

J. O. STEWART.  
Muffle-Furnace.

No. 219,122.

Patented Sept. 2, 1879.

Fig. 1

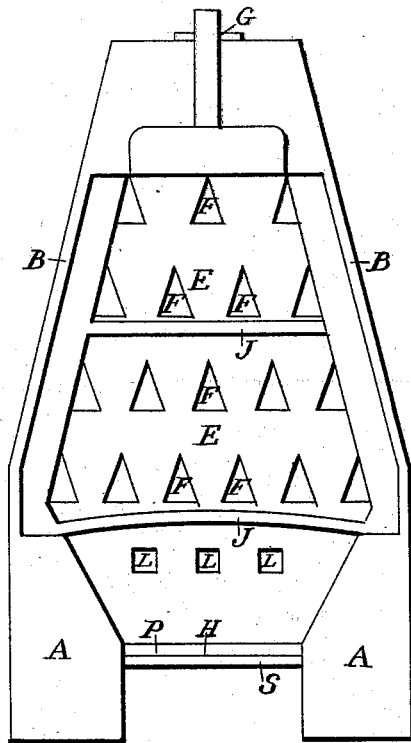
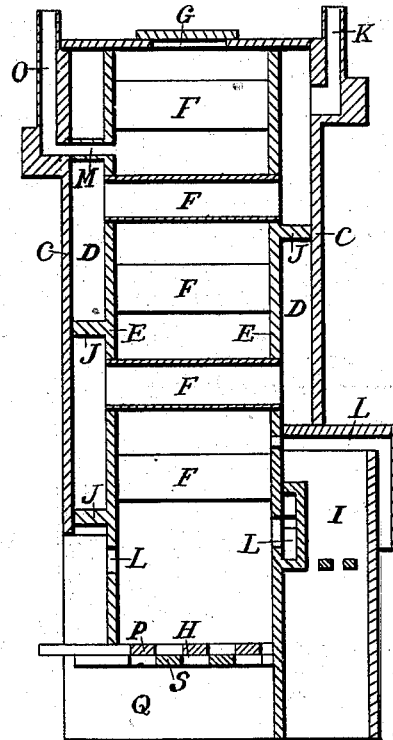


Fig. 2



Witnesses  
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# UNITED STATES PATENT OFFICE.

JAMES O. STEWART, OF SAN FRANCISCO, CALIFORNIA.

## IMPROVEMENT IN MUFFLE-FURNACES.

Specification forming part of Letters Patent No. **219,122**, dated September 2, 1879; application filed November 1, 1878.

### *To all whom it may concern:*

Be it known that I, JAMES O. STEWART, of the city and county of San Francisco, State of California, have invented an Improved Muffle-Furnace; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to certain drawings accompanying this specification, and forming a part of the same.

My invention has reference to that class of continuously-operating upright furnaces for roasting ores in which a number of A-shaped shelves are arranged across the furnace-chamber, so that the ore will rest upon and be directed by them as it passes down through the furnace, while the heat from the fire-place passes through and across the flues formed by the shelves, said shelves being closed at the bottom, so that the products of combustion do not commingle with the ore and cannot impair the quality of the product obtained.

My invention relates, first, to an improvement in the shape of the furnace, by which I secure beneficial results; secondly, to an arrangement for muffling the ore-chamber, and thereby preventing the products of combustion from the fire-place from coming in contact with the ore and intermingling with the gases generated in the ore-chamber; and, thirdly, to an arrangement for introducing undecomposed, but heated, air into the ore-chamber in an unlimited quantity, for the purpose of oxidizing the ore, all of which constitutes a new process for the treatment of ores, as hereinafter more fully specified.

In roasting ores of gold, silver, mercury, copper, zinc, lead, iron, &c., the object to be obtained is to eliminate the sulphur or other volatile metals from the more stable metals with which they may be combined or associated in their natural state, and to unite oxygen with such metals as copper, zinc, lead, iron, &c., which may be in the ore, leaving them in the condition of sulphates or oxides; and when it is desired to convert either silver or copper to a chloride, the object first mentioned must be attained before the latter is accomplished. Again, it is often desirable to obtain, for commercial or other uses, the volatile metals thus eliminated—such as sulphur, arsenic, mercury, &c.—and to obtain them as free from any other

associated metals as possible, and especially to prevent carbon and gases from the fuel used in roasting from being mixed either with the ore or the volatile metals.

My improved muffle-furnace is intended to accomplish these purposes.

