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PROTECTIVE COATING AND METHOD OF APPLYING SAME TO METAL PARTS

Vernon R. Nichols, Macon, Ill., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

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This invention relates to the protective coating of metal parts, and more particularly to a method of cleaning metal parts and of thereafter providing said parts with an attractive, corrosion-resistant coating, and to an improved protective coating solution.

Adequate methods for the protective coating of metal parts have long been sought. As is well known, most metals are readily subject to corrosion which not only deleteriously affects the appearance of the parts but also may result in surface destruction and reduction in the usefulness of the parts. In some cases paint coatings may be employed, but paint is subject to chipping and ordinarily the paint coating must be replaced periodically. Also various chemical processes for producing a protective coating by chemical action on the surface on the metal parts have been devised, but in large part these are expensive and often limited in their application to a single metal.

An object of the present invention is to provide a new and improved method for protective coating of metal, which method will be adaptable to a wide range of metals and which coating will be both attractive and have high corrosion resistance.

A further object of the present invention is to provide a new and improved protective coating solution for metal parts.

In accordance with one embodiment of this invention, the metal parts are thoroughly cleaned, as by a caustic soda dip, rinsed in hot water and then placed in a protective coating dip comprising a solution of chromic oxide, sulphuric acid, nitric acid and nickel sulphate, followed by a suitable rinse and drying of the metal parts. Parts so treated have a smooth, satin-like finish with remarkable corrosion resistance.

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

The first step in the protective coating method of this invention comprises a cleaning step wherein grease, dirt, and any corroded material are fully removed. The particular detergent solution employed is not critical and in general any good zinc cleaning solution may be employed, such as a solution of caustic soda. A typical cleaning solution of caustic soda may comprise from six to ten ounces of caustic soda per gallon of water. This solution is preferably used at a temperature of 190–200° Fahrenheit for a period of one to five minutes, depending on the condition of the part to be cleaned, an excessively dirty part requiring a longer period of cleaning and/or a stronger solution. It has been found that for best results, the temperature must be maintained above 190 degrees Fahrenheit, as lower temperatures tend to cause burning of the parts and to tend to confine the cleaning activities to the edges, whereas more uniform cleaning is obtained as the temperature is raised above 190 degrees Fahrenheit. Of course, above 212 degrees Fahrenheit the solution boils, which is in itself undesirable, and thereafter gradually becomes more concentrated, throwing the solution out of balance.

In the second step, the part is rinsed in a running water rinse at a temperature of approximately 190 degrees F. to thoroughly remove the caustic soda solution and whatever loose dirt or smut that remains after the caustic soda cleaning step. The exact temperature is not critical although the higher temperatures are usually preferable.

In the third step, in which the protective coating is developed, the metal parts are placed in a protective coating solution comprising from 150 to 600 grams of chromic oxide, 85 to 170 grams of concentrated sulphuric acid (66° Baumé acid being the preferred concentration), 43.4 to 130.2 grams of nitric acid (HNO_3), and one liter of water for a time sufficient to give a coating. To this solution may be added up to 1½% of nickel sulphate by weight of the total solution. The nickel sulphate is $NiSO_4 \cdot 6H_2O$ which is single nickel salt in crystal form. Expressed in terms of percentages by weight the solution may comprise approximately:

52.6 to 78% water
11.8 to 31.6% chromic oxide
6.7 to 9% sulphuric acid
3.5 to 6.8% nitric acid

This solution may be used at room temperature, the solution heating up during the dipping operation due to the reaction of the acid solution with the metal. The nickel sulphate up to 1½% by weight is added to the solution.

In the fourth step, the part is again rinsed in cold water followed by a caustic soda dip of the same type used in the first step. In the final step the part is rinsed in clean hot water and thereafter dried.

While satisfactory results may be obtained by omitting the nickel sulphate, the addition of nickel sulphate, as specified above, to the protective coating solution is definitely preferred. The nickel sulphate retards the eating action of the solution and provides more uniform action. Furthermore, the dip with nickel sulphate is more stable, its life cycle is increased, uniformity of color is more easily maintained, the color is deepened and residue in the bath remains evenly suspended yet does not spot the work as it tends to do when not suspended. Also salt spray test results are improved.

If the nitric acid content, by volume, of the solution exceeds that of the sulphuric acid, the solution will not perform properly until rebalanced. In general the nitric acid (HNO_3) should be used in a ratio of 1 to 2 parts 66° Baumé sulphuric acid but in no event in greater volume than the sulphuric acid.

The above method may be employed on material parts made of brass, copper, zinc, steel and aluminum, as well as various parts coated with one or another of these metals or with metals such as cadmium. While the ranges stated hereinabove provide effective coating, in general it has been found that the most economical all-around formula comprises the following typical solution: 263.5 grams of chromic oxide, 135.2 grams of sulphuric acid, 103.6 grams of nitric acid, 22.5 grams of nickel sulphate and one liter of water.

While but one embodiment of this invention has been described, it will be understood that many changes and modifications may be made therein without departing from the spirit or scope of the present invention.

I claim:

1. The method of providing a protective coating on brass, copper, zinc, steel, aluminum and cadmium surfaces of metal parts which comprises immersing the parts in a protective coating solution consisting per liter of water of 150 to 600 grams chromic oxide, 85 to 170 grams of 66° Baumé sulphuric acid, 43.4 to 130.2 grams of nitric acid (HNO_3), and not more than 22.5 grams of nickel sulphate hexahydrate ($NiSO_4.6H_2O$) in an amount suf-

ficient to substantially retard eating action of the solution on said metal parts.

2. A protective coating solution for brass, copper, zinc, steel, aluminum and cadmium surfaces of metal parts consisting by weight of approximately 52.6 to 78% water, 11.8 to 31.6% chromic oxide, 6.7–9% 66° Baumé sulphuric acid, 3.5–6.8% nitric acid (HNO_3), and nickel sulfate hexahydrate sufficient to substantially retard eating action of the solution on said metal parts but not substantially in excess of 1½% by weight.

3. A protective coating solution for brass, copper, zinc, steel, aluminum and cadmium surfaces of metal parts consisting of approximately 263.5 grams of chromic oxide, 135.2 grams of 66° Baumé sulphuric acid, 103.6 grams of nitric acid (HNO_3), and 22.5 grams of nickel sulphate hexahydrate ($NiSO_4.6H_2O$) per liter of water.

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