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PROCESS FOR THE PRODUCTION OF OPAQUE ENAMELLIKE, HARD, AND PROTECTIVE COATINGS ON ARTICLES OF ALUMINUM AND ITS ALLOYS

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9 Claims. (Cl. 204—58)

I have filed application in Switzerland on July 13, 1936.

This application is a continuation in part of my co-pending application Serial No. 153,051, filed July 10, 1937.

The invention relates to improvements in the production of opaque, enamel-like, hard and protective coatings on articles of aluminum and aluminum alloys.

In contradistinction to the methods of this kind already known in the art protective coatings of enamellike, opaque and hard quality on aluminum and aluminum alloys are obtained by making the article to be coated electrode in an aqueous electrolytic bath containing a salt of thorium.

The term "a salt of thorium," as used herein and in the appended claims, is to be understood as comprising those salts of thorium in which thorium is present in the cation in contradistinction to and to the exclusion of thorium compounds in which thorium is present in the anion.

The articles to be coated are preferably, before the treatment in the electrolytic bath, freed from oil or grease, for example by means of petroleum or spirit or benzene and thereafter subjected to a thorough etching operation. The etching substance may be alkaline, e. g. soda lye, soda, or basic phosphates, or acid, e. g. nitric acid or hydrofluoric acid.

The articles freed from oil or grease are immersed in the electrolytic bath containing a salt of thorium, whereupon they are subjected to the action of an electric current. This treatment may be carried out either with alternating current or anodically with direct current.

For use as anions both inorganic and organic substances are suitable with the exception of those derived from the strong mineral acids. Amongst the inorganic acids the following are suitable: Phosphoric acid, arsenic acid, boric acid, chromic acid, permanganic acid and others, as also their acid or neutral salts with alkali metals, ammonium, or organic bases. In the case of organic acids it is preferable to use dicarboxylic acids, oxycarboxylic acids or their acid or neutral salts with alkali metals, ammonium or organic bases, i. e. oxalic acid, malonic acid, succinic acid, glycolic acid, lactic acid, gluconic acid, tartaric acid, citric acid and others. The bath may further contain water soluble polyhydric alcohols and carbo-hydrates, such as, for example, glycerine, glycol, polyvinylic alcohol, mannite, glucose, cane sugar, dimethylcellulose, dextrine and others.

Some of the additions such as, e. g. acids become consumed in the course of time by the metal which dissolves and they may in this case be replaced in the necessary quantities during or before the working operation.

The temperature of the bath during the treatment may be about 10–95° C. according to the degree of acidity of the said bath, the result which it is desired to obtain, and the amount of the additional substances and the voltage employed at any given time. The said temperature can be rendered uniform and kept constant in the bath by means of suitable mixing and cooling devices.

The articles or surfaces coming from the electrolising bath are preferably first washed with water or dilute ammonia or dilute soda solution or other alkaline liquors, then dyed etc. and finally dried. The coating can further be hardened by after-treatment in a bath of boiled water or in a bath containing salts, whereby the pores of the coating are closed.

The white protective coating possessing good covering power which consists principally of aluminum oxyhydrate obtained according to the invention, contains the oxides or the acid hydrate of thorium oxyhydrate in very stable combination. The protecting coating provides the same as but sometimes considerably higher resistance to corrosion than a pure aluminum oxide film and affords quite exceptional protection to the metal forming the base.

It has further been found that articles of aluminum and aluminum alloys the surface of which has been coated according to any process whatever with a firmly adherent aluminum oxide film can be further treated according to the process forming the subject matter of the present invention.

The coating can be coloured by means of organic dyestuffs in a dye bath containing aqueous or organic solvents, or by applying to it or coating it with coloured oils, metallic soaps or varnishes in any desired manner. For the production of a pure white appearance an after-treatment may be carried out which consists in applying to the treated articles or surfaces over a certain time solutions of titanium, zirconium or thorium salts and hydrolising the salts retained in the coating by heating or by means of chemical agents.

Just according to the preliminary treatment of the surface before electrolising according to the present process (producing a polish, sandblasted,

etched, or fluted surface) bright enamel-like or half-matt to fully matt effects can be obtained.

By after-treatment with aliphatic acids or salts thereof with alkalis or strong bases, or with sulphonated oil, the opaque protecting coating can be made water-repellent. Or again, the coating may be subsequently coated with suitable varnishes or burning-in resins.

The following is an example of a suitable method of carrying the invention into effect:

A solution of 12 kilogrammes thorium ammonium oxalate $Th_2(C_2O_4)_5.(NH_4)_2.7H_2O$, 15 kilogrammes of citric acid, 15 kilogrammes of crystallised borax, 20 kilogrammes glycerine in 800 litres of filtered condensation water are employed as the bath. Electrolysis is carried out with direct current of 120 volts at a temperature of 68° C. and a current density of 3.5 amps. per square decimetre until the current density at full voltage has dropped to one half the original value.

I claim:

1. A process of producing opaque, enamel-like, hard and protective coatings containing an oxide of thorium on articles of aluminum or its alloys, which comprises immersing said articles in an aqueous acid bath containing cations of a salt of thorium and containing anions which are oxygen containing and will promote the formation of hard, adherent, opaque and enamel-like coatings on said articles, and passing electric current through said articles as an electrode.

2. The process according to claim 1, in which alternating current is passed through said articles.

3. The process according to claim 1, in which the article to be treated is made the anode in the bath and is subjected to the action of a direct current.

4. The process according to claim 1, with the additional steps of applying to the treated articles a solution containing a salt of thorium and then heating the treated article.

5. The process according to claim 1, in which the article to be treated by said process is first provided with an anodic aluminum oxide-containing coating.

6. The process according to claim 1, in which the salt of thorium is thorium ammonium oxalate.

7. The process according to claim 1, in which the aqueous acid bath contains a solution of thorium ammonium oxalate, citric acid, crystallized borax and glycerine.

8. A process according to claim 1, in which the bath is maintained at a temperature between 10° and 95° C. during passage of the electric current.

9. A process of producing opaque, enamel-like, hard and protective coatings containing an oxide of thorium on articles of aluminum or its alloys, which comprises immersing said articles in an aqueous bath containing thorium ammonium oxalate, citric acid, crystallized borax and glycerine, maintaining said bath at a temperature of 68° C., and passing through said articles a direct current of 120 volts at a current density of 3.5 amperes per square decimetre until the current density at full voltage has dropped to one half the original value.

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