2 Sheets—Sheet 1.

# R. SPENCER.

## APPARATUS FOR TREATING ORES.

No. 47,873. Patented May 23, 1865.

Fig. 1.

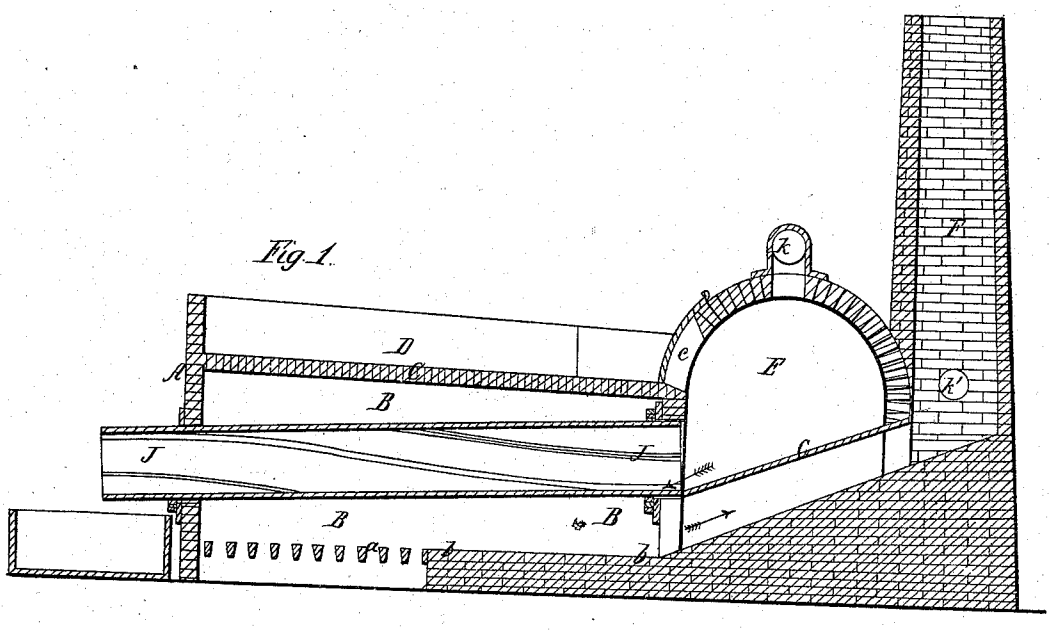



Fig. 2.

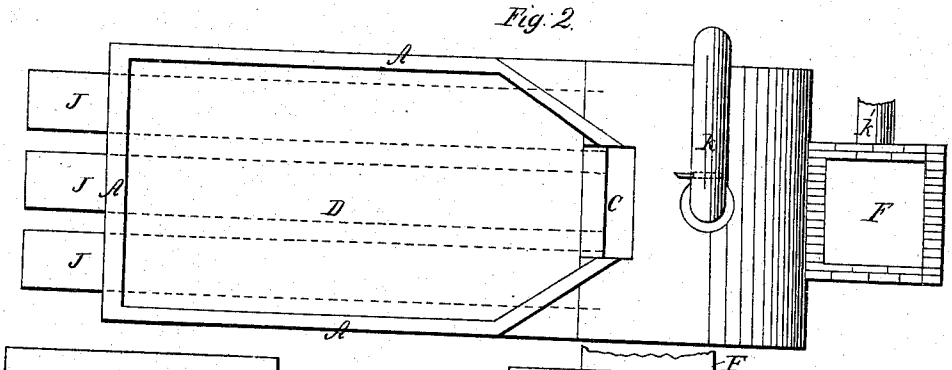



Fig. 3.

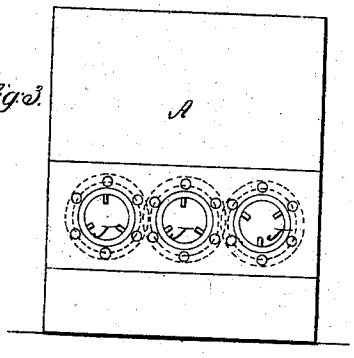
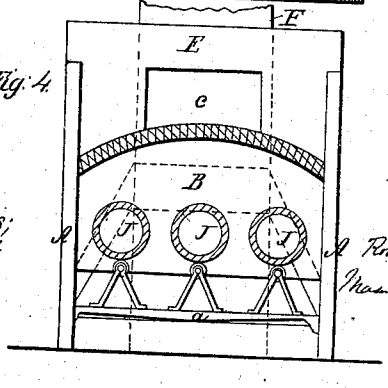



Fig. 4.




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by his Atty's
Munn & Comstock & Evans

2 Sheets—Sheet 2.

# R. SPENCER.

## APPARATUS FOR TREATING ORES.

No. 47,873. Patented May 23, 1865.

Fig. 5.

