WILLIAM QUANN.

2 Sheets--Sheet 1.

Improvement in Furnace for Roasting and Smelting Ores.

No. 120,165.

Patented Oct. 24, 1871.

Fig. 1.

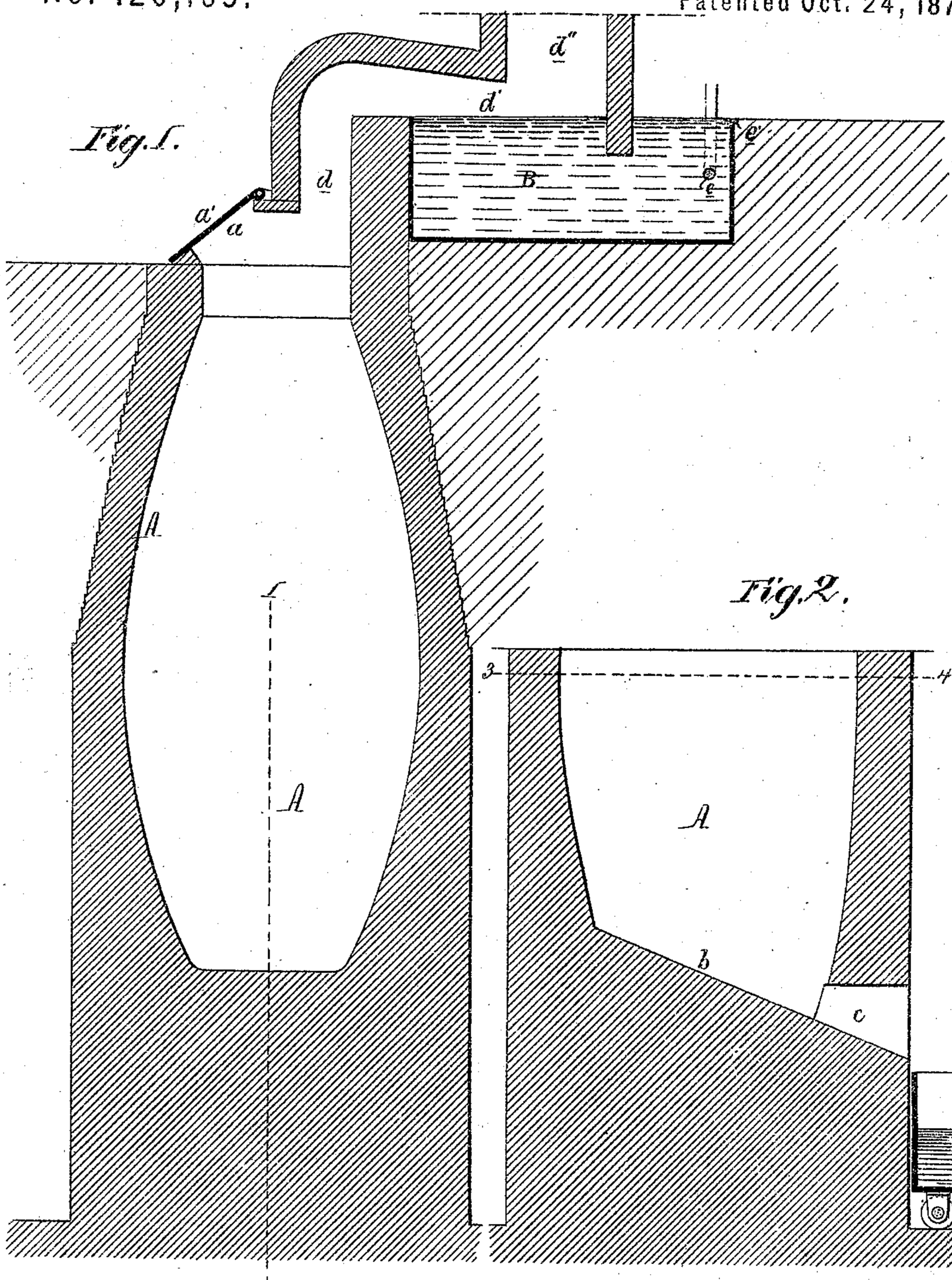

Fig. 2.

