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METHOD OF IMPARTING HIGH BRILLIANCY TO ARTICLES MADE OF ALUMINUM AND ITS ALLOYS

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This invention relates to the creation of a high brilliancy on aluminum and aluminum alloy articles; the invention is a continuation-in-part of our pending application Serial No. 247,744, filed September 21, 1951, now abandoned.

The application of usual mechanical polishing methods to aluminum surfaces is not practical and inefficient; this is particularly so if aluminum articles are to be glossed, which have an irregular shape or an uneven surface; moreover, mechanical polishing methods are expensive and this is particularly so, if a high brilliancy is to be imparted to sunk-in parts of the treated articles.

Hitherto a great variety of mechanical, chemical and electrolytic methods are being used for the surface polishing of metals.

These methods include, for instance, pickling with a solution containing a mixture of phosphoric acid, nitric acid and copper nitrate or the insertion of the metal articles in an aqueous acid bath containing hydrogen, nitrate, fluoride ammonium and chromate ions. The thereby produced aluminum surfaces are dull, the treating temperatures are high and the treatment time is very long.

It is the main object of the invention to produce within a short treating period and at a comparatively low temperature a brilliant gloss on aluminum and its alloys.

With this purpose in view the degreased aluminum alloy articles are maintained for a period of about 5 to 30 seconds in an aqueous glossing solution containing nitric acid, ammonium bifluoride and lead ions, the temperature of this treating bath being maintained at between 50° to 80° C.

The treating solution may preferably contain per liter 1.6 to 2.7 and preferably 2.1 gram molecules of nitric acid, 1.8 to 3.5 and preferably 2.8 gram molecules of ammonium,

3.5 to 7 and preferably 5.6 gram molecules of hydrofluoric acid, and

25×10^{-5} to 25×10^{-4} gram molecules of lead nitrate.

The treating solutions may be produced by mixing the required quantity of commercial pure nitric acid, commercial pure hydrofluoric acid, commercial pure lead nitrate and adding to the same an aqueous ammonia solution or entering into the same gaseous ammonia.

By the application of this solution which may have a low concentration and a low viscosity and therefore is economical, a high brilliancy surface is produced within a very short time on articles of aluminum and its alloys and particularly aluminum magnesium alloys. The short treatment time also enables the to-and-fro displacement of the work pieces in the treating solution, which may preferably be manually effected in order to prevent the adherence of gas bubbles.

It is advisable to degrease the objects before their introduction into the glossing bath; this purpose may be attained by treating the same with a solution consisting of

70 to 90 and preferably 80 parts by weight of concentrated nitric acid and

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10 to 30 and preferably 20 parts by weight of concentrated hydrofluoric acid.

The temperature of the degreasing bath should be kept between 10 and 70° C. and the duration of the degreasing treatment should be between 10 to 20 seconds.

It is advisable to adapt the temperature of the objects to the approximate temperature of the glossing bath prior to their introduction into the latter.

Since work pieces having walls or parts of a different thickness will assume a different temperature during the glossing period, it is advisable to preheat these objects differently in accordance with their wall thickness, i. e. the objects having a thick wall should be preheated to a higher temperature than the thin-walled objects. If the work pieces have thick-walled and thin-walled portions, the different preheating of the individual portions may be effected by first treating the entire work piece to a higher temperature as the temperature of the glossing bath and then partly cooling the same by immersion in cold water or by contact with a current of cold air. The thin-walled portions cool quicker than the thick-walled portions, whereby the desired temperature distribution is attained.

The efficiency of the glossing bath may be pressured, if, upon recognition of its decreasing efficiency, up to about one third of the amount of the original bath components is added to the bath; when a total exhaustion of the bath efficiency is reached, 0.6 to 0.7 and up to a total amount of 1.8 to 2.1 gram molecules of hydrofluoric acid per liter of the bath solution are added.

The treated objects are oxidized anodically or chemically.

From certain operational reasons, it is often impractical to carry-out the anodic oxidation immediately after the glossing treatment. Since during this time, the glossed surfaces are exposed to injurious influence of the air, it is recommended to immediately introduce the glossed objects after their removal from the glossing bath and after being rinsed with water into an aqueous solution containing certain purifying substances. For this purpose, salts of chromic acid, of permanganate acid, of persulfuric acid, of nitric acid, of perchloric acid and particularly the sodium and potassium salts of these acids may be used singly or collectively at the rate of not more than about 0.3 gram molecules, and preferably 0.06 gram molecules per liter of the treating solution. The glossed articles may be kept in the bath for at least one minute.

