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PROCESSES FOR THE PROTECTION OF MAGNESIUM AND MAGNESIUM BASE ALLOYS AGAINST CORROSION

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2 Claims. (Cl. 148—6)

This invention relates to processes for protection of magnesium and magnesium base alloys against corrosion by immersion in a solution which reacts chemically with the metal to produce a protective film on the surface of the metal. Two such processes are widely used in Great Britain, viz. what is known as the 30 minute hot chromate bath, and the cold acid chromate bath, comprising the subject respectively of British Patents 353,415 and 287,450 and described in the handbook "Elektron Magnesium Alloys," 1937, pages 91–951. The 30 minute bath whilst giving good surface finishes has the disadvantage of lengthy period of treatment and necessity for maintaining the solution near to boiling point. Moreover this hot bath is not so well suited to magnesium base alloys containing substantially only manganese as an alloying constituent, as to those alloys which contain aluminium. Alloys of the former type however (e. g. Elektron registered Trade-Mark AM503 alloy) are however widely used for the production of sheets for manufacture into welded articles such as fuel tanks. The problem of treating these tanks therefore cannot well be solved by the use of the hot bath. The acid chromate treatment however involves a cold solution and normally a very short period of immersion but the solution is strongly acid and therefore removes a small but appreciable amount of the metal (of the order of 0.00025'' reduction in thickness from each surface) during treatment and is therefore not so suitable for use on parts machined to fine tolerances. In some circumstances for example when treating very large fuel tanks it is difficult to avoid immersion of the work for abnormally long periods, e. g. 1 minute, with consequential increase of dimensional reductions. I have made a series of experiments with a view to overcoming this difficulty and as a result I have ascertained that if the acid content of the solution is reduced considerably below the amount heretofore recommended not only is the rate of metal dissolution reduced to an unexpectedly high extent but an unexpected increase is obtained in the protective value against corrosion afforded by the film produced.

The composition of the bath as heretofore recommended is 15 parts by weight of potassium or sodium dichromate with 20 to 25 parts by volume of concentrated nitric acid in 100 parts of cold water. According to certain tests using specimens of magnesium alloy containing only about 1.5% manganese as alloying constituent, and solutions containing varying amounts of nitric acid from 5 up to 20 parts to 100 parts of water the weight loss for a 20 second immersion increased from 14.5 mgs. per square dcm. of exposed surface up to 67, a graph representing this increase being substantially a straight line between these two figures. Similar examples with 40 second and 60 second immersions gave weight loss increases from 22 to 99.5 and 30.5 to 133.5 respectively. The samples were then immersed for 48 hours in a 3% sodium chloride solution, the further loss in weight caused by corrosion being then ascertained. The result showed that the corrosion weight loss decreased from 40 mgs. per square dcm. per day with 20 parts acid down to 30.5 with 15 parts acid, and to 22.5 with 10 parts acid, and after some further reduction in weight loss with further reduced acid content it was found that still further reduction of acid content resulted in an increase in the corrosion weight loss so that with 5 parts only of acid the weight loss was 24.5 mgs. My tests indicate that the optimum acid concentration is about 7.5 parts acid as this gives maximum protection against corrosion and at the same time reduces metal losses by about 60% as compared with the bath as heretofore proposed. A range of 5 to 10 or 12½ parts acid gives good results and even up to 15 parts gives a substantial improvement over the bath as heretofore proposed. As the acid content decreases during treatment of the metal the acid content of a new bath should preferably not be as low as 5 parts but should be preferably at least 6 or 7 parts.

In use careful check should be made on the acid content of the solution except where a definite area of metal is treated for a predetermined time by any given volume of the solution.

According to the present invention therefore magnesium or magnesium alloys are treated in a solution containing a bichromate together with from 5 (or preferably 6 or 7) parts of concentrated nitric acid up to 15 (or preferably not more than 10 or 12½) in 100 parts of water. The bichromate may be sodium or potassium bichromate and 15 parts (or say 10 to 20) of this may be used to 100 parts water. A solution which we prefer contains 15 parts of bichromate and 7½ parts of concentrated nitric acid to 100 parts of water. The alloy may be of the kind above referred to containing only manganese as alloying constituent and may be in the form of sheet, extrusions or other wrought form. This alloy may for the purpose of the present invention be defined as containing 0.5–2.5% manganese and

less than 1.0% of all other substances other than magnesium.

Another surprising and unexpected advantage of the present invention is that in spite of the reduced acid content of the solution a given quantity will produce a satisfactory coating on a surface area approximately equal to the area which can be treated by a normal acid chromating solution.

I claim:

1. A process for improving the resistance to corrosion of magnesium and magnesium base alloys which consists in subjecting the metal to treatment with an aqueous solution which when first prepared contains approximately 15 parts of a bichromate of an alkali metal and about 7½ parts of concentrated nitric acid to 100 parts of water.

2. A process for improving the resistance to corrosion of magnesium and magnesium base alloys, which consists in subjecting the metal to a treatment with an aqueous solution of components which when first prepared consist of at least 10 parts of a substance selected from the group consisting of sodium bichromate and potassium bichromate and from 6 to 10 parts of concentrated nitric acid to 100 parts of water.

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