

UNITED STATES PATENT OFFICE

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TREATMENT OF GOLD AND SILVER

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This invention relates in the first place to a method of bringing gold and silver into solution to provide liquors for electrolytic processes, such as the refining of the metal by electrolysis, or its deposition in electrolytic gilding and silvering or gold and silver plating, or for other methods of gilding and silvering such as the dipping, boiling, contact and rubbing processes, or for the manufacture of gold and silver salts.

The method consists in acting upon the metal with iodine in solution in, or in the presence of, a solvent for the iodide of the metal.

More specifically the invention consists in acting upon gold and silver with iodine dissolved in a solution of oxygen-free iodine compound of the alkali or alkaline earth metals, with or without an addition of the soluble chlorides or bromides of the alkali or alkaline earth metals.

A further development of the invention is a method of electrolysis of gold and silver, for example for the purpose of refining, in which the electrolyte employed is a solution of an oxygen-free iodine compound of the metal in an iodide of an alkali or alkaline earth metal.

Yet other developments of the invention are solutions for gilding or silvering by dipping and other non-electrolytic processes, and cleaning pastes for rubbing processes of gilding or silvering.

A typical example of the invention consists in the solution of gold and silver in the treatment of gold ores, or in dissolved commercial gold and silver for the purpose of further purification or for electrolytic work. In the latter case the metal should preferably be in the form of gold leaf or silver powder to accelerate solution.

A solution of 20 gms. of iodine in 110 gms. of potassium iodide dissolved in 1,000 c. c. of water will, if thoroughly stirred, dissolve 10 gms. of gold leaf.

Such a solution, unlike the usual solution of gold cyanide, is odourless, keeps well, and is not poisonous. Because of its keeping qualities the solution can be regenerated by the introduction of fresh gold or gold compounds when as the result of electrolytic deposition or use as a gilding bath or the like its gold content has fallen below the limit practically allowable for metal deposition. This regeneration is a simple operation not needing expert supervision. Consequently a solution prepared according to the invention can at any time be restored to full strength, whereas a nearly exhausted cyanide bath has little or no solvent power for fresh gold on account of incipient decomposition of the cyanogen salts and must either be employed in its weakened state to use up the last remnant of gold or subjected to costly processes for the recovery of the gold.

A bath of the above stated composition is specially suitable for use with gold anodes in electrolytic gilding or in gold refining.

In gilding by, for instance, dipping, boiling or contact processes without the use of electric current it has been found desirable to dilute the above given solution by addition of potassium iodide solution so as to get directly a brilliant gold coating for instance, on silver. For example the solution above given may advantageously be diluted with 10% aqueous solution of potassium iodide to one third of its gold content.

The potassium iodide in the solutions may in part be replaced by soluble chlorides or bromides, for instance of the alkali or alkaline earth metals.

Thus a solution of 20 gms. of iodine in a solution of 60 gms. of potassium iodide and 60 gms. of potassium bromide and 1000 c. c. of water; or

20 gms. of iodine in 75 gms. of potassium iodide and 75 gms. of sodium chloride and 1000 c. c. of water; or

20 gms. of iodine in 75 gms. of potassium

iodide and 90 gms. of calcium bromide and 1000 c. c. water will with intensive stirring dissolve about 10 gms. of gold leaf. Such solutions will also dissolve about 10 gms. of silver.

In the case of silver 15 gms. of iodine in a solution of 120 gms. of potassium iodide in 1,000 c. c. of water will, when thoroughly stirred, dissolve 10 gms. of the metal.

Such a bath is specially suited for refining crude silver and for electro-plating with soluble silver anodes as described below.

For silvering, for instance on copper, by the dipping, boiling or contact process without electric current the content of potassium iodide must be increased to give a brilliant silver coating. If there is too little potassium iodide in the solution, silver iodide and copper iodide deposit upon the object which is dipped as well as silver.

For the purpose of gliding or silvering by the rubbing process, suitable cleaning preparations such as Vienna lime or the like may be added to the gold or silver solution to produce a cleaning paste.

Gold and silver solutions produced according to the present process can also be used to advantage in the gilding and silvering of porcelain since upon burning all the constituents of the solution except the gold and silver vaporize.

For electrolysis, solutions prepared according to the present invention enable a considerable saving of current. For the gold is present in the iodide as a monovalent ion, and hence only one third as much current is needed to deposit a given weight of gold as is required in the case of chloride solutions in which the gold is usually a trivalent ion. Moreover the electrolytic action does not produce poisonous gases, as happens in the electrolysis of cyanide compounds, nor is the electrolyte liable to deterioration through oxidation at the anode even if it be vigorously stirred. Any iodine that may be formed during an electrolytic process employing insoluble anodes is immediately dissolved in the excess of potassium iodide, or may in part form additive compounds with the metal iodide. When soluble electrodes are employed, solution proceeds steadily, and both at the anode and cathode the process is quantitative, so that the gold content of the electrolyte remains constant.

In the case of silver electrolysis an electrolyte composed according to the present invention of a solution of oxygen-free iodine compound has the advantage that the silver is deposited in a smooth adherent layer, and not in crystalline form as happens when silver nitrate is the electrolyte. It has the same advantages over cyanide electrolytes as are explained above.

The new electrolytes are of value both in refining the crude metal and also in electro-

plating. For electrolytic separation of gold according to the present invention a bath of the following composition has been found suitable:—

Water 1000 c. c.

Iodide of gold (AuI) 21 gms.

Potassium iodide (KI) 140 gms.

and for electrolytic separation of silver a bath of the following composition:—

Water 1000 c. c.

Iodide of silver (AgI) 40 gms.

Potassium iodide (KI) 370 gms.

In these baths an E. M. F. of about 0.1 to 0.3 volts is employed and a current density of about 100 amperes per square meter; while in existing processes as a rule current densities of no more than 25 amperes per square meter can be allowed if the quality of the deposit is not to deteriorate.

What I claim is:—

1. An electrolytic method of producing gold and silver which consists in electrolyzing a solution of iodide of the metal in an alkali iodide admixed with another oxygen-free halogenide.

2. An electrolytic method of preparing gold and silver in which solutions of iodides of the metals are employed as electrolytes.

3. A method of preparing gold and silver which consists in forming an oxygen-free iodine compound of the metal, dissolving said compound in a solution of oxygen-free salts, of alkali or alkaline earth metals, and electrolyzing said solution.

4. An electrolyte for the electrolytic separation of gold and silver consisting of a solution of the metal iodide in alkali iodide.

5. A method of refining gold and silver which consists in electrolytically dissolving the same in and depositing it from a solution of its iodide.

6. A method of refining gold and silver which consists in electrolytically dissolving the same in and depositing it from a solution containing only iodine anions.

7. A method of electrolytically depositing gold and silver which consists in passing an electric current through a solution of an oxygen-free iodine compound of the metal containing only iodine anions.

In testimony whereof I have signed my name to this specification.

MAX SCHLÖTTER.