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METHOD OF IMPROVING THE RESISTANCE TO CORROSION AND ABRASION OF CERTAIN COATED ALUMINUM SURFACES

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1 Claim. (Cl. 148—6.16)

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This invention relates to the art of coating aluminum and alloys thereof in which aluminum is the principal ingredient and in the following disclosure, as well as in the appended claims, the word "aluminum" is intended to be understood as including alloys thereof in which aluminum is the principal or dominant ingredient.

It has been known to those skilled in this art that aluminum surfaces can be improved as to their corrosion resistance and paint holding ability if they are coated by subjecting them to the action of an acid aqueous solution, the essential coating-producing ingredients of which are fluoride ions, dichromate ions and ions from the class of acids consisting of phosphoric and arsenic acids. Coating treatments of this kind are fully described and claimed in my prior patents, No. 2,438,877, issued March 30, 1948, No. 2,471,909, issued April 5, 1949, and No. 2,494,910, issued January 17, 1950. Another treatment of this nature is disclosed in U. S. Patent 2,472,864, issued on June 14, 1949, to James H. Thirsk and myself. In the several disclosures just mentioned, various methods and materials are described for the coating of aluminum by treating it with acid aqueous solutions of the nature above specified.

The present invention is based upon the discovery that aluminum surfaces which are coated in accordance with the teachings of the foregoing patents may have their resistance to corrosion and abrasion substantially improved if the coated surfaces are subsequently treated with certain acid aqueous solutions to be described below and the principal object of the present invention is to so improve such coated aluminum surfaces. Another important object is to provide a method for treating such coated aluminum surfaces which will permit of a much greater tolerance to wider variations in the coating solutions heretofore familiar to those skilled in the art—for example, those disclosed in the above referred to patents. A concomitant object of the present invention is to make it possible to practice the prior coating procedures with somewhat less exactitude and care, and therefore with less experienced personnel which, of course, results in a corresponding decrease in the costs of the coating operation. The present invention also has for an object the provision of a method which minimizes the tendency to powder, which has heretofore been characteristic of some of the coatings produced by prior procedures unless the processes are operated with a great deal of care and exactitude.

By way of examples of coatings produced by previous methods upon which coatings my present invention is particularly useful, I wish to cite the following. For instance, a coating may be produced by means of a solution which is formulated in accordance with

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Formula No. I

	Grams
Sodium fluoride	5
Chromic acid (CrO_3)	10
Phosphoric acid, 75%	64
Water, to make 1 liter.	

A coating may be obtained by immersing the aluminum surface in the foregoing solution or by flowing or spraying the solution upon the work or by any other convenient technique familiar to the art in which the solution is brought into contact with all portions of the surface of the metal and allowed to act thereupon until the coating is produced. The time required to produce the coating will vary, of course, with the temperature. At ordinary living temperature it may require as much as five to ten minutes to produce an appreciable coating with the above solution by this time can be substantially reduced, say to as little as one or two minutes or even less by suitably heating the solution. If the period of contact between the solution and the surface is to be relatively short, after which the adhering film of solution is to be permitted to act for some time, it may be desirable to use a solution which is considerably more concentrated than that given in the above formula.

Other representative formulae for various coating solutions of the nature disclosed in the above referred to patents are as follows:

Formula No. II

	Grams
Ammonium acid difluoride	30
Potassium dichromate	20
Ammonium dihydrogen phosphate	80
Water, to make 1 liter.	

Formula No. III

	Grams
Sodium fluoride	5
Chromic acid (CrO_3)	10
Phosphoric acid, 75%	61
Arsenic acid	2
Water, to make 1 liter.	

Formula No. IV

	Grams
Sodium fluoride	5.0
Chromic acid (CrO_3)	10.0
Arsenic acid	92.5
Water, to make 1 liter.	

After treatment with any of the typical solutions described above or with other coating solutions of a similar nature, the essential coating-producing ingredients of which are fluoride ions, dichromate ions and ions from the class of acids consisting of phosphoric and arsenic acids, the coated surface may be rinsed with water and then treated in accordance with the present invention, or the method of the present invention may be applied without a prior rinse of water. The solutions used in carrying out the present method may be applied by dipping the work into the solution or by spraying or flowing the solution over the surface or by means of any other convenient technique by which the solution can be brought into contact with the coated surface.

The treatment of the present method involves the use either of a mixture of chromic and phosphoric acids or of chromic and arsenic acids and I have found that the following proportions should be observed for best results. In mixtures of chromic acid and phosphoric acid, the phosphoric acid content must be between 2 and 30 grams per liter calculated as P_2O_5 and preferably between 18 and 20 grams per liter while the chromic acid content must be between 0.5 and 40 grams per liter calculated as CrO_3, and preferably between 3 and 5 grams per liter calculated as CrO_3.

In mixtures of chromic acid and arsenic acid, the content of arsenic acid should be between 3.5 and 48 grams per liter calculated as As_2O_5, and preferably between 29.2 and 32.4 grams per liter calculated as As_2O_5, while the content of chromic acid should be between 0.5 and 40 grams per liter calculated as CrO_3, and preferably between 3 and 5 grams per liter calculated as CrO_3.

It should be noted that the amount of arsenic acid and the amount of phosphoric acid used in these solutions are stoichiometric equivalents.

Within the teachings of the preferred ranges given above, mixtures of chromic acid and phosphoric acid or of chromic acid and arsenic acid may be prepared in accordance with the following typical examples:

Formula No. V

	Grams
Chromic acid (CrO_3)	4
Phosphoric acid, 75%	25
Water, to make 1 liter.	

Formula No. VI

	Grams
Chromic acid (CrO_3)	4
Arsenic acid (As_2O_5)	25
Water, to make 1 liter.	

In conclusion I wish to point out that all of the acids employed in carrying out my invention belong to the class of non-rust stimulative acids and if the ranges of concentration specified are adhered to, the final treatments described will give highly satisfactory results. In this connection it should be noted that if the concentrations go over the maximums given above, there is a tendency for the treatment to dissolve the coating while, on the other hand, if the concentrations fall below those specified, the beneficial effects are greatly diminished.

The present application is in the nature of a continuation-in-part of my earlier filed application Serial No. 58,158, filed November 3, 1948, now abandoned.

I claim:

In the art of coating aluminum to increase its resistance to corrosion and abrasion where the surface of the metal has been coated by subjecting it to the action of an acid aqueous solution the essential coating-producing ingredients of which are fluoride ions, dichromate ions and ions from the class of acids consisting of phosphoric and arsenic acids; the method which consists in treating a surface so coated with an acid aqueous solution containing, as its essential active material, a mixture of chromic acid with acid from the group consisting of phosphoric acid and arsenic acid; the concentration of chromic acid to be from 0.5 to 40 grams per liter and the concentration of acid from said group being the stoichiometric equivalent of from 2 to 30 grams per liter calculated as P_2O_5.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,403,426	Douty et al.	July 2, 1946