Witnesses,

Thos. McElwain

Harry Smith

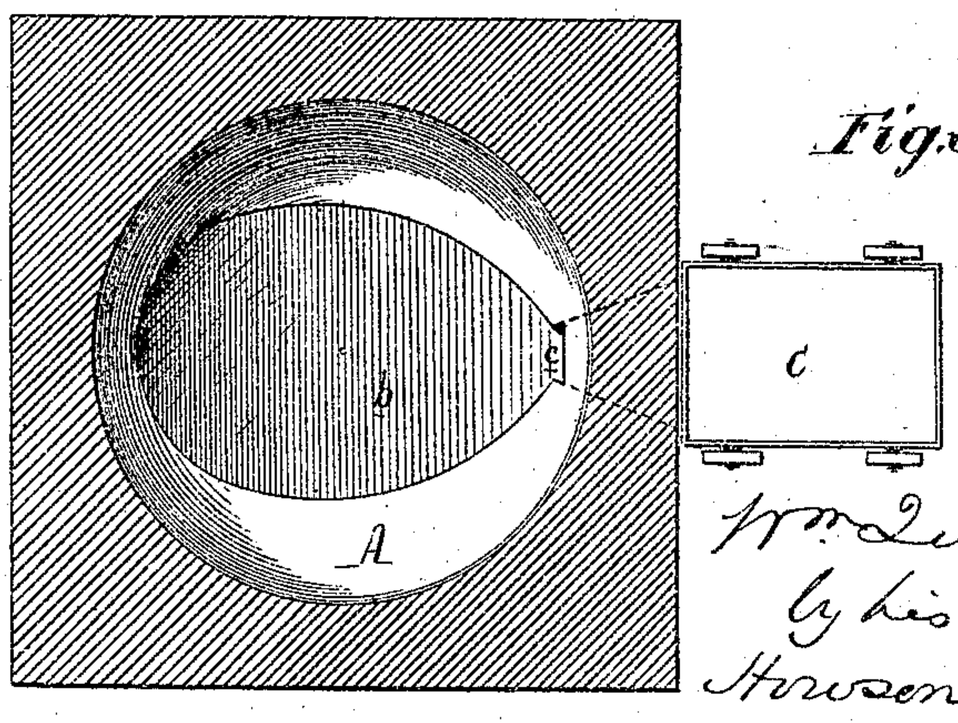

Fig. 3

Scale 3/8" = 1 Foot

Wm. Quann

by his Attys

Howson and Sons

WILLIAM QUANN.

2 Sheets--Sheet 2.

Improvement in Furnace for Roasting and Smelting Ores.

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Sheet K.

