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CHROMIUM STRIPPING BATH

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This invention relates to a method of stripping chromium plating, and particularly the electrolytic chromium deposit upon a nickel-plated surface.

It is a well recognized fact that chromium plating is difficult of performance, due to the well known difficulty in throwing chromium. The result is that there is a large amount of scrap chromium plated articles. These articles that have not been properly plated have to be plated over again. It has been customary to use a caustic soda solution bath in doing this stripping, but it has been uniformly found necessary after the stripping to in some way work the nickel surface underneath, as by buffing, in order to prepare it for again receiving a deposit of chromium. In short, the nickel-plated surface is passive, and this I believe is due to the presence on the nickel surface of an invisible oxide formed by the alkali chromate ion, CrO_4. At any rate, the surface after such a stripping action is substantially passive, and if it does receive any deposit of chromium this chromium is quite likely to peel off.

It is the object of my discovery to provide a stripping bath which will successfully remove the chromium and will not render the under surface passive to a second deposit of chromium. This I accomplish by using a conducting acid aqueous solution which has the characteristic of reducing the chromic acid formed to a trivalent chromium. This prevents the forming of the alkali chromate ions which I believe to be the cause of the passiveness of the under surface.

I find that substantially any of the organic acids which is a good electric conductor, and which is formed of hydrogen, carbon, and oxygen, and which is capable of reducing the CrO_3, the hexavalent form of chromium, to a trivalent form, will answer the purpose. I find that oxalic acid, tartaric acid, and citric acid are most useful in this connection. For instance, with oxalic acid I preferably use an aqueous solution of 60–120 grams per liter of water. The temperature range should be from 77 to 85 degrees Fahrenheit; voltage, 12 volts in full load, using the article to be stripped as the anode. The chromium then dissolves in its hexavalent state as chromic acid, and is then immediately reduced to the trivalent form by the oxalic acid, and thus the nickel plate is not rendered passive by the hexavalent chromium ion. The reaction is as follows: At the anode $Cr+3O=CrO_3$, chromic acid; using oxalic acid, $H_2C_2O_4$, we have the reaction:

$$2CrO_3 \text{ (hexavalent)} + 6H_2C_2O_4 = Cr_2(C_2O_4)3 + 6CO_2 + 6H_2O.$$

Using tartaric acid, $C_4H_6O_6$, the reaction is as follows:

$$2CrO_3 \text{ (hexavalent)} + 2C_4H_6O_6 = 2Cr{+}{+}{+} \text{ (trivalent)} + 4H_2CO_2 + 4CO_2 + 2H_2O.$$

Using citric acid, $H_3C_6H_5O_7$, the reaction is as follows:

$$6H_3C_6H_5O_7 + 2CrO_3 \text{ (hexavalent)} = 2Cr{+}{+}{+} \text{ (trivalent)} + 6CO_2 + 6H_2O + 6(CH_2)2CO(CO_2H)2.$$

Oxalic acid is cheaper than citric or tartaric acid, and also a better conductor of electricity.

I might add that hydrochloric acid has been used in stripping, but this attacks the base metal, such as die-cast metal, and it is also much slower than oxalic acid.

What I claim is:

1. An electrolytic bath for stripping chromium plated articles by placing the article at the anode, comprising an aqueous solution of an organic electrolytic acidic reducing agent.

2. An electrolytic bath for stripping chromium plated articles, with the article acting as the anode of the bath, which bath comprises an aqueous solution of an organic acid capable of reducing chromium from the hexavalent to the trivalent form, and forming a good conductor of electricity, said solution being a constituent of a class consisting of oxalic acid, tartaric acid, and citric acid.

3. An electrolytic bath for stripping chromium plated articles, with the article as an anode, comprising an aqueous solution of oxalic acid.

4. An electrolytic bath for stripping chromium plated articles, with the article acting as an anode, comprising an aqueous solution of oxalic acid of from 60–120 grams of the acid per liter of water, and with a temperature range of from 77 degrees Fahrenheit

to 85 degrees Fahrenheit, and with a voltage of approximately 12 volts.

5. An electrolytic bath for anodically stripping a chromium plated article, comprising an aqueous solution of a substantial quantity of an organic acid electrolyte that is substantially passive to the base metal of the said chromium plated article.

In testimony whereof I have affixed my signature.

JOHN F. McCULLOUGH.