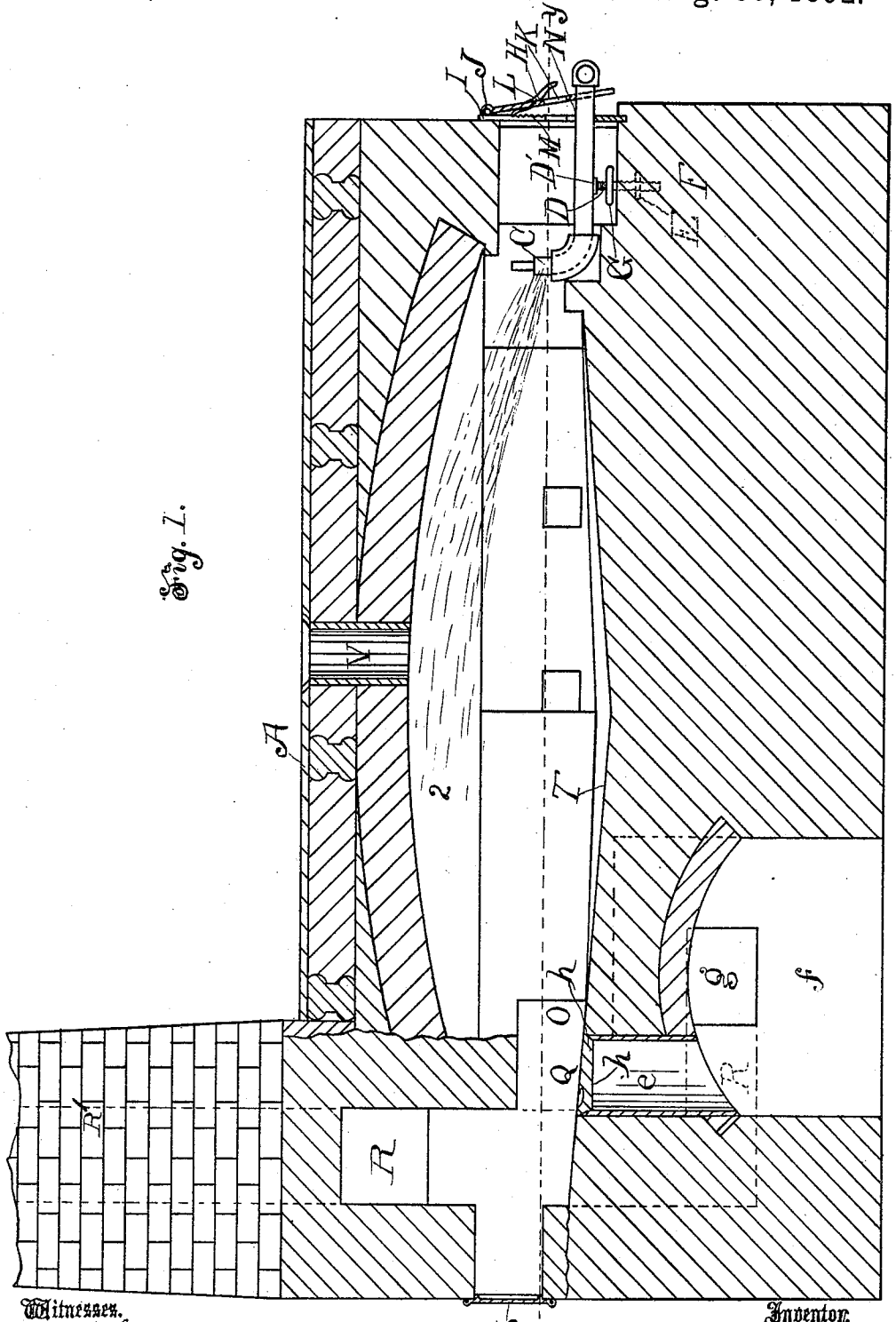
(No Model.) 2 Sheets—Sheet 1.

H. MATHEY.

REVERBERATORY SMELTING FURNACE.

No. 481,703. Patented Aug. 30, 1892.



Witnesses.
W. W. Lee.
Alfred L. Townsend.

Inventor.
Henry Mathey
by Hazard & Townsend
his attys.

(No Model.) 2 Sheets—Sheet 2.

H. MATHEY.

REVERBERATORY SMELTING FURNACE.

No. 481,703. Patented Aug. 30, 1892.

Fig. 2.

