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TREATMENT OF MAGNESIUM AND ITS ALLOYS

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The invention relates to improvements in methods of producing a protective and decorative coating upon articles fabricated of magnesium and its alloys.

5 The type of treatment to which magnesium alloy articles have heretofore been subjected to produce thereon a conventional protective coating generally consists in treating the article with an aqueous solution of a salt producing an adherent water insoluble deposit on the metal. Such coatings, however, have limitations which adversely affect their utility, so that they are seldom used without a further treatment, as by painting. One disadvantage is that they are seldom uniform in appearance, the shade and depth of color varying, we have found, with the homogeneity of the metal itself. The variations in color and shade over the surface of a given treated article are particularly marked in cast articles, such as die castings. Rolled and formed articles also exhibit a certain amount of superficial variation of metal structure and as a consequence develop non-uniform coatings when subjected to a conventional chemical treatment. This non-uniformity of the chemically produced coatings on fabricated magnesium articles seems to be due primarily to the different rates of action of the treating solution upon various portions of the metal surface, and to the fact that the protective deposit does not possess a sufficient opacity to fully hide the underlying irregularities in the metal surface. Attempts to build up thicker coatings, to mask the inhomogeneity of the ordinary coatings, do not produce satisfactory results, because such coatings lack adequate mechanical strength. Such attempts also involve dissolving or etching away an excessive amount of the underlying metal, thus materially affecting the dimensional accuracy of the article.

40 The principal object of the invention is, accordingly, to provide a method of producing a corrosion-resistant coating upon magnesium and its alloys, without excessively attacking or dissolving the underlying metal, which coating is uniform in appearance, irrespective of any normal inhomogeneity of the structure of the metal itself. Other objects and advantages will be apparent as the description proceeds.

We have discovered that, by subjecting articles of magnesium and its alloys to the action of an aqueous solution containing chromic sulphate and an alkali metal chromate or bichromate, a uniform adherent corrosion-resistant coating is produced upon the metal, regardless of any superficial inhomogeneity of the metal itself and with-

out substantially affecting its original dimensions or weight. The invention then consists of the method hereinafter fully described and particularly pointed out in the claims.

According to our invention, treating solutions suitable for the purpose contain as effective constituents from 1 to 20 per cent of an alkali metal chromate, and from 0.5 to 10 per cent of chromic sulphate, based upon the dry weight of the salts, dissolved in water. A generally useful composition is made by dissolving in water 9 per cent of sodium bichromate, $\text{Na}_2\text{Cr}_2\text{O}_7$ and 1 per cent of chromic sulphate, $\text{Cr}_2(\text{SO}_4)_3$. Potassium chromic sulphate (chrome alum) or ammonium chromic sulphate may be used, if desired, as the source of chromic sulphate. In carrying our invention into effect, the article to be treated is first cleaned, if necessary, in a known manner, as by wire brushing or by pickling in dilute nitric acid. The cleaned article is then immersed in the treating solution, preferably at the boiling temperature thereof, for from about 0.5 to 60 minutes, until the desired coating is obtained. After the coating has been produced, the article is removed from the solution and rinsed immediately, preferably in hot water, and then air dried.

The treating solution may contain other ingredients and may, after use, contain a minor amount of products of solution of the articles treated. It will eventually become exhausted or lean in active ingredients and require regeneration or renewal. Any solution preparable by dissolving in water the said active ingredients will function in accordance with our discovery.

The following example is illustrative of a mode of carrying out the invention:—

An article composed of a magnesium alloy containing 10 per cent Al, 0.1 per cent Mn, 0.5 per cent Si, the balance being magnesium, was immersed for 5 minutes at the boiling temperature in an aqueous treating bath containing 1.7 per cent of potassium chromic sulphate, $\text{K}_2\text{Cr}_2(\text{SO}_4)_4$ and 9.0 per cent of sodium bichromate, $\text{Na}_2\text{Cr}_2\text{O}_7$. The article was then withdrawn, rinsed, and dried. The treatment produced a uniform, black adherent coating without material alteration of the dimensions or weight of the article.

On subjecting the so treated article to the action of a 3 per cent solution of sodium chloride by the usual alternate immersion test for resistance to corrosion, it was found that the coating retained its original uniform black color for more than two weeks of the test. Similar results are obtained within the scope of our invention with

other magnesium alloys, the depth of color varying somewhat with the composition of the alloy.

Among the advantages of the invention are: that a uniform appearing coating may be produced on articles of magnesium and its alloys in spite of a lack of homogeneity in the metal itself; the coatings are not only highly decorative, but also possess great resistance to corrosion.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the method herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

We therefore particularly point out and distinctly claim as our invention:

1. In a method of producing a coating upon articles of magnesium and its alloys, the step which consists in subjecting the article to the

action of an aqueous solution containing as effective constituents chromic sulphate and an alkali metal chromate.

2. In a method of producing a coating upon articles of magnesium and its alloys, the step which consists in subjecting the article to the action of an aqueous solution containing as effective constituents from about 1 to 20 per cent of chromic sulphate and from about 0.5 to 20 per cent of an alkali metal chromate.

3. In a method of producing a coating upon articles of magnesium and its alloys, the step which consists in subjecting the article to the action of an aqueous solution containing from about 1 to 20 per cent of a chromic sulphate of the group consisting of sodium, potassium and ammonium and from 0.5 to 20 per cent of sodium bichromate at the boiling temperature.

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