United States Patent Office 2,855,348 Patented Oct. 7, 1958

2,855,348

CHROMIUM PLATING

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No Drawing. Application August 25, 1955
Serial No. 530,640

6 Claims. (Cl. 204—29)

The invention relates to chromium plating, and is more particularly concerned with the conditioning or special preparation of an object of zinc or lead or their respective alloys to provide a direct and tightly adherent bond between the deposit of chromium and the zinc or lead object.

Various methods have been proposed for plating articles of zinc or lead or their alloys with chromium. These metals have been initially plated with one or more metals, other than chromium, prior to plating with chromium to obtain adequate adherence of the chromium deposit. Zinc and lead objects have been subjected to the action of etching solutions prior to plating with chromium. Such methods have generally required the deposition of chromium from solutions of special composition, and/or uncommon relationships of temperature, current density and cathode to anode ratios. Even so, the zinc or lead object has been plated with a metal such as nickel prior to chromium plating.

The main object of the present invention is to condition the surface of objects of zinc or lead or their alloys to permit the direct plating with chromium in a manner which will furnish a strongly adherent bond between the chromium deposit and the underlying zinc or lead. After conditioning the base metal in accordance with my invention, the chromium deposit is so strongly adherent that it will not peel or flake, though subjected to severe mechanical distortion.

Another object of the invention is to condition the zinc or lead object in a manner which will permit the direct deposition of hard, dense, malleable chromium from standard hard chromium plating baths to furnish a deposit suitable for the rigid applications encountered in engineering use.

The invention contemplates preliminarily treating objects of commercially pure zinc, zinc base alloy die castings or any alloy of zinc, prior to chromium plating. The invention is also applicable to commercially pure lead and lead alloys, such as type metal which contains lead, tin and antimony. The terms "zinc" and "lead" as hereinafter used in the specifications and claims is intended to include both the commercially pure metals and alloys of these metals which are predominantly zinc or lead.

Other objects and advantages of my invention will be apparent from the following detailed description.

In accordance with my invention, the zinc or lead object is first degreased and cleaned by any suitable or conventional practices. The object may be degreased in trichloroethylene or perchloroethylene, and after degreasing may be cleaned in a hot caustic soda solution, and then rinsed in cold water.

To condition the zinc or lead object for the direct deposition of an adherent chromium plate, the object is subjected to treatment, as by immersion, in a solution comprising chromic acid, phosphoric acid and hydrochloric acid. The conditioning solution preferably contains substantially equal amounts of phosphoric acid and hydrochloric acid. The solution is prepared by dissolving approximately 40 ounces of chromic acid in approximately 1000 cc. of phosphoric acid. Suitable ranges of chromic acid and phosphoric acid are 36 to 44 ounces of the former and 800 to 1200 cc. of the latter. Orthophosphoric acid, having a concentration of 85%, is preferred. The chromic acid is thoroughly stirred into the phosphoric acid. Thereafter, hydrochloric acid is very slowly added to the chromic acid-phosphoric acid solution. The hydrochloric acid may be of any suitable concentration. It is preferred to use approximately 900 cc. of concentrated or 36% hydrochloric acid. A suitable range is 700 to 1100 cc. Great caution must be exercised in adding the hydrochloric acid to the chromic acid-phosphoric acid mixture for the reaction is extremely violent. After adding the hydrochloric acid very slowly, the solution is allowed to stand for at least 24 hours under a hood. The fumes are highly toxic.

The above-described solution may be subjected to an electrolytic "cook" for a period of four (4) hours under a voltage of four (4) volts.

A zinc or lead object is immersed in the chromic acid-phosphoric acid-hydrochloric acid solution described above without any current being applied. In two (2) minutes or slightly longer, gassing occurs and the object turns a pale yellowish color. The object is then removed and thoroughly rinsed in cold water, and is now ready for placement in the chromium plating tank.