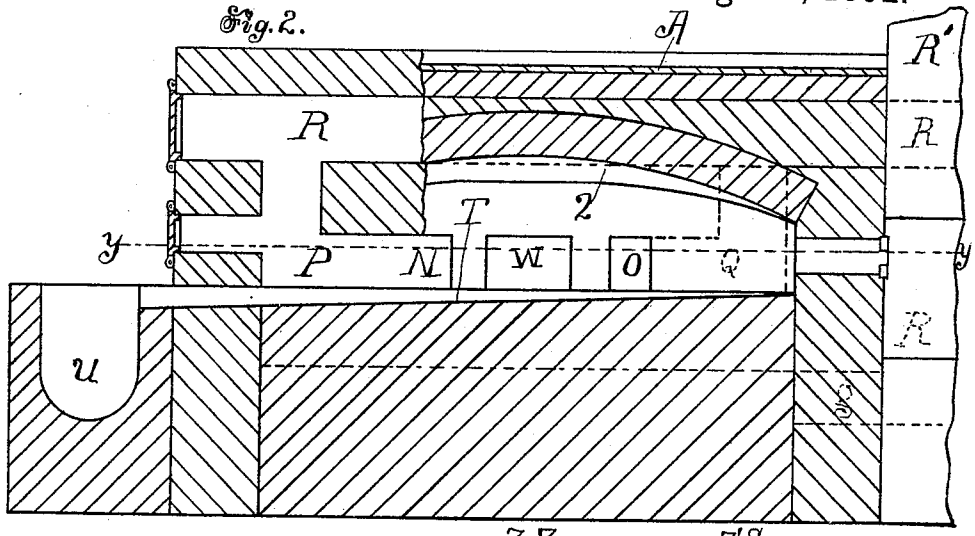
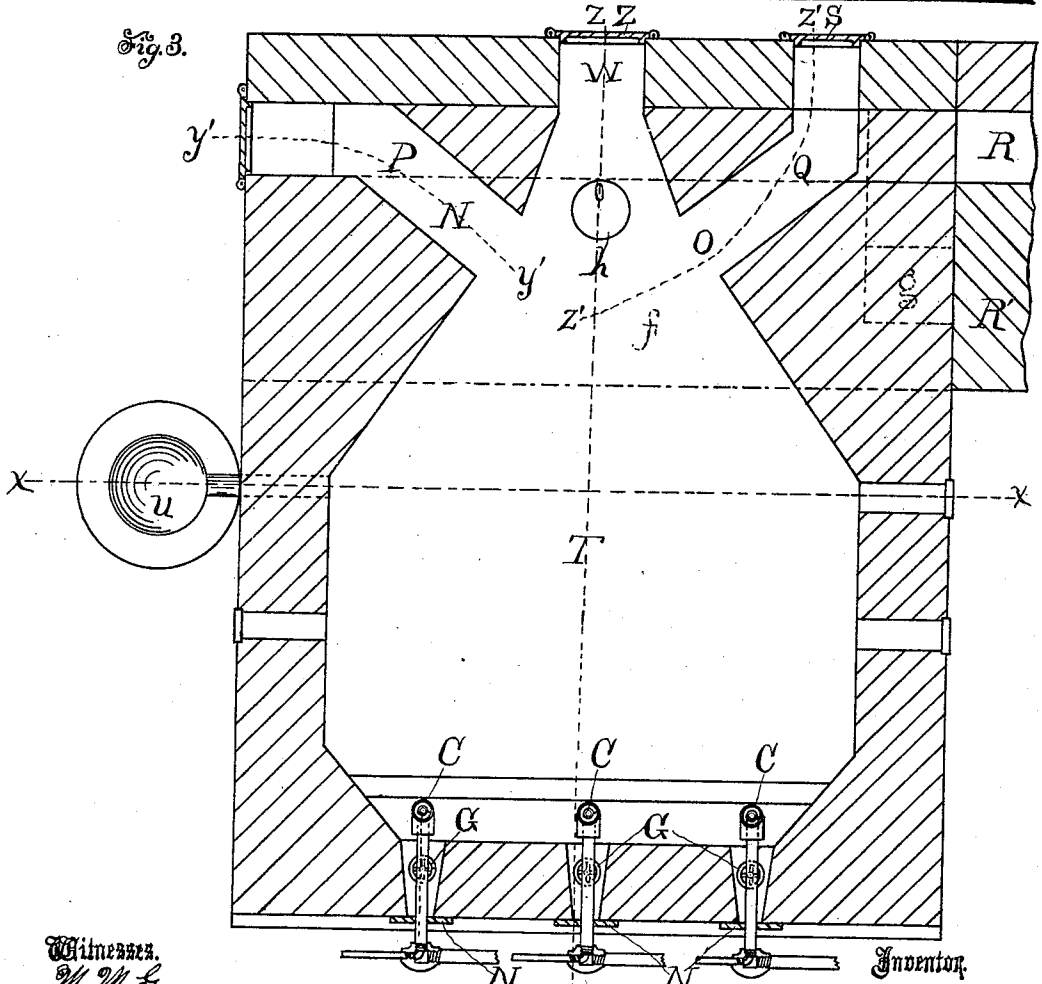