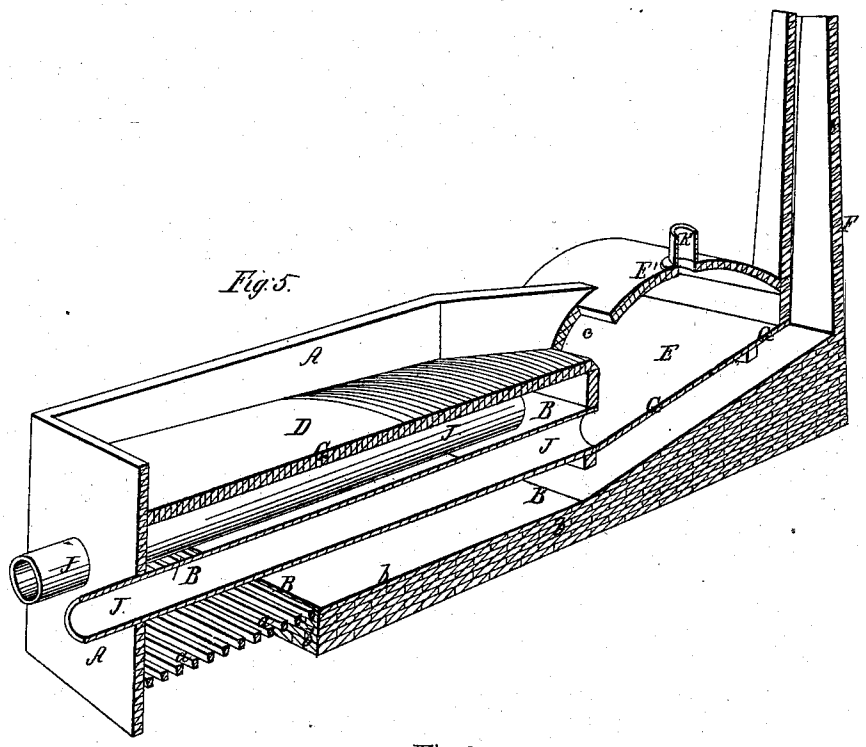



Fig. 6.

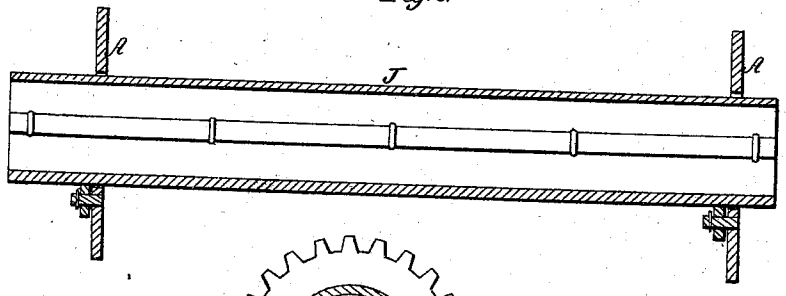
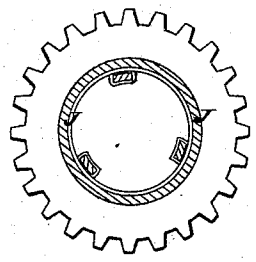



Fig. 7.




Fig. 8.



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by his attys
Munn, Lemuel & Co.

# UNITED STATES PATENT OFFICE.

ROBERT SPENCER, OF NEW YORK, N. Y.

## IMPROVED APPARATUS FOR TREATING ORES.

Specification forming part of Letters Patent No. **47,873**, dated May 23, 1865.

*To all whom it may concern:*

Be it known that I, ROBERT SPENCER, of New York city, State of New York, have invented a new Improvement in the Treatment of Ores; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a vertical longitudinal section through the calcining and desulphurating furnace. Fig. 2 is a top view of the furnace. Fig. 3 is a front view. Fig. 4 is a vertical cross-section of the furnace. Fig. 5 is a perspective section of the furnace. Fig. 6 is a diametrical section through one of the calcining-cylinders. Fig. 7 is a cross-section through the cylinder of Fig. 6. Fig. 8 is a cross-section through one of the cylinders, having a driving-wheel applied to it.

Similar letters of reference indicate corresponding parts in the several figures.

This invention is intended for preparing the ores of gold and silver for the amalgamating process by roasting the ore, and thus depriving it of its sulphur, and then discharging the heated ore into a bath, for the purpose of disintegrating the matrix and exposing the atoms of metal, so that they will be taken up by the mercury in the amalgamator.

In the process of roasting ores, particularly such as contain sulphur, it has been found that the vessels soon burn out and are rendered useless, and as such vessels are very expensive when transported to the mines, it is my object to prevent their rapid destruction by covering their inside surfaces, and, if desirable, their outside surfaces, with a fire-proof enamel which will resist the action of fumes of sulphur and protect the iron vessels from injury, as will be hereinafter described.

To enable others skilled in the art to understand my invention, I will describe its construction and operation.

