

UNITED STATES PATENT OFFICE.

HENRY STULL, OF IONE CITY, CALIFORNIA.

IMPROVEMENT IN THE PROCESSES FOR THE REDUCTION OF COPPER AND OTHER ORES.

Specification forming part of Letters Patent No. **146,031**, dated December 30, 1873; application filed October 13, 1873.

To all whom it may concern:

Be it known that I, HENRY STULL, of Ione City, Amador county, State of California, have invented a Process for the Reduction of Copper and other Ores; and I do hereby declare that the following specification is sufficient to enable any person skilled in the art or science to which it most nearly appertains to use my said invention without further explanation.

The object of my invention is to provide an improved process for the reduction of ores, and it is more especially applicable to that class of copper ores containing sulphur, and which are mixed with iron ores. My invention consists in the use of two chambers, within the lowermost of which the ore is first placed and burned or roasted with a supply of air and steam, by which it is partially decomposed. From this chamber the ore is removed to the upper chamber, above which are tanks containing sulphuric acid. A new charge of ore is placed in the lower chamber, and this is ignited, and the resulting fumes are passed up through the burned charge in the upper chamber, thus completing its decomposition.

In order to carry out my process, the ore is first screened, and the finer parts are laid upon the grating or bottom of the first chamber, which is provided with arches or tubes for the admission of air and steam. A layer of wood is placed upon the fine ore, and coarser ore is placed upon this, after which the whole is ignited, and the sulphur in the ore will be sufficient to continue the combustion until the ore is entirely burned.

After the ore has been removed to the upper chamber and the process is repeated, the additional fumes arising from the burning in the lower chamber will assist in further reducing the ore.

The operation will be as follows: The steam introduced into the roasting-oven with the burning ore will be decomposed by the iron

contained in the ore as a bisulphide, and the iron will be oxidized, thereby liberating the hydrogen. This hydrogen combines with a portion of the air and burns, thus keeping up the heat until all the sulphur is expelled. The copper is also oxidized by the oxygen set free, as above described, and by that contained in the heated air introduced into the oven. The oxides of iron and copper thus formed each take one equivalent of the sulphurous acid formed by the burning sulphur and form sulphites. The ore is then removed to the upper chamber, and a new charge of ore is placed in the oven and ignited, as before. The sulphites previously formed in the oven are then subjected to the sulphurous fumes from the mass below, and are also sprinkled with sulphuric acid, which converts the sulphites of iron and copper (CuO, SO_2 and FeO, SO_2) into sulphates, (CuO, SO_3 and FeO, SO_3 .) The copper is then reduced from its sulphate, after separation from the remaining pulp, by the ordinary iron process, while the sulphurous fumes are carried on with nitrate-of-soda fumes, and converted into sulphuric acid in the ordinary manner.

By this process I am enabled to dispense with much mechanical labor in the reduction of copper ores, and the work is cheaply and effectively done.

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

The process herein described of reducing ore by the use of two chambers, situated one above the other successively, substantially as herein described.

In witness whereof I hereunto set my hand and seal.

HENRY STULL. [L. S.]

Witnesses:

GEO. H. STRONG,

C. M. RICHARDSON.