Fig. 3.



Witnesses.
M. M. Lee.
Alfred L. Townsend.

Inventor.
Henry Mathey
by Hazard & Townsend
his attys

UNITED STATES PATENT OFFICE.

HENRY MATHEY, OF SOUTH RIVERSIDE, CALIFORNIA.

REVERBERATORY SMELTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 481,703, dated August 30, 1892.

Application filed February 24, 1891. Serial No. 382,444. (No model.)

To all whom it may concern.

Be it known that I, HENRY MATHEY, a citizen of the United States, residing at South Riverside, in the county of San Bernardino, State of California, have invented a new and useful Apparatus for Reducing Ores Containing Tin or other Volatile Metals, of which the following is a specification.

Except in Cornwall, England, black tin is to-day all over the world smelted in blast-furnaces fired with charcoal. The process is simple and the reduction easy; but the loss is much greater than in the Cornwall process, which is not generally adopted elsewhere on account of the difficulty of obtaining coal of proper quality without paying an exorbitant price therefor. During the smelting of the tin concentrates in both processes the loss by volatilization alone, caused by too high temperature at times (which is very difficult to control) and also excessive draft, is equal to nine per cent. in the blast-furnace, but is somewhat less in the reverberatory furnace. Another loss of from four to six per cent. is caused by the excessive heat forming a vitreous slag, which contains small globules of tin and particles of cassiterite, which are very difficult to recover.

The object of my invention is to reduce the loss from these two causes (*i. e.*, excessive heat and draft) to a minimum.

A further object of my invention is to produce rapid cooling of the refuse slag after being discharged from the reducing-chamber, so that it can be removed more readily.

The accompanying drawings illustrate means invented by me to accomplish the desired result.

Figure 1 is a vertical longitudinal mid-section of my improved furnace, a portion of the rear wall thereof being removed to show the arrangement of the flues. Line $z\,z$, Fig. 3, indicates the line of section and line $z'\,z'$, Fig. 3, indicates the line upon which the wall is broken away. Fig. 2 is a transverse section on line $x\,x$, Fig. 3, with a portion of the wall removed to show the flue P. Line $y'\,y'$, Fig. 3, indicates the line upon which the wall is broken away. Fig. 3 is a horizontal section on line $y\,y$, Figs. 1 and 2.

My invention comprises the combination of a hydrocarbon-burner and a suitable deflecting-roof arranged to receive the flame from such burner and direct the heat downward upon the charge to be smelted.

My invention also comprises a hydrocarbon-burning reverberatory furnace having its chamber narrowed by diagonally-arranged walls at the end opposite that at which the flame is introduced and provided with two or more draft-flues opening, respectively, from the chamber through such diagonal wall.

My invention also comprises the combination of a smelting-chamber, a cooling-chamber adapted to receive the refuse from such smelting-chamber and situated adjacent thereto and connected therewith by an intermediate passage, and having one end open to permit free access of air and at its other end connected with a stack or chimney, (or other suitable draft-inducing device may be substituted,) whereby a cooling draft of air is continually applied to the cooling-chamber to rapidly cool the refuse, in order that it may readily be removed.

The ore is placed upon the iron floor A and mixed with an addition of about twenty per cent. of its weight of crushed coke.

