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METHOD OF PREPARING CHROMIUM-PLATED FERROUS ARTICLES

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The desirable characteristics of electrically deposited chromium metal are well known. The chromium coating is extremely hard and resists abrasion very well; it has a pleasing blue-white color and is capable of taking and retaining a high polish; it resists the corrosive action of the atmosphere, sea-water, and many acids, including the common food acids; and it resists oxidation even at high temperatures. This combination of desirable properties renders it particularly suitable for coating a great variety of commercial products, and more particularly articles of iron or steel.

Thin, adherent coatings of chromium can readily be deposited upon clean surfaces of iron or steel; but investigation has shown that these coatings as heretofore prepared, are not continuous over considerable areas, but present defects of the nature of minute unplated areas, or so-called pin holes, where the underlying metal is subject to attack. This difficulty has been partially overcome in the past by preliminarily coating the iron or steel with copper or nickel, which may increase the total protective effect, even though it does not very greatly improve the continuity of the chromium film.

I have made the surprising discovery that continuous or practically continuous films of chromium metal may be electrolytically deposited directly upon iron, steel or other ferrous metal (such as predominantly ferrous alloy steels) provided the ferrous metal is preliminarily subjected to a suitable heat-treatment, followed by an adequate cleaning of its surface.

Following is a preferred method of carrying out the invention, which is not however limited to the particular manipulations and operating conditions recited by way of example:

The ferrous article to be plated, for example in the form of a sheet or if desired of a fashioned implement or article, is first heated to dull redness, and permitted to cool, preferably slowly. The surfaces are then thoroughly cleaned by suitable chemical or mechanical methods or combinations of these. The cleaning method which I now prefer is as follows, although it forms no part of the present invention:

The heat-treated article is immersed in a hot solution of hydrochloric acid, for example 20% HCl at 85° C., until all oxid is removed, after which it is immersed in a hot solution of caustic soda. The article is then connected as the cathode in a 10% solution of sulfuric acid and subjected to a high current density, say 150 amperes per square foot for five minutes. It is immediately transferred to a suitable chromium-plating bath and plated under standard conditions. I prefer to employ a bath consisting of an aqueous solution of chromic acid containing a relatively small proportion of chromic sulfate, although any other suitable plating solution may be used.

Articles prepared as above will be found quite free from pin holes and like defects, even when the chromium coating is extremely thin, or of the "flash" type. Naturally, the perfection of the coating is dependent upon the care with which the several operations are carried out; and with sufficient care coatings which are absolutely continuous may be applied over large areas. So far as I am aware, such continuous or practically continuous coatings of chromium have not heretofore been secured directly upon ferrous metal surfaces.

I claim:

1. In the art of electrodepositing chromium on iron, steel and predominantly ferrous alloys, that improvement which comprises heating the aforesaid material of ferrous character to a dull redness, thereupon cooling the heated material, and immediately cleaning the surface of the cool material.

2. In the art of electrodepositing chromium on iron, steel and predominantly ferrous alloys that improvement, which comprises heating the material of ferrous character to a dull redness, slowly cooling the heated material, immediately cleaning the cool material with warm dilute hydrochloric acid until the surface film on said material is removed, then subjecting said material to the action of hot caustic soda solution and finally electrolytically cleaning the thus treated ma-

terial in a dilute sulphuric acid medium under the action of an electric current of a character sufficient to give a high current density.

3. The method of electrodepositing continuous platings of chromium on iron, steel and predominantly ferrous alloys, which comprises heating the aforesaid material of ferrous character to a dull redness, thereupon cooling the heated material, and immediately electrodepositing chromium on the freshly cleaned surface of the material whereby a practically continuous plating of chromium is made on the material.

4. The method of electrodepositing continuous platings of chromium on iron, steel and predominantly ferrous alloys, which comprises heating the material of ferrous character to a dull redness, slowly cooling the heated material, immediately cleaning the cool material with warm dilute hydrochloric acid until the surface film on said material is removed, then subjecting said material to the action of hot caustic soda solution, finally electrolytically cleaning the thus treated material in a dilute sulphuric acid medium under the action of an electric current of a character sufficient to give a high current density and immediately thereafter electrodepositing chromium on the freshly cleaned surface of the material whereby a practically continuous plating of chromium is made on the material.

In testimony whereof, I affix my signature.

VINCENT M. VERTUCCI.