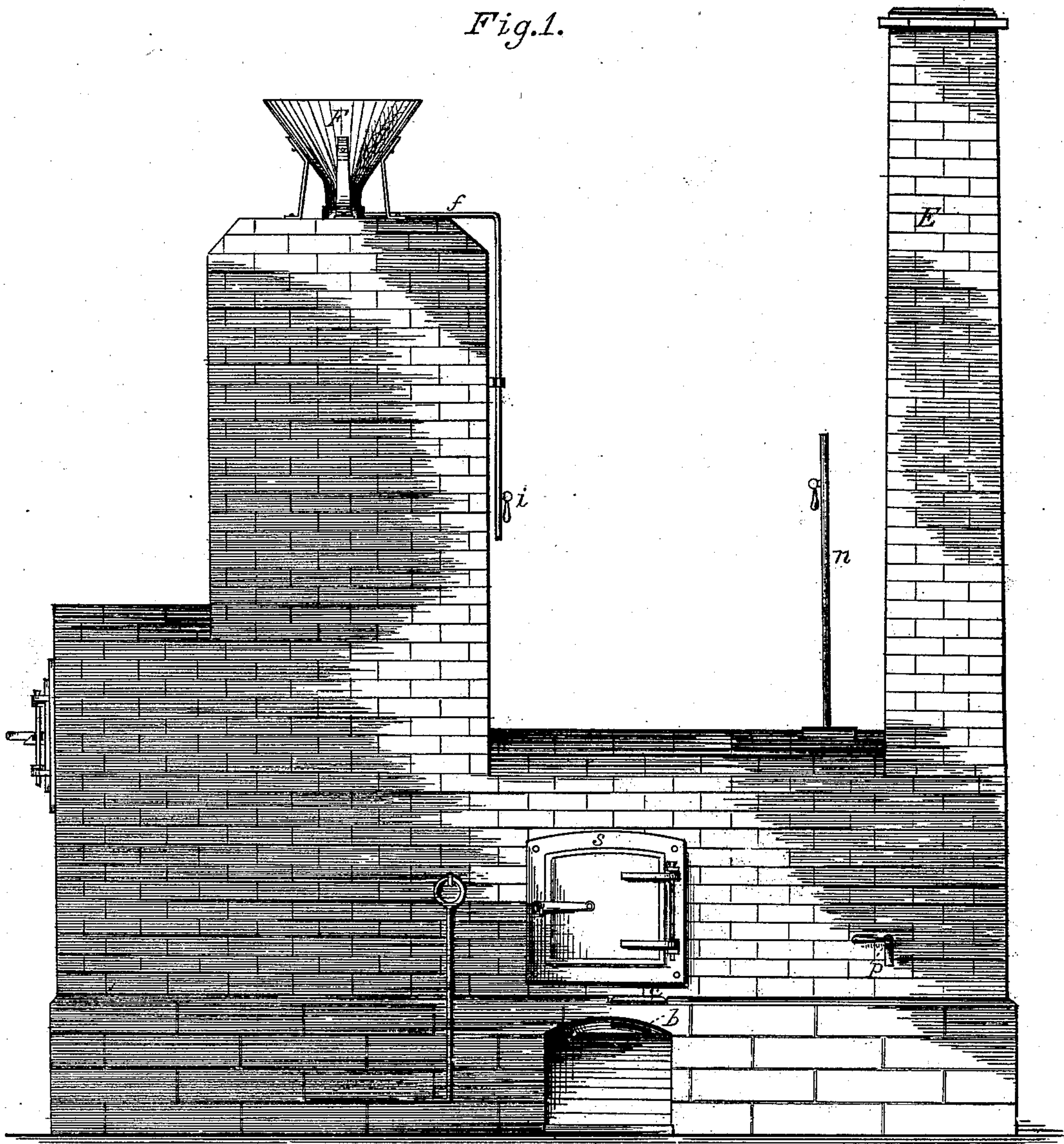


A. RAMAGE.  
Ore-Roasting and Desulphurizing Furnace.  
No. 207,065.      Patented Aug. 13, 1878.

*Fig. 1.*



—*Witnesses:*—

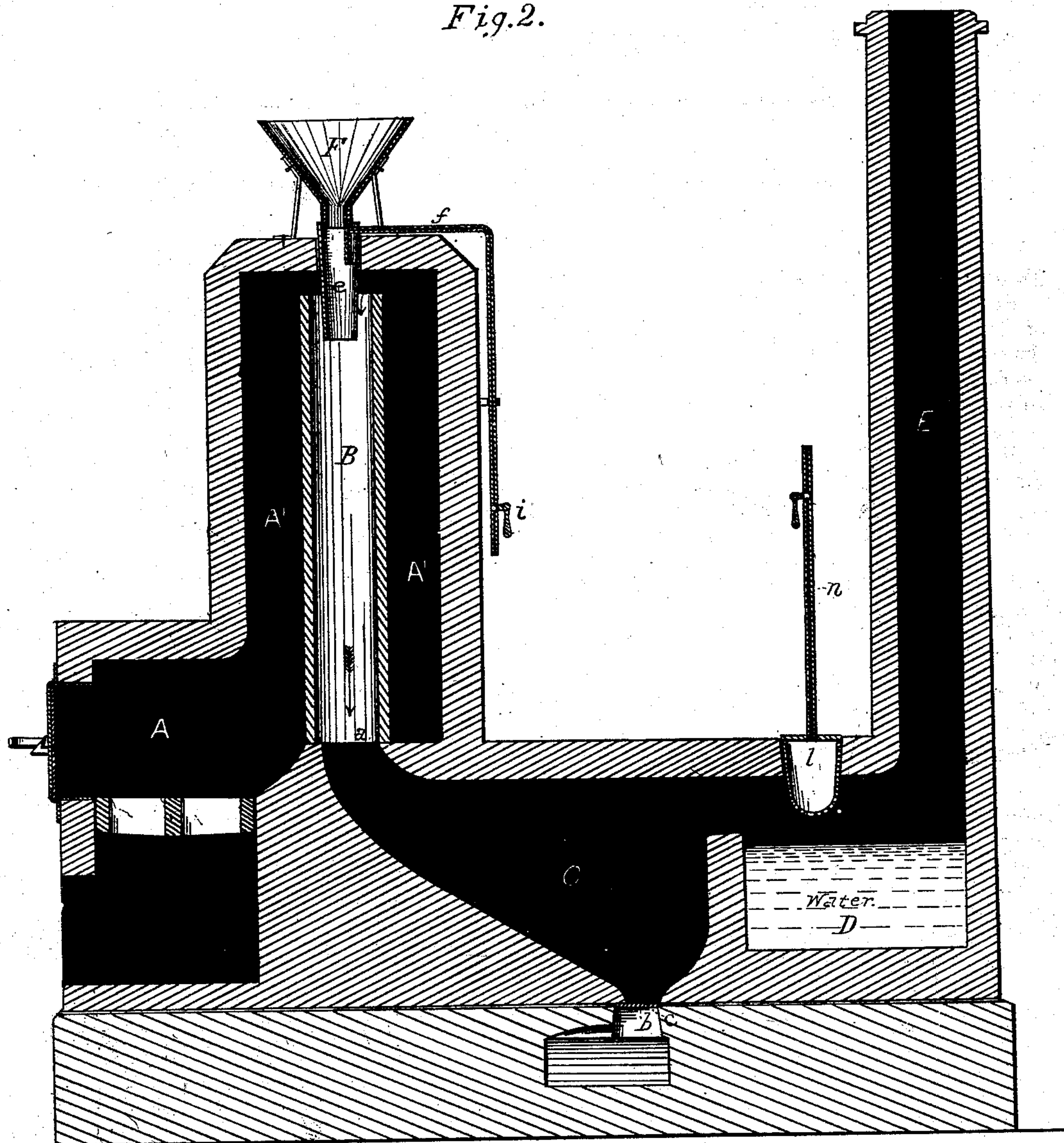
*Chs. C. Lewis.*  
*A. C. Eader.*

—*Inventor:*—

*Alex. Ramage*  
*By his atty*  
*Chas B. Mann*

A. RAMAGE.  
Ore-Roasting and Desulphurizing Furnace.  
No. 207,065. Patented Aug. 13, 1878.

Fig. 2.



—Witnesses:—

Chs. E. Lewis.  
A. C. Eader

—Inventor:—

Alex. Ramage  
By his Atty  
Chas B. Mann



# UNITED STATES PATENT OFFICE.

ALEXANDER RAMAGE, OF DENVER, COLORADO, ASSIGNOR OF THREE-FOURTHS OF HIS RIGHT TO WILLIAM BROWN, HOMER T. ENGLE, AND ROBERT RAEURN, OF SAME PLACE.