The oil-burners C C C extend into the furnace from the front through the openings N, provided in the door-frame and ventilating-door, and are each provided with a bearing D′, in which is journaled the upper end of the burner-height-regulating screw D. The tap-plate E, through which such screw passes, is rigidly fixed in the wall F of the furnace, and is provided with female threads corresponding to the male threads of the screw D, so that by revolving the said screw by means of the hand-wheel G the burner will be correspondingly elevated or depressed to direct the flame into the proper position for obtaining the best results. The burners may be of any of the well-known forms in successful operation and do not require illustration or description. The adjustment of the burner required to direct the flame so as to secure the best results is very slight, the object being to prevent draft upon the surface of the charge and consequent carrying away of the fine particles of cassiterite and tin. The heat is reflected from the reflecting-roof 2 and thus operates to smelt the ore with scarcely perceptible loss from volatilization. Sometimes when

an extra heavy charge of ore is introduced and the surface thereof is elevated above the usual plane occupied by the surface of a charge the lower portion of the flame from the burner may be thus brought so near to the surface of the charge as to produce a draft. In such cases the burner is elevated by turning the hand-wheel G sufficiently to remedy the difficulty.

The ventilating-doors H are hinged at the top to the door-frames I by hinges J. Near the center of such doors are provided the isinglass-covered openings K, through which the operator observes the charge while the reduction is taking place. These doors are also each provided with a pivoted arm L, the upper end of which arm engages the serrations M on the door-frame to allow adjustment of the door to admit the proper quantity of air to the furnace.

In the rear of the furnace, in place of one central aperture communicating with the flue, I provide two apertures N O—one on each side of the rear of the furnace—each opening into the main flue through short intermediate flues P Q, arranged diagonal to the direction of the flame, so that the draft will not be so direct. In reverberatory furnaces as usually constructed there is difficulty in securing equal distribution of the heat to all parts of the chamber on account of the central flue causing a central concentration of the draft. By my arrangement of the flues the heat is equally distributed on each side of the chamber and superior results obtained thereby.

In case the tendency of the draft is to pass through the flue Q, on account of its opening into the main flue R nearer the stack or chimney R′ than the flue N, I provide a door S in the rear of the furnace, through which I introduce fire-brick sufficient to close the aperture of such flue to cause equal distribution of the draft. The floor T of the reverberatory chamber is inclined to cause the molten metal to flow into the receptacle *u*.

By using crushed coke as the reducing agent there is a much greater yield of metal than when anthracite coal or charcoal is used as such agent, which superiority is no doubt due to the slowness of burning, which keeps the carbon of the coke longer in contact with the cassiterite during the metallurgical reaction.

The operation is as follows: The oil-burners are lighted and the furnace heated to the desired degree. The charge of ore and crushed coke is introduced into the chamber through the aperture V and properly distributed about the floor thereof by an implement introduced through the opening W, closed by the door Z in the rear of the furnace. The burners are regulated to direct the flame at the proper point between the charge and the crown of the arch. The ventilating-doors are opened sufficiently to admit the air necessary for perfect combustion, and when once regulated there is no occasion to disturb the doors until the reduction is complete. The amount of oil admitted to the burner is regulated from the exterior of the furnace, and the operator can determine by a glance through the openings K whether there is too great a degree of heat or not enough, and can increase or diminish the flow of oil to the burners or the amount of air admitted to the furnace, as he may desire. When the reduction is completed, the slag is discharged through the opening *e*, which is closed by the lid *h*, into the chamber *f*, which communicates with a chimney or stack R′ by means of the opening *g*. The heat from such slag causes a draft in the chimney or stack and a consequent rapid circulation of air and cooling of such slag, thus enabling it to be removed with less inconvenience than by the old methods.

It is obvious that my improved furnace may be adapted to various other uses besides the reduction of tin ores, and I do not limit myself thereto.

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

1. A reverberatory furnace comprising the combination of a hydrocarbon-burner, a suitable deflecting-roof arranged to receive the flame from such burner and direct the heat downward upon the charge to be smelted, and a chamber narrowed by diagonally-arranged walls at the end opposite that at which the flame is introduced and provided with two or more draft-flues opening, respectively, from the chamber through such diagonal walls.

2. A hydrocarbon-burning reverberatory furnace having its chamber narrowed by diagonally-arranged walls at the ends opposite that at which the flame is introduced and provided with two or more draft-flues opening, respectively, from the chamber through such diagonal walls.

4. A hydrocarbon-burning reverberatory furnace having its chamber narrowed by diagonally-arranged walls at the end opposite that at which the flame is introduced, two or more draft-flues opening, respectively, from the chamber through such diagonal walls, and means for partially closing one or more of such flues to direct the draft toward the other draft flue or flues.

HENRY MATHEY.

Witnesses:
M. M. GEE,
ALFRED I. TOWNSEND.