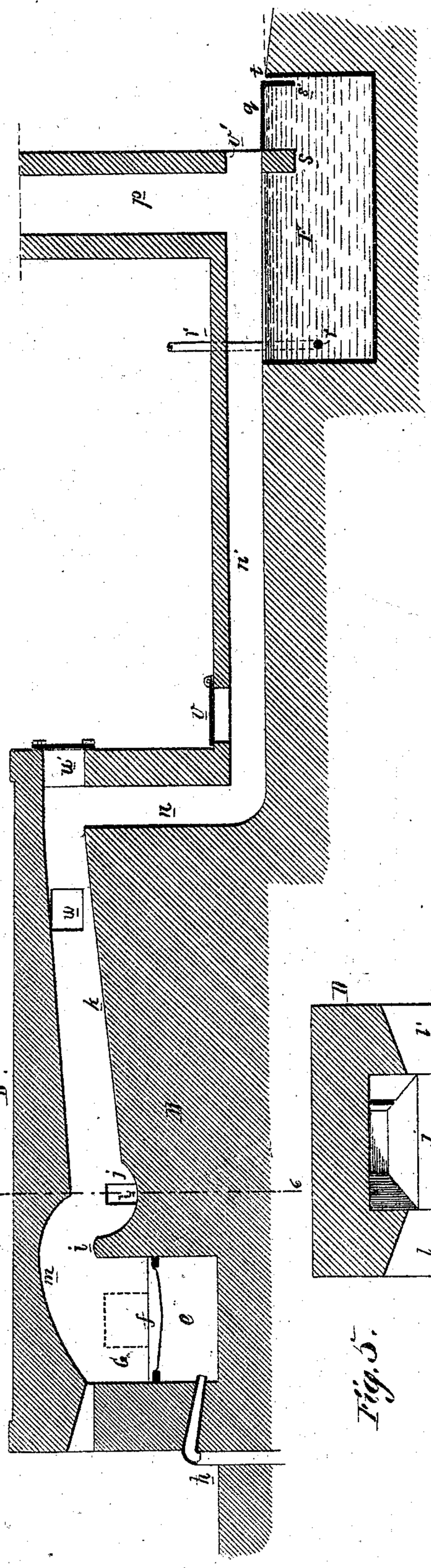

Fig. 4.

Fig. 5.

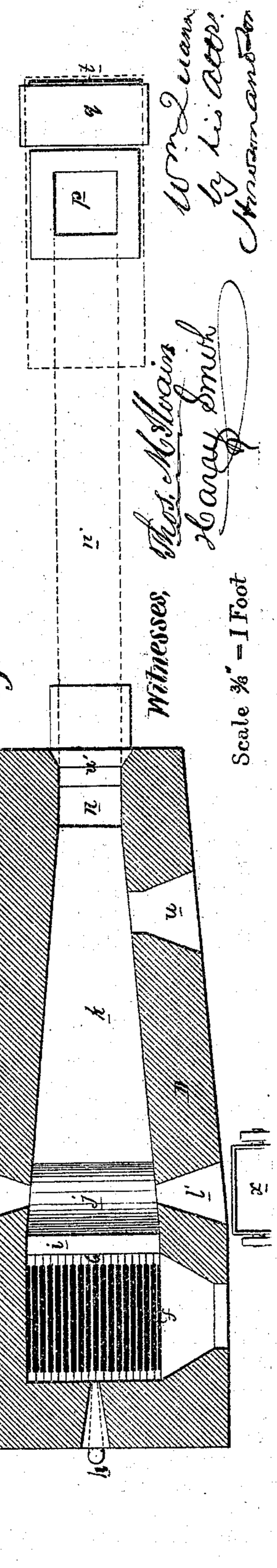

Fig. 6

Witnesses,
Thos. McElvain
Henry Smith

Inventor,
Wm Quann
by his Attys.
Munn & Co

Scale ⅜" = 1 Foot

UNITED STATES PATENT OFFICE.

WILLIAM QUANN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO HIMSELF, JOHN W. THACKARA, AND EDWARD L. SPAIN, OF SAME PLACE.

IMPROVEMENT IN FURNACES FOR ROASTING AND SMELTING ORES.

Specification forming part of Letters Patent No. 120,165, dated October 24, 1871.

To all whom it may concern:

Be it known that I, WILLIAM QUANN, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain Improvements in Roasting and Smelting Ores, of which the following is a specification:

My invention consists of certain improvements, too fully explained hereafter to need preliminary description, in roasting and smelting ores, the said improvements having been designed mainly with the view of recovering by condensation the volatile and other constituents of the ore, which in ordinary furnaces are permitted to pass off through the stack or stacks; of preventing the escape of noxious gases into the surrounding atmosphere; of granulating the molten metal as it is withdrawn from the smelting-furnace; and of preventing the burning out of the roof and other portions of the furnace.

