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BRIGHTENING AND PASSIVATING SOLUTION

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The present invention relates to a solution for brightening and passivating the surfaces of articles made of, or plated with, zinc or cadmium. The solution made in accordance with this invention is also of value for brightening and passivating certain alloys whose principal constituent is zinc or cadmium.

Zinc or cadmium surfaces, but particularly zinc surfaces, become corroded in a relatively short time in ordinary atmospheres and when the atmosphere contains salt, as it does near the sea coast, the corrosion is quite severe. As the corrosion progresses, the surface becomes covered with a gray powder and roughens to a considerable extent. It is obvious that this is quite objectionable when the surface is on a moving part which was originally made to close tolerances and that in any event such a rough, powdery surface is unsightly.

To avoid the above objections it is common practice to provide a protective film over the zinc or cadmium surface and one of the known methods of providing the film is to dip the article into a solution consisting of chromic acid and various other ingredients.

The passivating solutions used prior to the present invention have all been open to certain objections. The best of them leave a film which is iridescent and unmetallic in appearance.

It is an object of the present invention to provide an improved solution for coating zinc or cadmium surfaced articles which will brighten or polish the surface and will cause a protective film to be formed thereupon, which film will protect the surface from corrosion without appreciably altering the normal metallic appearance thereof.

It is a further object of the present invention to provide a solution which not only passivates, or renders inactive, zinc or cadmium surfaces but which will in the same operation give a bright etch or mirror like finish to the surface.

Other and further objects of the invention will be come apparent as the description proceeds.

In general, the brightening and passivating solution of the present invention consists of chromic acid, sulphuric acid, nitric acid, orthophosphoric acid and water. However the essence of this invention resides in the proportional amounts of each ingredient employed in the solution.

Passivating solutions consisting of aqueous solutions of chromic and sulphuric acids have been used, and in some instances nitric or acetic acid has been added to the solution. While some of

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these solutions are satisfactory insofar as brightening and passivating the surface are concerned, they leave a yellowish film on the surface which is iridescent in nature and which varies in shades from light yellow to bronze or even to brown. The amount of color can be reduced by subjecting the article to a dip in a second bath consisting of an aqueous solution of sodium hydroxide or other alkaline solution. Of course this second dip makes the process more expensive. Also even repeated dips in the alkaline solution will either leave an iridescent film or remove the film entirely, in which event the protection desired will be lost.

I have found that the addition of orthophosphoric acid, within certain limits, slows the reaction of the other acids upon the zinc or cadmium surface by building up on the surface a thin layer of comparatively insoluble salts. As a result, the reaction with the metal surface is controlled, or slowed down, to prevent the formation of highly colored or iridescent films. As a further result a bright, and relatively colorless film is produced, which is resistant to finger staining and resistant to corrosion.

For the most satisfactory results, the amount of orthophosphoric acid should be kept within a range of 25% to 66% of the sulphuric acid present in the solution.

The preferred solution made in accordance with this invention is as follows:

Chromic acid	gms.	100
Concentrated sulphuric acid	gms.	6.16
Ortho-phosphoric acid	gms.	2.9
Nitric acid	gms.	7–70

Water to make 1 liter.

Substantially good results have been obtained from solutions containing from 6 to 12 grams of sulphuric acid per 100 gms. of chromic acid and a quantity of ortho-phosphoric acid sufficient to maintain the ortho-phosphoric-sulphuric acid ratio above set out.

The concentration of the chromic acid may vary between 50 and 300 gms. per liter of solution without appreciable ill effect on the film provided that the 25–66% ortho-phosphoric-sulphuric acid ratio is maintained. For best results the percentage of ortho-phosphoric acid to sulphuric acid should be increased within the range set forth as the amount of chromic acid is increased.

The thin protective film of this invention will have a slight amount of color but appreciably less than is the case when other solutions are employed.

When the article is removed from the brightening and passivating solution it is subjected to a rinse of plain water to remove any of the unreacted materials and then dried in an air blast. In commercial practice there will usually be a time lag of several seconds between removal of the article from the solution and the rinsing operation. During this time the article may become streaked if the nitric acid is not employed in the solution.

Since the only function of the nitric acid is to prevent streaking between the time the article is removed from the brightening and passivating solution and the time that it is rinsed, the amount of nitric acid employed is not critical and for that reason rather wide limits are set forth in the preferred formula. It is not known whether the nitric acid causes a re-oxidation of some of the trivalent chromium or whether some other reaction is involved but in any event a more uniform color is obtained and no streaking occurs.

Having thus described my invention, I claim:

1. A solution for use in brightening and passivating the surface of zinc or cadmium articles consisting of an aqueous solution composed of

50 to 300 grams of chromic acid per liter of solution, 3 to 24 grams of sulphuric acid per liter of solution, 25 to 66% as much ortho-phosphoric acid as sulphuric acid, and sufficient nitric acid to prevent the surface from streaking.

2. A solution for use in brightening and passivating the surface of zinc or cadmium articles consisting of an aqueous solution composed of approximately 100 grams of chromic acid, 6.16 grams of sulphuric acid, 2.9 grams of ortho-phosphoric acid, and 7 to 70 grams of nitric acid, all amounts stated being per liter of solution.

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