## IMPROVEMENT IN ORE ROASTING AND DESULPHURIZING FURNACES.

Specification forming part of Letters Patent No. **207,065**, dated August 13, 1878; application filed April 4, 1878.

*To all whom it may concern:*

Be it known that I, ALEXANDER RAMAGE, of Denver, in the county of Arapahoe and State of Colorado, have invented a new and useful Improvement in Ore Roasting and Desulphurizing Furnaces, of which the following is a specification:

My invention relates to a furnace for roasting and desulphurizing metallic ores; and consists in constructing the flue leading from the furnace or fire-box so as to surround the vertical roasting-tube, the upper end of which is open to admit the flame and products of combustion, all of which pass through the tube downward and then over the ore-chamber and condenser to the main escape-flue, whereby all the heat of the fuel is availed of, first outside and then inside of the roasting-tube, and the flame and gases are utilized in the process.

In the accompanying drawings, which are made a part of this specification, Figure 1, Sheet 1, is a side elevation of a furnace embodying my improvement. Fig. 2, Sheet 2, is a vertical section of same, showing the construction.

The foundations are of stone masonry, and the walls of brick.

A represents the fire-box or furnace; A', the flue leading to the open top of the vertical roasting-tube B, which is constructed of fire-clay or other suitable material, and is entirely surrounded by the flue.

The lower end, *a*, of the tube communicates with the ore-chamber C, the bottom of which gradually deepens, and is provided at the lowest point with a discharge, *b*, which is closed by a sliding plate, *c*. *d* is a bridge separating the condensing-tank D from the ore-chamber. E is the escape-flue.

Upon the top of the dome inclosing the roasting-tube is fixed the hopper F, from which a tube, *e*, leads through the dome to the large tube B. A small iron pipe, *f*, enters the tube *e*, and has its end bent downward. It is provided with a cock, *i*, and leads to a suitable apparatus from which dry steam is supplied. *l* is a metallic vessel, with a finely-perforated

bottom, placed across the top of the condensing-tank. Water is supplied to this perforated vessel by the pipe *n*. A cock, *p*, is attached to the tank D for drawing off the water. In the side of the ore-chamber is a door, *s*, placed so as to afford access to the discharge *b* for the purpose of cleaning or repairing.

The furnace is operated as follows: In heating up, the flames and hot gases of combustion surround the large tube B and enter the same at the top, passing downward, and thence over the ore-chamber C, bridge *d*, and condensing-tank D, escaping finally by the flue E. The heating is to continue until the inside of the tube B is red, which may be seen by looking through the hopper, when the ore, which has been previously pulverized as fine as possible, is delivered into the hopper, from which it runs in a steady stream through the pipe *e* into the heated roasting-tube. At the same time steam in proper quantity is admitted by the pipe *f*, and descends with the pulverized ore.

By the action of the decomposed steam and gases present in the roasting-tube the sulphides are decomposed, and the easily-oxidized metals, such as iron, take up oxygen, sulphur passes off, and the gold or silver is set free. As the ore falls into the chamber C the smoke and gases pass over the bridge, and, in passing across the condenser, are sprayed by the water from the vessel *l*, the effect of which is to cool the same and throw down any particles of metal that have been carried over by the draft. The withdrawal of the slide *c* permits the ores to discharge.

This furnace will desulphurize and oxidize ores of iron, as well as ores of tellurium, with a great economy of fuel. Ores of galena may be treated, and it will chlorinate successfully by mixing with the ore chloride of sodium, and admitting chlorine gas instead of steam.

I am aware that furnaces have been used having an upright tube, through which, when heated, the ore is passed; but in such the tube is heated only on the outside, while by the arrangement described the heat is first availed of on the outside of the tube, and then the flame and gases are further utilized in the pro-

cess by their passing through the tube from the top downward.

What I claim, and desire to secure by Letters Patent, is—

1. In a furnace for roasting and desulphurizing ores, the combination of the vertical tube B, having its upper end open to admit the flame and gases of combustion, and tube *e*, leading from the hopper, and its lower end communicating with the ore-chamber C, as shown and described.

2. In a furnace for roasting and desulphurizing ores, the combination of the several parts described—namely, the furnace A, flue A', entirely surrounding the roasting-tube B and connecting with its open upper end, tube *e*, leading from the hopper, and pipe *f* and ore-chamber C, all substantially as specified.

ALEXANDER RAMAGE.

Witnesses:

ROBERT RAEBURN,  
H. L. THAYER.