Figure 1, Sheet 1, is a vertical sectional view of a roasting-furnace with my improvements; Fig. 2, a sectional view of the lower portion of the same on the line 1 2, Fig. 1; Fig. 3, a sectional plan on the line 3 4, Fig. 2; Fig. 4, Sheet 2, a longitudinal vertical section of a smelting-furnace with my improvements; Fig. 5, a transverse section on the line 5 6, Fig. 4; and Fig. 6, a sectional plan.

In Sheet 1, A represents an upright roasting-furnace somewhat resembling a cupola in its interior construction. This furnace has at the top a charging-hole, *a*, covered by an iron plate, a^1, except when the charge of combined ore and fuel is being introduced; and the furnace has an inclined bottom, *b'*, terminating at its lowest point in a discharge-opening, *c*, through which the roasted ore is withdrawn, as hereafter described. The stack at the top of the furnace first ascends vertically for a short distance, as shown at *d*, and is then extended horizontally or slightly inclined downward over a water-vessel, B, as shown at *d'*, the stack being then extended vertically upward from a point directly over the water-vessel to any desired height. The vessel B is to be filled with pure water, which constantly enters it through a pipe, *e*, and is as constantly discharged from the top of the vessel at about the point *e'*. A water-tank, C, mounted upon wheels for convenience in moving it about from place to place, is arranged to receive the roasted ore as it is drawn from the furnace through the opening *c*, the object of which will be hereafter described. The smelting-furnace in which the ore is treated after its removal from the roasting-furnace is illustrated in Sheet 2 of the drawing, D representing the body of the furnace, built of or lined with suitable refractory material; *e*, the ash-pit; *f*, the grate; *g*, the fire-chamber; *h*, the blast-pipe, entering the furnace beneath the grate; *i*, the bridge-wall; *j*, the basin, into which the molten metal is received; and *k*, the bench upon which the ore and flux is placed, and which inclines downward toward the basin. The basin is a deep semi-cylindrical depression formed within the furnace between the bridge-wall and the bench, and communicating at its opposite ends with two discharge-openings or tapping-holes, *l* and *l'*, one for the slag and the other for the molten metal. A water-tank, *x*, Figs. 5 and 6, placed beneath the opening from which the molten metal is discharged so as to receive and at once granulate the latter, as hereafter described. The roof of the furnace above the fire-place is curved, and inclined downward toward the basin, as shown at *m* in Fig. 4, for the purpose of directing the products of combustion down into the basin and onto the bench beyond the same; and the products of combustion, thus directed in the first instance, are caused to pass over the surface of the bench instead of rising as usual to the roof of the furnace by means of a descending flue, *n*, at the end of the furnace, this flue and a horizontal passage, *n'*, forming a communication between the furnace and a vertical stack, *p*, through which the products of combustion finally escape. The products of combustion in their passage through the horizontal flue *n'* are conveyed over water contained in a tank, F, which is also arranged beneath the vertical stack, and extends outward beyond the latter, where it is provided with a lid, *q*. This tank is constantly supplied with running water in the same manner as the tank B of the roasting furnace by means of a pipe, *r*, and the water constantly flows off from the tank at the point *t* after passing beneath partitions *s* and *s'*. Access can be obtained to the interior of the furnace through openings *u* *u'*, and to the interior of the horizontal flue *n'* through openings *v* and *v'* for purposes of cleansing, &c.

