UNITED STATES PATENT OFFICE.

GEORGE T. LEWIS, OF PHILADELPHIA, PENNSYLVANIA.

PROCESS OF REDUCING REFRACTORY SILVER AND GOLD BEARING ORES.

SPECIFICATION forming part of Letters Patent No. 343,589, dated June 15, 1886.

Application filed August 3, 1885. Serial No. 173,439. (No specimens.)

To all whom it may concern:

Be it known that I, GEORGE T. LEWIS, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain Improvements in Processes of Reducing Refractory Silver and Gold Bearing Ores, of which the following is a specification.

Certain silver and gold bearing ores containing sulphurets of base metals—such as lead, copper, zinc, &c., and also arsenic, tellurium, antimony, &c.—cannot be smelted by the usual process without a great loss by volatilization of both base and precious metals. Such ores have previously been treated by complicated salt-roasting processes and by amalgamation, whereby most of the base metals are entirely lost. These ores have also been smelted directly in a cupola-furnace; but this method works very poorly with sulphureted ore. To work sulphureted ore by this process, it is necessary, first, to oxidize or roast the ore, which makes the process too expensive when poor ore is treated.

I am aware of Letters Patent No. 212,855, and also of Letters Patent No. 286,025, which present some points of resemblance to the process herein described; but I have found in practice that there is great difficulty in smelting ores containing sulphur and arsenic by that process, and have therefore, after careful experiment, devised the process which I shall now proceed to describe.

My improved process consists in roasting the crushed ore by first mixing it with carbonaceous matter—such as bituminous coal—and exposing this mixture after ignition to a blast of air, preferably hot. This process has great advantages over the ordinary roasting process, in which an oxidizing-flame passes over the ore, and by which process the roasting takes a long time, requires extensive apparatus and much fuel and labor, as it is necessary to turn the charge frequently to expose fresh surfaces to the flame.

In my improved process only a comparatively small furnace is required. The air-blast being blown directly into the mass of ore acts quicker, and labor and fuel amount to but very little, the sulphur in the ore giving nearly enough heat to keep up the temperature required for the roasting.

The furnace required is of the simplest kind. Any furnace-bed with hot blasts entering not more than one or two inches over the surface of the bed and with tuyeres all around the bed will answer; but preferably the furnace should be of the Scotch hearth order, like Rossie's American-Scotch hearth, where the sides and back of the furnace heat the blast. If a water-back Scotch hearth is used, I prefer to heat the blast somewhat before letting it enter the furnace. This furnace I prefer to make about twice the ordinary width, but not any deeper, and with a number of tuyeres, so that the blast can enter in several jets all over the furnace-bed. The box for the lead-well in the Scotch hearth may be made very shallow, the ore and coal is thrown in the fire just as lead ore and coal are thrown on the fire in the lead-smelting process. If the ore contains much lead, part of this will smelt down to the metallic state, but ore poor in lead only roasts and slags together, the semi-melted slag forms a bottom on which the ore is roasted, and this serves the same purpose as the lead bath in lead-smelting, so that the workmen are able to stir the mass thoroughly. In this roasting process a large amount of metallic fumes are formed. These are driven by a fan through a series of cooling flues or pipes, and are then forced into receptacles of textile fabric, preferably in the shape of bags or sacks attached to collars on sheet-iron bins. The gases are filtered through the interstices of the fabric, while the solid particles are arrested in the bags and from time to time are shaken down in the bins, collecting on the bottom until let out upon the floor and set fire to by a taper, the small percentage of soot and sulphur present being sufficient to form a slow combustion in the mass, so that the particles of the metallic fumes cinder together, and are easier handled in the next process than the light bulky deposit from the waste fumes in their raw state. This collecting apparatus is fully shown and described in Letters Patent No. 212,855, granted to me, and I do not here claim it. The mass from the roasting-furnace, together with the deposit from the waste fumes, are now smelted in a cupola-furnace—such as the Rachette furnace—and if there is not lead enough to thoroughly desilverize the ore this may be added in the shape of lead ore, litharge, or granulated lead. Certain basic fluxes should

also be added, as otherwise the slag would be so silicious that much lead, and with it silver and gold, would be lost. These fluxes are generally iron ore and magnesian limestone. By the proper use of these fluxes practically all lead, and with it all silver and gold, smelt down to the metallic state. A large amount of copper forms a matte which runs off with the slag and is separated from this in the usual manner, while the zinc, arsenic, &c., form a part of the slag. In this process there is also some loss in metals by volatilization. This may be avoided by providing the furnace with a catching apparatus similar to that attached to the roasting-furnace, or by drawing these gases into the same apparatus in which the fumes from the roasting-furnace are arrested. Such metallic fumes are collected and condensed, and can be smelted over again.

Having thus described my process, I claim and desire to secure by Letters Patent—

The within-described process of smelting refractory ores of gold and silver, or ores which contain, together with lead or similar base metal, sulphur or arsenic, or both, by roasting such ores in a crushed state intimately mixed with carbon in an open-hearth furnace with the aid of a blast of air, preferably hot, blown directly into the mass of ore; secondly, collecting the waste fumes from this furnace in strainers of textile fabric and smelting the residual roasted mass from the first process, together with the solid matter of the waste fumes and proper basic fluxes, in a low cupola-furnace, and collecting the waste fumes from this process in strainers of textile fabric, as before, the whole being conducted substantially as set forth.

In witness whereof I have hereunto set my hand.

GEORGE T. LEWIS.

Witnesses:

JOHN L. VANDIVER,

H. R. SHULTZ.