

# UNITED STATES PATENT OFFICE.

CYPRIEN MARIE TESSIE DU MOTAY, OF PARIS, FRANCE, AND WILHELM HILLEGEIRT, OF CLAUSTHAL, HANOVER.

IMPROVEMENT IN THE PROCESSES OF TREATING ORES OF COPPER, &c.

Specification forming part of Letters Patent No. 128,026, dated June 18, 1872.

*To all whom it may concern:*

Be it known that we, CYPRIEN MARIE TESSIE DU MOTAY, of Paris, in the Republic of France, and WILHELM HILLEGEIRT, of Clausthal, Hanover, have invented a new process of treating ores of copper, carbonates, oxides, and double or multiple sulphurets, and also mats and black coppers containing or not gold, silver, lead, antimony, and arsenic; and we do hereby declare the following to be a full, clear, and exact description of the same.

It is well known that sulphuric and chlorhydric acids employed singly or together dissolve but little or not at all the sulphurets and the double oxysulphurets of copper and iron containing or not containing gold, silver, lead, antimony, and arsenic.

It has been impossible heretofore to successfully treat these ores in a crude or roasted state either by sulphuric or chlorhydric acid, or by a mixture of these two acids. The solutions of persulphate of iron used alone, cold or warm, to dissolve these ores act very slowly, and for this reason they cannot be successfully employed to melt the copper contained in the complex pyrites containing this metal alone or mixed with gold, silver, lead, antimony, and arsenic.

We have discovered a new dissolvent—positive and economical—of the ores of copper, carbonates, oxides, and double or multiple sulphurets, and also mats and black coppers containing or not containing gold, silver, lead, antimony, and arsenic.

This dissolvent—which has for its object to rapidly dissolve the sulphurets and oxysulphurets, and all other copper ores, roasted or not—is a mixture of persulphate of iron and chlorhydric acid, or, what amounts to the same, a bath of persulphate of iron, through which passes a continuous current of gaseous chlorhydric acid.

The iron, copper, antimony, and arsenic rapidly and entirely dissolve in this compound. The iron, copper, and antimony, dissolved first to a state of chloride, finally return, in yielding their chlorhydric acid, to the state of sulphates, while the arsenic remains in solution in a state of chloride. The other metals, such as silver and lead, are attacked first by the chlorhydric acid, and finally precipitated in

an insoluble state in the form of sulphates. The gold, unattacked, follows them into the residuum insoluble. This residuum, separate from the liquid part, is first roasted and afterward reduced, in the presence of lead, in the cupel. The liquid bath, containing the sulphates of iron, copper, and antimony, and the chloride of arsenic in solution, is evaporated to dryness. During the concentration of the bath a part of the chloride of arsenic volatilizes, while the other part remains in the liquor.

The salts, after evaporation, are recovered by the water; the sulphate of antimony is precipitated to the state of subsulphate of antimony, nearly insoluble; and the chloride of arsenic remaining passes to the state of arsenious acid, likewise not soluble; while only the copper and iron remain dissolved in the liquor.

When, during the evaporation, all the chlorhydric acid has not been expelled, and only the antimony and arsenic are left in a chloride state in the liquor, similar reactions to those before described occur—that is to say, the chlorides of arsenic and antimony recovered by the water after evaporation pass away, the first in a state of arsenious acid, and the second in a state of oxychloride, insoluble. The double sulphates of copper and iron remaining in solution are treated by means of metallic iron, which precipitates the copper by the process of cementation. The protosulphuret of iron remaining is treated, in either a moist or hard state, by the oxygen of the air, or by a mingling of air, chlorine, or nitrous vapors, which brings it to a state of persulphate. The peroxide of hydrated iron remaining insoluble from this operation is separated by decantation and set aside. Subsequently treated, and dissolved by sulphurous-acid liquid in connection with air, it produces sulphate of peroxide of iron, which serves to replace the quantity of sulphate lost in the preceding operations. In this manner the chlorhydric acid displaced by the sulphuric acid is replaced by persulphate of iron, which serves the same purpose as the persulphate in the other operation.

It sometimes occurs that in the double liquid of sulphate of copper and iron a small portion of sulphate of silver remains insoluble. To

precipitate to a metallic state the silver contained in this sulphate we cause the reaction of plates of copper or lead, which adhere to the silver, and which we add to the residuum insoluble before being treated in the cupel.

We claim as our invention—

1. The mingling of persulphate of iron and chlorhydric acid, which constitute a new and positive dissolvent of the ores of copper, carbonates, oxides, and double or multiple sulphurets, likewise mats and black coppers containing or not containing gold, silver, lead, antimony, and arsenic.

2. The reactions above described for obtaining in an insoluble state salts and precious metals contained in copper ores treated by our dissolvent.

3. The separation of the copper in a pure

state and the removal of the antimony and arsenic.

4. The incessant regeneration of persulphate of iron and chlorhydric acid, constituting our dissolving liquor.

5. The employment of persulphate of iron with sulphuric acid in the same manner as we have used chlorhydric acid.

In testimony whereof we have signed our names to this specification before two subscribing witnesses.

C. M. TESSIE DU MOTAY.  
W. HILLEGEIRT.

Witnesses:

J. ARMENGAUD,  
GILBERT VILLENEUVE.