The ore is submitted to the following treatment in the roasting and smelting-furnaces: The

raw ore is, in the first instance, introduced into the roasting-furnace through the charging-hole *a* in the top of the same, and is layered with fuel in the ordinary manner, this fuel being ignited for the purpose of roasting the ore. Volatile metals—such as lead, arsenic, and bismuth, and a considerable percentage of sulphur—will be disengaged from the ore by the process of roasting, and will, with particles which are mechanically suspended in the heated ascending current of the products of combustion, rise through the vertical and horizontal portions *d* and d^1 of the stack, and pass finally into the stack proper d^2. A considerable portion of the water in the tank B, over which the heated products of combustion are thus caused to pass, will be converted into steam, which will mingle with the said products and separate from the same by condensation the volatile matters and particles held in suspension, which condensed particles will fall back into the water. This process of condensation is continued up through the vertical stack d^2, which is situated directly over the water-vessel, so that particles will be constantly disengaged and condensed, and will fall back into the water contained in the said vessel, the consequence being that most of the volatile matters are recovered, while but a small proportion of noxious vapors escape from the top of the stack to taint the surrounding atmosphere. The condensed metals fall to the bottom of the tank, from which they can be removed from time to time without interfering with or stopping the furnace, as one end of the tank projects outward beyond the flue so as to permit the introduction into the same of proper tools for raking up and withdrawing the condensed particles.

The water, as before mentioned, is caused to flow continuously through the vessel in order that those condensed matters which are soluble in water may be at once carried off with the same instead of being permitted to remain and saturate the water, and thus prevent the deposit of pure metals in the latter. It is important, also, that the water should be constantly changed in order to keep up the supply which is constantly decreased by evaporation, and in order, also, to maintain it in as cool a state as possible so as to effect a more perfect condensation.

It should be understood that but a portion of the volatile metals, and sulphur and other impurities, are disengaged by the roasting process. The remainder have to be disengaged in the subsequent operations, which I will now proceed to describe.

The roasted ore (at about red heat) is discharged from the opening *c* at the bottom of the furnace into the water-tank C. This sudden change of temperature and plunging into water causes the ore to crumble, and enables the sulphurous acid and some other impurities to be driven off; a decomposition, in other words, taking place, and the impurities being absorbed by the water, while a considerable percentage of oxygen is taken up by the ore.

After having been thus treated the ore is dried, and is then mixed with a suitable flux or fluxes and placed upon the bench K of the smelting-furnace, where it is subjected to a most intense heat caused to impinge directly upon it, as before described, by reason of the peculiarly-curved roof *m* of the front portion of the furnace and descending flue *n* at the rear end of the same, the products of combustion having no tendency to rise after striking the basin and bench, but passing over the bench and through the mass of ore until the latter is thoroughly melted and flows down into the basin. This method of directing the heated products of combustion onto the ore also protects the roof of the furnace, and prevents that rapid burning out of the same, which is so great an objection in ordinary furnaces.

The water-tank F beneath the horizontal flue n' and vertical stack *p* is intended for precisely the same purpose as the tank B of the roasting-furnace, namely, to condense and recover the volatile metals and matters held in suspension by the products of combustion, and also to prevent the escape of noxious gases from the stack into the surrounding atmosphere. This tank has also a supply of water running constantly through it so as to carry off impurities, to prevent undue heating, and to effect a perfect condensation. The lid of the tank can be removed at any time, and the condensed particles raked up and withdrawn from the bottom of the same without interfering with the draught of the furnace. The slag is withdrawn from the basin of the furnace through the tapping-hole *l*, and the molten metal or "matt" is withdrawn through the hole l' and discharged at once into the water-tank *x*. This granulating the metal or matt, so that it can, when removed from the tank, be at once treated with the proper chemicals for the purpose of separating the different kinds of metals—the usual necessity of remelting the metal or matt for the purpose of granulating it—being thus avoided.

I claim as my invention—

1. The arrangement, beneath and combination with the outlet-flue or stack of a roasting or smelting-furnace, of a body of water flowing freely and constantly, and over which the gases are caused to pass, all substantially as and for the purpose specified.

2. A smelting-furnace in which an arched or curved roof, *m*, and descending flue *n* are combined with and arranged in respect to the basin and bench of the said furnace, substantially as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM QUANN.

Witnesses:

JOHN K. RUPERTUS,

HARRY SMITH.

(99)