

## UNITED STATES PATENT OFFICE.

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## PRECIPITATING METALS FROM SOLUTIONS.

SPECIFICATION forming part of Letters Patent No. 756,211, dated April 5, 1904.

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*To all whom it may concern:*

Be it known that I, CHARLES BUTTERS, a citizen of the United States, and a resident of Berkeley, in the county of Alameda and State of California, have invented certain new and useful Improvements in Precipitating Metals from Solutions, of which the following is a specification.

This invention relates to the electrolytic method of precipitating or separating metals from solutions, and more particularly to the precipitation of gold, silver, copper, and other electronegative metals from cyanid solutions.

It is well known that when metals, such as gold and silver, have been dissolved in solutions, such as potassium cyanid, they may again be separated from the solution by a suitable electric current, using an insoluble anode and a suitable surface as a cathode. Also it is well known that when the current is of low density the deposit becomes of a high regular nature, adhering more or less firmly to the cathode-surface, while with a high current density the deposit becomes of a loose powdery or slimy nature and may be easily wiped off the cathode-surface. When the deposit is hard, as formed with a low-density current, considerable difficulty and expense are experienced in removing it from the cathode-surface; but when in a slimy or powdery form the deposit may be brushed or wiped off without difficulty. Anodes of lead peroxid have been found suitable for this purpose and cathodes of iron, aluminium, or lead have been employed; but it has been found that iron rusts and produces a rough surface, which makes it difficult to wipe off the fine slimy deposit. This difficulty was got over by employing aluminium cathodes; but it was found that the aluminium or lead soon became brittle and fell to pieces, especially if mercury was present in the solutions. Now I have found that by employing a cathode of tin or of metal coated with tin, such as tinned iron, these difficulties are obviated, and that if the anode is of lead peroxid it is not acted on by the solution when the current is of the requisite electromotive force to produce the slimy deposit.

In carrying out my invention I prefer to employ sheets of metal coated with tin, such as the so-called "tin plates" of commerce, and I connect these in the cyanid solution with an electric generator to form cathodes, while the anodes are of lead peroxid. The anodes and cathodes are usually placed three inches apart, but may be nearer or farther apart, and the solution containing the metal or metals to be deposited is caused to flow between the electrodes, preferably in an upward or downward direction, at a uniform velocity, while an electric current of high density enters the cathode. In practice about 0.5 ampere per square foot of cathode is found suitable in most cases; but this may be greater or less, as conditions change. The dissolved metals then deposit in a loose slimy form on the tin cathode-surface and may be removed by brushing or wiping the plates with a soft material, such as rubber, wood, and the like. This may be conveniently done by removing the cathodes from the solution when the deposit is sufficiently thick or, as usually, by running a wiper over the plates at intervals of, say, once a day while in position in the solution and allowing the removed slime to settle to the bottom of the vessel. This slimy deposit is removed from the vessel at regular periods, and the metals are separated and refined in the usual way.

The apparatus as ordinarily employed in the electrolytic process of precipitating in the cyanid-of-gold extraction and the usual method of procedure is particularly suitable for this invention.

To obtain the most suitable current density at the cathode, the voltage of the electric current is made to vary with the conductivity of the solution and the most suitable current is found by gradually increasing or decreasing the electromotive force until the metal deposits just loosely enough to be wiped off easily. What I call a "high-density electric current" is that current which deposits the metal in this loose form.

What I claim, and desire to secure by Letters Patent, is—

1. The improvement in the process of precipitating metals from solutions, chiefly cyanid

solutions, which consists in employing cathodes having surfaces of tin and a high-density electric current, substantially as described.

2. The improvement in the process of precipitating metals from solutions which consists in employing cathodes having surfaces of tin in combination with anodes of lead peroxid and a high-density electric current, substantially as described.

10 3. The improvement in the process of the electrolytic separation of metals from solu-

tions which consists in using a cathode having smooth surfaces of tin, substantially as described.

In testimony whereof I have hereunto set my hand, at the city of New York, in the State of New York, this 1st day of October, 1902.

CHAS. BUTTERS.

In presence of—

JOHN S. SEYMOUR,  
JOHN J. RANAGAN.