Referring to the accompanying drawings, Figure 1 is an elevation of the interior of the furnace, the front wall being removed. Fig. 2 is a vertical section.

A A represent the base-walls of my furnace, and B B the side walls of the body of the furnace. These side walls, B B, are inclined, so that they converge toward the top, thus producing a gradually-widening ore-chamber from the top to the bottom, as shown. The other two sides, C C, of the furnace are vertical, as represented at Fig. 2.

Inside of the walls C C, I construct the end walls, E E, of the ore-chamber, so as to leave a space, D, between them. I then connect the two walls E of the ore-chamber by means of a number of flues or pipes, F, which extend across and through the chamber and open into the spaces D on each side.

The pipes or tubes can be made of any desired shape, and can be variously arranged. I prefer to make them triangular in cross-section, so that the ore will rest against and pass over the inclined sides, as shown, and I prefer to arrange the flues of one row in alternation with the flues of the row above and below them, as this gives the best result in directing the downward-moving ore. These flues are to be closed on all sides, so that the heat and products of combustion pass through them, and do not pass into the ore-chamber or commingle with the ore.

The charging-door G is placed on the top of the furnace, and a discharge-grate, H, to be hereinafter described, is placed at the bottom of the ore-chamber.

The fire-place I is located at one side of the furnace, and connects with the space D on one side, so that the heat and products of combustion will pass through the flues or tubes F from one side to the other.

Partitions J are arranged across the spaces D between each two or more rows of tubes or flues, alternately on opposite sides, so that the heat is compelled to pass back and forth across the

furnace, first through one set of tubes and then through another toward the top of the furnace, until they pass out through the stack K, which is connected with the space D at one side of the furnace, thus utilizing the heat to the very best advantage.

It is not necessary to have the tubes or pipes open at their ends, for they could be connected by means of elbows which would conduct the heat from one series of tubes to the other, in which case the outer walls, E E, could be dispensed with.

L L are air-passages through the bridge-wall of the fire-box, and also around the outside of the fire-box, which lead through the walls of the ore-chamber, so as to conduct a supply of undecomposed air into the chamber, where it will come in contact with the ore in the chamber. Sliding doors or dampers are arranged for regulating the supply of air, as required.

M M are the flues or passages which lead from the upper end of the ore-chamber to the flue or chimney O, for carrying off the volatilized metal, acids, or gases to the open air, or conducting them to suitable receivers, if it is desired to save them. A fan or suction apparatus can be connected with these flues or passages, if desired, for the more speedy withdrawal of the fumes and gases.

In charging the furnace the ore is introduced through the door G until the chamber is filled, the inclined faces of the flues directing and distributing it as it descends. The ore will then rest upon a double-grated floor at the bottom of the chamber, the upper grate, P, being movable above the fixed grate S, so that by shaking the upper grate the ore is sifted through and dumped into a car beneath in the space Q. After being charged, the ore is heated by the heat and products of combustion passing through the flues F F, which heats the tubes sufficiently to roast the ore lying upon them in a short time. When the ore is heated suf-

ficiently to ignite the sulphur, a proper supply of air is admitted into the ore-chamber through the air-passages L L. When the ore around the first two rows of flues is sufficiently roasted, which can be ascertained by means of a trier through a small air-door in front, the grates are shaken and the ore discharged. The portion of ore lying between the lower row of tubes and the grate should be then returned to the furnace until the roasted ore reaches the grates, after which the ore need only be discharged when that portion around the first two rows of flues is sufficiently roasted. As the roasted ore is withdrawn at the bottom, fresh ore is introduced at the top, so as to keep the chamber full.

I thus roast the ore out of contact with the products of combustion from the fire-place, so that the gases or fumes are withdrawn uncontaminated by the carbon and gases from the fuel. The fresh undecomposed air which I introduce into the ore-chamber in a heated state oxidizes the ore readily and thoroughly, so that it is left in a proper condition to yield to subsequent treatment.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

A furnace for roasting ore, adapted to contain the ore continuously until it is roasted, consisting of an ore-chamber, of smoke-flues D D, formed by inner and outer walls, transverse flues F F, having a triangular section, being closed at the bottom to prevent the products of combustion from passing into the ore-chamber, and grates S, constructed and arranged as set forth.

In witness whereof I have hereunto set my hand and seal.

JAMES O. STEWART. [L.S.]

Witnesses:

H. M. CHACE,

D. B. LAWLER.