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METHOD OF PREPARING FERROUS METAL OBJECTS FOR THE APPLICATION OF SYNTHETIC RESINS

Charles Henry Hempel, Manitowoc, Wis., assignor to Heresite & Chemical Company, a corporation of Wisconsin

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8 Claims. (Cl. 148—6.2)

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This invention relates to a method of treating steel surfaces to prepare them for the application of oil-free synthetic resins, and more particularly for the application of oil-free phenol-formaldehyde resins.

It has been recognized that phenol-formaldehyde type coatings, when oil-free, cannot be applied to unprepared steel surfaces.

A common method of preparation is to apply a sand blast or its equivalent; the sand blasting process, however, involves the human element to such an extent that it is not always uniform and the present method gives a process which may be mechanically controlled and produces better and more uniform results than the sand blast treatment.

In carrying out the present process, the steel or other ferrous metal surfaces are cleaned of any adhering grease by a suitable grease solvent. This is preferably a 3 to 5% solution of caustic alkali at a temperature of 15 to 80° C. Ordinarily two to fifteen minutes' treatment is required, depending upon the surface condition of the steel. After cleaning the metal is washed free of alkali and is then etched with a suitable acid to produce a clean crystalline appearance. This may be accomplished by first dipping the metal in a solution of hydrochloric acid of 15 to 38% concentration at a temperature of 25° to 90° C. for 3 to 30 minutes. A 10 minute period is usually satisfactory in 30% hydrochloric acid at 75° C.

The metal is then rinsed in water and dipped momentarily in a 1% solution of alkali metal dichromate. This dichromate solution should contain a small proportion of added alkali material, suitably sodium carbonate in amounts from 1 to 2% of the dichromate may be used.

The percentage of dichromate may be reduced slightly, or it may be increased somewhat, but increasing the amount of the material does not add to the effectiveness of the process.

The effect of the acid dip is to create a thin film of a ferric salt on the surface of the metal. Upon dipping the metal into the dichromate solution, the ferric ions on the surface of the metal react with the dichromate ions forming ferric chromate, which is insoluble under the conditions and adheres to the metal in the form of a thin, invisible, probably monomolecular coating.

Instead of the use of the hydrochloric acid bath the metal may be dipped into 15 to 70% nitric acid at room temperature (17° C.) for one-half to four minutes, followed by a dip, after cleaning, in 15 to 75% sulphuric acid. The sulphuric acid is maintained at 25° to 90° C. and immersion may be from 1 to 15 minutes. After removal from the sulphuric acid the metal is treated as before in a dichromate solution.

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Steel or other similar ferrous meal materials when treated in this manner may be water rinsed and dried at relatively high temperatures without any oxidation which will interfere with the adherence of a synthetic varnish or enamel. The surface will not rust for periods of twenty-four hours or even somewhat longer.

The steel surface when so prepared has remarkable adherence to synthetic varnishes and enamels, such as phenolic, either urea or formaldehyde, alkyd, vinyl and chlorinated rubber type. The surface is especially adherent to oil-free phenol formaldehyde resins of the type disclosed in Hempel Patent No. 2,198,939. Those resins are applied by spraying or dipping while in the liquid "A" stage, and then are baked to the infusible, hard "C" stage.

As a specific example of the invention, a steel sheet was immersed in a 5% solution of caustic maintained at a temperature of 75° C. and held therein for five minutes. It was then washed in water and dipped for twelve minutes in a solution of 25% sulphuric acid maintained at 75° C. It was then rinsed and dipped in a 1% solution of sodium dichromate containing sodium carbonate in an amount approximately 2% of the dichromate. It was immediately removed from this bath, rinsed in water while still wet from the dichromate soltuion and dried. It was then coated with an oil-free phenol formaldehyde resin of the type disclosed in Hempel Patent No. 2,198,939.

I claim:

1. The method which comprises etching a ferrous metal object with an acid, removing the acid, dipping the object in a dilute solution of alkali metal dichromate, removing the object therefrom, washing the object while still wet from the dichromate solution and drying it and then baking an oil-free phenolic resin coating thereon.

2. The method set forth in claim 1, in which the synthetic resin is a phenol formaldehyde resin.

3. The method for preparing a ferrous metal object for the application of a phenolic resin coating which comprises etching the object with an acid, removing the acid, dipping the object in an approximately 1% solution of alkali metal dichromate to which has been added sodium carbonate in an amount of 1 to 2% of the dichromate, removing the object therefrom, washing the ob-

ject in water while still wet from the dichromate solution and then drying the object.

4. The method which comprises etching a ferrous metal object with an acid chosen from the class consisting of hydrochloric, sulphuric and nitric acids, removing the acid, dipping the object in an approximately 1% solution of alkali metal dichromate to which has been added sodium carbonate in an amount of 1 to 2% of the dichromate, removing the object therefrom, washing the object in water while still wet from the dichromate solution and drying it, applying a protective coating of an oil-free phenol formaldehyde resin in the "A"-stage to the object and then baking the coating thereon.

5. A ferrous metal object having a baked phenolic resin coating thereon prepared by the method of claim 1.

6. A ferrous metal object having a baked phenolic resin coating thereon prepared by the method of claim 2.

7. A ferrous metal object prepared by the method of claim 3.

8. A ferrous metal object having a baked, oil-free phenol-formaldehyde resin coating thereon prepared by the method of claim 4.

CHARLES HENRY HEMPEL.

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