Before describing my invention I will describe a furnace in which I propose to conduct the process of desulphurating and disintegrating the ores of metals, so as to expose the metal to the best advantage for a subsequent process of amalgamation.

A A represent the vertical walls of the furnace, which are carried up a sufficient height to form a chamber, B, which is covered by an arch, C, inclining backward, and also a receptacle, D, above the arch. Near one end of the fire-chamber B the furnace proper is applied, of which *a a* are the grate-bars, and *b* a fire-wall, which forms a flue which is continued back beneath an arched chamber, E, and terminated at the chimney F, which forms a portion of the back part of the arched chamber E, as shown in Figs. 1 and 5. The dome or arch of the chamber E is carried up above the surface of the arch of the fire-chamber, and through the arch E' an opening, *c*, is made, which is provided with a hinged or sliding door or valve for closing the opening *c*, when desired. The bottom of the chamber E is formed by introducing a plate, G, which inclines toward the furnace-chamber, as shown in Figs. 1 and 5, and conducts the powdered ore, which is put into the chamber E, into cylinders J J, which extend longitudinally through the furnace-chamber and incline toward the fire-chamber, as shown in Fig. 1. These cylinders pass through the end walls of the furnace, and are supported in such manner that they can be rotated or oscillated. Both ends of each cylinder are left open for the free passage of air through them in one direction and the passage of ore through them in an opposite direction.

The ore is fed into the cylinders in proper quantities from the chamber E and slowly carried toward their inclined ends, from which the ore is allowed to fall into a bath, which suddenly cools the particles of mineral and bursts them into a fine powder, thus exposing the metal. The heat to which these cylinders are subjected is very considerable, in order to drive off the sulphur, which combines with the oxygen of the air entering the ends of the cylinders, and is burned in these cylinders. Large quantities of the sulphurous fumes will of course escape from the upper ends of the cylinders into the chamber E; but I have made provision for conducting off this sulphur and condensing it, as will be presently described.

The ore, which has been pulverized in any of the well-known modes, is conducted into the receptacle above the arched fire-chamber, where it is heated and fed into the chamber E through the opening *c*, in proper quantities. In this chamber the pulverized ore is again heated, and in this heated state it is slowly

fed into the ends of the cylinders J J. A pipe, K, communicates with the chamber E and leads off to a condenser of any suitable description, and from the condenser a pipe, K′, communicates with the chimney F. By this arrangement I obtain a sufficient draft to conduct air into the cylinders J and to carry off the gases from the ore into a condenser, where they are condensed and their solid particles saved. In order to secure success, it is important to subject the ore to a gradually-increasing heat as it passes through the cylinders, and thus prevent the fusible matrix from running to slag and enveloping the particles of gold or silver. It is also important to subject the ore to an intense heat, which fits it for the bath, into which it falls as it leaves the cylinders.

My invention consists in protecting the cylinders J J, or other metallic surfaces which are brought into contact with the ores of metals during the process of desulphuration, by coating such surfaces with an enamel, which will not be injured by heat or acted upon by the fumes of sulphur. I propose to employ any of the well-known enameling compounds which will not be liable to crack or split from the effects of heat. Such enamel may be made and applied in the following manner, although I do not desire to be understood as limiting my invention to any particular enamel: The vessel is first cleaned with dilute sulphuric acid, then washed with boiling water. The composition is next applied. This consists of one hundred pounds of calcined ground flints and fifty pounds of borax calcined and finely ground, the mixture to be fused and gradually cooled. Forty pounds of this mixture is then ground with water, with five pounds of potter's clay, into a pasty mass, such as will form a coat of a suitable thickness on the surface of the vessel. This coating is set by putting the vessel in a warm room. The glazing is then applied. This consists of one hundred and twenty-five pounds of white glass, twenty-five pounds of borax, twenty pounds of soda in crystals, all pulverized together and vitrified by fusion, then ground, cooled in water, and dried. To forty-five pounds of this mixture one pound of soda is to be added, the whole mixed in hot water, and when dry pounded. A portion of this powder is sifted finely and evenly over the internal surface of the vessel while the first coating is still moist. The vessel is dried in a stove at the temperature of 212° Fahrenheit, and next heated gradually in a furnace or muffle until the glaze fuses.

I construct the cylinders J J with ribs applied to their inside surface either in a straight or spiral form. If such ribs are not made so as to form a part of their respective cylinders, I enamel them and secure them within the cylinders by means of clamps, as shown in Figs. 6 and 7. The object of the ribs or elevations is to carry the ore to the highest points of the cylinders, and then allow it to fall again, and thus keep the ore in constant motion as it moves toward the discharging ends of the cylinders.

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

Protecting metallic vessels which are used in the process of roasting ores by coating their exposed surfaces with a fire-proof enamel, substantially as described.

Witness my hand in the matter of my application for a patent for treating ores.

ROBT. SPENCER.

Witnesses:

R. T. CAMPBELL,

E. SCHAFER.