A zinc or lead object conditioned in the manner above-described may be plated directly with chromium in any suitable commercial chromium plating bath. To best realize the advantages of my invention, it is preferred to deposit a hard, dense, malleable deposit of chromium suitable for engineering use. A chromium plating bath which has been found to be particularly suitable is one containing 33 ounces per gallon of chromic acid and 0.33 ounce of sulphate in the form of sulphuric acid. The bath is maintained at a temperature of approximately 132° F. and a current density of approximately 3 amps./sq. in. is used. It is preferred to put the zinc or lead object in the bath for 10 to 15 seconds with the current off before beginning plating.

Another standard hard chromium plating bath which is suitable is a 54 ounce per gallon solution with the temperature and current density conditions described in ASTM standard, designation B 177–49.

Zinc or lead objects conditioned for plating and plated in the manner above-described provide hard, dense and malleable chromium deposits which will not flake or peel. The chromium deposit is so tightly adherent to the underlying zinc or lead that the object may be severely distorted by bending or hammering without breaking away of the plate.

It is believed that the novel conditioning solution, and method of conditioning and chromium plating of zinc and lead, as well as the advantages thereof, will be apparent from the foregoing detailed description, and it will also be apparent that while the invention has been described in its preferred form, changes may be made without departing from the spirit and scope of the invention as sought to be defined in the following claims.

I claim:

1. A method of chromium plating a metal object selected from the group consisting of zinc and lead comprising treating the object with a solution consisting essentially of chromic acid, phosphoric acid and hydrochloric acid in the proportions of approximately 36 to 44 ounces of chromic acid, 800 to 1200 cc. of 85% orthophosphoric acid and 700 to 1100 cc. of concentrated hydrochloric acid, rinsing, placing the object in a chromium electroplating bath, and electroplating with chromium.

2. A method of chromium plating a metal object selected from the group consisting of zinc and lead comprising treating the object with a solution consisting essentially of chromic acid, phosphoric acid and hydrochloric acid in the proportion of approximately 40 ounces of chromic acid, 1000 cc. of 85% orthophosphoric acid and 900 cc. of concentrated hydrochloric acid, rinsing, placing the object in a chromium electroplating bath, and electroplating with chromium.

3. A method of chromium plating a metal object selected from the group consisting of zinc and lead compring treating the object with a solution consisting essentially of chromic acid, phosphoric acid and hydrochloric acid in the proportions of approximately 36 to 44 ounces of chromic acid, 800 to 1200 cc. of 85% orthophosphoric acid and 700 to 1100 cc. of concentrated hydrochloric acid for a period of not less than two (2) minutes, rinsing, placing the object in a chromium electroplating bath for a short period with the current off, and electroplating with chromium.

4. A method of plating a metal object selected from the group consisting of zinc and lead with hard, dense, malleable chromium from a standard hard chromium plating bath comprising treating the object with a solution consisting essentially of chromic acid, phosphoric acid and hydrochloric acid in the proportions of approximately 36 to 44 ounces of chromic acid, 800 to 1200 cc. of 85% orthophosphoric acid and 700 to 1100 cc. of concentrated hydrochloric acid for a period of not less than two (2) minutes, rinsing, placing the object in a standard hard chromium electroplating bath for a short period with the current off, and electroplating with chromium.

5. A solution for preparing a metal object selected from the group consisting of zinc and lead for direct plating with chromium, said solution consisting essentially of chromic acid, phosphoric acid, and hydrochloric acid in the proportions of approximately 36 to 44 ounces of chromic acid, 800 to 1200 cc. of 85% orthophosphoric acid and 700 to 1100 cc. of concentrated hydrochloric acid.

6. A solution for preparing a metal object selected from the group consisting of zinc and lead for direct plating with chromium, said solution consisting essentially of chromic acid, phosphoric acid, and hydrochloric acid in the proportions of approximately 40 ounces of chromic acid, 1000 cc. of 85% orthophosphoric acid and 900 cc. of concentrated hydrochloric acid.

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