UNITED STATES PATENT OFFICE.

CONSTANTIN JEAN TOSSIZZA, OF PARIS, FRANCE.

ELECTROMETALLURGIC TREATMENT OF ORES OF COPPER OR OTHER METALS.

SPECIFICATION forming part of Letters Patent No. 710,346, dated September 30, 1902.

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To all whom it may concern:

Be it known that I, CONSTANTIN JEAN TOSSIZZA, a citizen of the Republic of France, residing at Paris, France, have invented a new and useful Improvement in Electrometallurgic Treatment of Ores of Copper, &c., of which the following is a specification.

The direct electrolytic treatment with insoluble anodes of the solutions obtained by the action of sulfuric acid on previously-roasted copper ores has heretofore been impracticable, because it required, before all, a complete purification of the solutions obtained in order to free them of all sulfates other than the sulfate of copper. Such a purification being very difficult, the direct electrolytic treatment was for that reason industrially inapplicable.

The present invention has for its object to make possible the said electrolytic treatment without preliminary purification.

A solution of the sulfates from treating copper ores contains besides the sulfate of copper the sulfates of other metals and in particular the sulfate of iron. Among all these sulfates that which is decomposed at the lowest voltage is sulfate of copper. Theoretically, then, by effecting the electrolysis at a voltage sufficiently high to decompose the sulfate of copper and not high enough to decompose the sulfates of iron and other metals a pure electrolytic deposit of copper ought to be obtained; but in working with insoluble anodes incidental phenomena of polarization do not permit the practical realization of the indispensable theoretic condition—to wit, the maintenance of a constant voltage between very restricted limits. The potential at the poles of the electrolytic cell is not slow to rise, and the metallic deposit, which in the first instants of the operation was formed of pure copper, quickly becomes impure and formed almost exclusively of spongy iron. It is necessary, then, in order that the operation may be possible to be able to keep uniform the voltage first established. This result could be obtained by the use of soluble metallic anodes; but in working to avoid the electrolysis of the iron it would be necessary for the said electrodes to be such as by their solution to yield an electromotive force less than that for the decomposition of iron. It would be necessary, then, to use copper electrodes, which would render the system impracticable, because there would be dissolved at the anode exactly the quantity of copper deposited at the cathode. Under these conditions I have thought to use in place of soluble electrodes insoluble anodes kept in contact with sulfurous acid, and thus to utilize the known depolarization properties of the said sulfurous acid. These anodes can be made of carbon, and in this case the sulfurous acid can be introduced outside the anode or in the interior thereof, if the anode is hollow, and it may be in the state of a solution or in the gaseous state.

I have ascertained that the transformation of the sulfurous acid into sulfuric acid at the anode gives rise to an electromotive force which diminishes the necessary voltage and lowers it to two-tenths of a volt. One can thus obtain a very beautiful deposit of pure electrolytic copper directly from an impure solution with a sufficient intensity at a voltage of about six-tenths of a volt, whereas in all processes heretofore known one could only obtain this electrolysis with insoluble anodes at voltages above one and three-tenths volts. Incidentally I may remark that the copper thus obtained being tenacious and ductile is directly laminable or it can be deposited directly in the form of tubes which can be employed in industry.

It results from the preceding that sulfurous acid, which has been considered an objectionable element in metallurgy and which it has been sought to get rid of as much as possible, becomes an auxiliary in electrometallurgy and makes it possible to manufacture metals at voltages inferior to those of their theoretical formation in their direct or indirect electrolysis.

The sulfurous acid introduced into the electrollytic bath is preferably obtained from the preliminary treatment of the ores. Copper and most metals exist in the form of sulfid ores, which when roasted produce oxids and sulfurous acid. The oxids are transformed into sulfids by dissolving them in sulfuric

acid. The sulfurous acid is dissolved in water and the solution introduced into the electrolytic bath.

I claim—

1. The process of treating electrolytically the impure and ferruginous solutions of sulfate of copper obtainable by the solution of copper ores in sulfuric acid, in order to recover the copper electrolytically without special preparation, by proceeding with the electrolytic treatment at a voltage between about two-tenths and eight-tenths of a volt with insoluble anodes maintained in contact with sulfurous acid, substantially as described.

2. In the electrolytic decomposition of the impure solutions obtained by roasting sulfid ores and dissolving the products of such roasting, the process of recovering a metal from said solution without preliminary treatment to remove another metal or other metals present therein, consisting in introducing sulfurous acid from the said roasting operation into the electrolytic bath, while at the same time adjusting the voltage in such manner as to effect the decomposition of the salts of the metal to be recovered and not of the other metals present in said solution, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CONSTANTIN JEAN TOSSIZZA.

Witnesses:
JULES ARMENGAUD, Jr.,
MARCEL ARMENGAUD, Jr.