UNITED STATES PATENT OFFICE.

THOMAS S. HUNT, OF MONTREAL, QUEBEC, CANADA, AND JAMES DOUGLAS, JR., OF PHŒNIXVILLE, PENNSYLVANIA.

EXTRACTING COPPER FROM ORES.

SPECIFICATION forming part of Letters Patent No. 227,902, dated May 25, 1880.

Application filed January 21, 1880.

To all whom it may concern:

Be it known that we, THOMAS STERRY HUNT, an American citizen, residing in the city of Montreal, in the Province of Quebec, and in the Dominion of Canada, and JAMES DOUGLAS, Jr., a British subject, residing in the borough of Phœnixville, in the county of Chester, and in the State of Pennsylvania, have invented a new and useful Improvement in the Art of Extracting Copper from its Ores, for which we desire to obtain Letters Patent.

Many copper-bearing ores and furnace products contain, besides silver and gold, portions of nickel, cobalt, arsenic, antimony, and tin, which are more or less injurious to the quality of the metallic copper got from them by ordinary methods. To effect the separation of the copper from all the various elements named, we propose a new, simple, and economic method, proceeding as follows:

We grind the copper-bearing ore or matter to a suitable fineness, which will differ with different materials. If the material is sulphureted, we then proceed to oxidize it by roasting in a suitable furnace at a low red heat, so as to get as large a proportion as possible of the copper in the state of a soluble sulphate. A little common salt may be added in the roasting-furnace in cases where it is found advantageous to the calcination, but is best omitted if gold or silver is present. We next take a solution of copper, which we may get by dissolving the sulphate of copper by water from a sulphureted ore or matte roasted, as above described, or else by dissolving oxide or carbonate of copper in dilute sulphuric or muriatic acid. When treating sulphureted materials the first is, of course, the most convenient source. If the roasted ore or matte contain silver, a very little common salt, sufficient to chloridize any sulphate of silver, should be added to the water used for the solution. This solution should hold not less than one or two ounces of copper to the gallon, and may be much stronger with advantage. We next add thereto some soluble chloride, such as common salt, at the rate of two (2) pounds of salt to each pound of copper dissolved. Sulphurous-acid gas, best got by burning sulphur or from roasting pyritous ores, is now forced or drawn through the clear solution by means of a suitable pump or blower, when the copper will be rapidly separated as insoluble dichloride of copper. The completion of the process may be known with sufficient accuracy by the change of color in the solution. A complete precipitation is not necessary, since the liquor is to be used over again.

In the reaction which thus takes place between protochloride of copper in solution and sulphurous acid there are formed, besides insoluble dichloride of copper, free chlorhydric or muriatic acid and sulphuric acid, the latter giving rise to bisulphate of soda. The acid liquor thus resulting is now used to dissolve, by the aid of heat, the oxide of copper from any naturally or artificially oxidized material. The charge of this should not contain in the state of oxide more copper than was contained in the original solution. The acid liquor may with advantage be added directly to a roasted ore containing both xide and sulphate of copper. To the clear solution thus obtained must now be added sufficient common salt to chloridize the additional amount of sulphate of copper present, avoiding a considerable excess, and the solution must be again treated with sulphurous acid, as before, when the copper will be thrown down as dichloride, as in the first operation.

The same operation of dissolving the copper and precipitating it by sulphurous acid may be repeated indefinitely with the same solution, and, provided there is added each time a portion of sulphate of copper from roasted ore, the liquid grows continually in acidity and in solvent power, unless the ore should contain considerable quantities of other basic oxides, such as those of zinc and lead. If the liquor, in time, becomes, by many repetitions of the process, too highly charged with free acid and soluble salts, a portion may be rejected after separating, by known chemical methods, a small portion of dissolved copper, together with nickel and cobalt, should these metals be present. The remaining portion of the liquid may be diluted with water and used as before.

The ore or matte thus deprived of its copper may contain, in an insoluble state, besides

the base metals—lead, tin, and antimony—both gold and silver. The latter, being now in a state of chloride, may be extracted from the residue by strong solutions of chloride of sodium or chloride of calcium by hyposulphite solution or by other well-known methods. If gold be also present, both of these metals may be taken out together by the use of chlorinated brine or by mercury.

The dichloride of copper which has been got from the acid liquors is washed with water, and is then free from all foreign metals. It may now be treated in one of two ways: first, by digesting it with metallic iron, such as scrap-iron, by which it is readily reduced to a metallic sponge or cement copper; or, second, it may be decomposed by heating it with the proper quantity of milk of lime, by which it is converted into the red oxide of copper. This may be separated by a convenient filter, pressed and dried in blocks, which, in a reverberatory furnace, are readily reduced to metal.

The chloride of iron or chloride of calcium got by these methods of treatment may be added to the copper solutions in place of common salt, or employed to dissolve chloride of silver, as above suggested.

We do not claim the use of sulphurous acid to attack or dissolve the oxides of copper or other metals, nor yet the production of dichloride of copper by its use; neither do we claim any special modes of treating the dichloride of copper thus obtained.

That which we claim as our invention, and for which we ask Letters Patent, is—

The method herein described of separating copper from its chloride solution and of simultaneously generating hydrochloric and sulphuric acids, which consists in adding to such solution sulphurous acid, whereby dichloride of copper is thrown down in the solid form, to be subsequently reduced to the metallic state, and hydrochloric and sulphuric acids are set free, and in adding the acid liquor so obtained as a solvent to oxidize compounds of copper, whereby chloride of copper is again formed and separated in solution from insoluble metals, and the process of copper extraction and precipitation thus rendered continuous with the same liquors, substantially as described.

THOMAS STERRY HUNT.
JAMES DOUGLAS, JR.

Witnesses:
R. HILL,
F. GRIMSDALE.