The high brilliancy of particularly pure aluminum and aluminum alloy articles may be further improved by an after-glossing step.

Example

High brilliancy is applied to an article made of pure aluminum containing 0.5 per cent Mg, in the following manner.

The aluminum article is degreased by treating the same with an aqueous solution containing 80 parts by weight of concentrated nitric acid and 20 parts by weight of concentrated hydrofluoric acid at a temperature of 50° C. for 15 seconds. The article has been heated to a temperature of about 99° C. prior to its introduction into the degreasing solution.

Hereupon the degreased article is entered into the glossing bath proper, which contains 2.1 gram molecules of nitric acid, 2.8 gram molecules of ammonium and 5.6 gram molecules of hydrofluoric acid and 25×10^{-5} gram molecules of lead nitrate. The articles kept in the bath, which is maintained at a temperature of about 65° C. for 15 seconds and manually displaced in the bath during this time.

The article is removed and cooled by a short immersion into cold water, entered into an oxidizing bath containing 0.3 per cent of sodium persulfate per liter and

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kept in the same for about 12 minutes. The article is now removed, rinsed with water and dried.

It will be apparent to those skilled in the art that the novel principle of the invention disclosed herein in connection with specific exemplification thereof will suggest various other modifications and applications of the same. It is accordingly desired that in construing the breadth of the appended claims they shall not be limited to the specific exemplifications of the invention described herein.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent, is as follows:

1. A method for imparting high gloss to articles made of aluminum and its alloys comprising maintaining the said articles for a period of about 5 to 30 seconds at a temperature of 50 to 80° C., in an aqueous solution containing per liter 1.6 to 2.7 gram molecules of nitric acid, 1.8 to 3.5 gram molecules of ammonium, 3.5 to 7 gram molecules of hydrofluoric acid and from 25 times 10⁻⁵ to 25 times 10⁻⁴ gram molecules of lead nitrate.

2. A method for imparting a high gloss to articles made of aluminum and its alloys comprising maintaining the said articles for a period of about 5 to 30 seconds at a temperature of 50 to 80° C., in an aqueous solution containing per liter 1.6 to 2.7 gram molecules of nitric acid, 1.8 to 3.5 gram molecules of ammonium, 3.5 to 7 gram molecules of hydrofluoric acid at about a mutual ratio to form ammonium bifluoride and from 25 times 10⁻⁵ to 25 times 10⁻⁴ gram molecules of lead nitrate and mechanically displacing the said articles in the said solution.

3. A method for imparting a high gloss to articles made of aluminum and its alloys comprising maintaining the said articles for a period of about 5 to 30 seconds at a temperature of 50 to 80° C., in an aqueous solution containing per liter 1.6 to 2.7 gram molecules of nitric acid, 1.8 to 3.5 gram molecules of ammonium, 3.5 to 7 gram molecules of hydrofluoric acid at about a mutual ratio to form ammonium bifluoride and from 25 times 10⁻⁵ to 25 times 10⁻⁴ gram molecules of lead nitrate and subjecting the glossed articles to the action of an oxidizing bath.

4. A method for imparting a high gloss to articles made

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of aluminum and its alloys comprising maintaining the said articles for a period of about 5 to 30 seconds at a temperature of 50 to 80° C., in an aqueous solution containing per liter 2.1 gram molecules of nitric acid, 2.8 gram molecules of ammonium, 5.6 gram molecules of hydrofluoric acid and from 25 times 10⁻⁵ to 25 times 10⁻⁴ gram molecules of lead nitrate.

5. In a method according to claim 1, the step of adding to the bath shortly before its exhaustion one-third of the originally applied bath components.

6. In a method according to claim 1, the step of adding to the treating bath prior to its exhaustion about 1.8 to 2.1 gram molecules of hydrofluoric acid per square meter of article surface to be glossed.

7. In a method according to claim 1, the step of using as a surface purifying medium an aqueous solution of a substance selected from a group consisting of chromic acid, permanganate acid, persulfuric acid, nitric acid, perchloric acid, perboric acid and the sodium, potassium and calcium salts of these acids the concentration of the solution being controlled to a rate of about 0.3 to 0.6 gram molecules per liter.

8. In a method according to claim 1, subjecting the articles prior to the oxidizing treatment to an anodic after-glossing action.

9. In a method according to claim 1, degreasing the articles prior to the glossing work with a mixture of nitric acid and hydrofluoric acid at a temperature of between 10 to 70° C., and for a period not to exceed thirty seconds.

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