

UNITED STATES PATENT OFFICE

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METHOD FOR REVITALIZING CHROMIUM-PLATING SOLUTIONS

No Drawing.

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My invention relates to the electrolytes or solutions utilized in the electro-deposition of chromium and more particularly to a process for indefinitely extending the time that such solutions are effective in service.

The principal object of this invention is to provide a method for revitalizing the baths or electrolytes commonly used in chromium electro-plating processes which have become deficient in service because of the formation of an excessive amount of chromium compounds in which chromium is present in the trivalent form.

Another and more specific object of my invention is to provide a method for oxidizing the chromic chromate, which gradually forms during electrolysis in electrolytes composed essentially of chromic acid and chromic sulfate and which is deleterious because it has the tendency to prevent the chromium from changing from the hexavalent form in which it is present in chromic acid to the trivalent and divalent forms in which it is present in chromic and chromous sulphate, respectively, and through which it must pass before being finally deposited as metallic chromium.

The electrolyte or bath most commonly employed in the electro-deposition of chromium consists essentially of an aqueous solution of chromium trioxide and chromic sulphate in the proportions of about 250 grams of chromium trioxide, 3 to 5 grams of chromic sulphate, and 1 liter of water. It is customary to use commercial chromium trioxide, which generally contains a small amount of chromic sulphate, and to add sufficient additional chromic sulphate so that the solution will have approximately the proportions specified. The cathode employed in the electrolysis of such a bath consists of the article that it is desired to plate, while the anode usually consists of some metal, such as lead or iron.

Solutions of the above-specified type find extensive use in the electro-plating industry, but it has been found that the duration or life of such electrolytes is limited to a comparatively short period, say from 2 to 3 months. In the process of electro-plating from such

solutions, chromium is deposited upon the cathode, with the evolution of hydrogen at the cathode and oxygen at the anode, the bath being replenished, as required, by the addition of a suitable solution of chromic acid.

The sulphate ions in the bath remain practically constant, and the theoretical assumption is that the chromium passes from the hexavalent form, in which it is present in chromic acid, through the trivalent form, in which it is present in chromic sulphate, before it is finally deposited as metallic chromium. Since chromium and chromate ions are both present in the solution, they have the tendency, during the electro-plating process, to form chromic chromate, in which compound chromium is also present in the trivalent form. This produces an excess of trivalent chromium in the solution, which not only increases the resistance of the bath during electrolysis but prevents the chromium from passing from the hexavalent form through the trivalent and divalent forms, thus gradually diminishing the amount of metallic chromium that is deposited upon the cathode and rendering the bath unprofitable for further use.

I have made the discovery that electrolytes of the type specified which have become deficient in service, may be revived and rendered suitable for further use by a very simple electrolyzing process. The container, in which the electro-plating of chromium is practiced, usually consists of a lead-lined wooden vessel and, in practicing my invention, the lead-lining may be used as the anode and a narrow strip of lead may be used as the cathode. A current is passed through the solution and, as the cathode is comparatively small in proportion to the anode, there will be a high current density, say from 3 to 5 amperes per square inch at the cathode, and a low current density, say from .1 to .3 amperes per square inch at the anode. The chromate ions passing to the lead anode will oxidize the lead-lined vessel to lead peroxide which, in turn, will oxidize the trivalent chromium in the bath existing in the form of chromic chromate to the hexavalent form in which it is present in chromic acid. The electromotive

force required to maintain a current through the solution is from 4 to 6 volts.

The time necessary to pass the electrolyzing current through the bath will, of course, depend upon the amount of chromic chromate that has formed in the solution. A solution of the type specified that had become unsatisfactory for further use, because of the formation of an excessive amount of chromic chromate, was completely revitalized in from 3 to 4 hours.

While I have described a specific form of my invention, various modifications will occur to those skilled in the art without departing from the spirit or scope of my invention as defined in the appended claims.

I claim as my invention:

1. The process of revitalizing electrolytes that have been used in the electro-plating of chromium which comprises passing a current through a solution containing chromic chromate, the electrodes being of such proportions that the cathode will have a current density of between 3 and 5 amperes per square inch and the anode will have a current density at or substantially below .3 amperes per square inch.

2. The process of revitalizing electrolytes that have been used in the electro-plating of chromium which consists in passing a current through a circuit comprising a comparatively small cathode, a comparatively large anode and a solution containing chromic acid, chromic sulphate and chromic chromate, the electrodes being of such proportions that the cathode will have a current density of from 3 to 5 amperes per square inch and the anode will have a current density of from .1 to .3 amperes per square inch.

3. The process of electrolyzing baths that have been employed in chromium plating processes which comprises passing a current through a bath provided with a comparatively small metallic cathode and a comparatively large lead anode, the proportions of the electrodes being such that a current density of 3 to 5 amperes per square inch will be maintained during electrolysis at the cathode while a current density of from .1 to .3 amperes per square inch is maintained at the anode.

4. The process of revitalizing electrolytes that have been utilized in the electro-plating of chromium and have become deficient in throwing power because of formation of an excessive amount of compounds of chromium in which chromium has a valency of three, which comprises passing a current through the electrolyte in conjunction with electrodes having different current densities, the current density at the cathode being substantially in excess of two times the current density at the anode.

5. The process of revitalizing electrolytes that have been utilized in the electroplating

of chromium and which have become deficient in throwing power because of the formation of an excessive amount of compounds of chromium in which chromium has a valency of three, which comprises passing a current through the electrolyte in conjunction with a metallic cathode and a lead anode, the current density at the cathode being approximately from ten to fifty times as great as the current density at the anode.

In testimony whereof, I have hereunto subscribed my name this 6th day of October, 1927.

THOMAS P. THOMAS.