Patented Sept. 1, 1953

2,650,902

UNITED STATES PATENT OFFICE

2,650,902

ELECTRODEPOSITION ON MAGNESIUM AND MAGNESIUM-BASE ALLOYS

William F. Higgins, Salford, England, assignor to Magnesium-Elektron Limited, Clifton Junction, England

No Drawing. Application June 6, 1949, Serial No. 97,481. In Great Britain June 10, 1948

5 Claims. (Cl. 204—38)

1

This invention relates to the provision on magnesium and magnesium base alloys of metallic coatings by electrodeposition.

According to the present invention magnesium or magnesium alloy is immersed in a solution of a zinc, cadmium or manganese compound which is decomposed by the magnesium to produce a coating of metallic zinc, cadmium or manganese on the magnesium metal, whereafter the magnesium metal is treated electrolytically in a solution adapted to produce an electrodeposited film of another metal on the said coating. Such metals may include silver, nickel, cadmium, chromium, copper, brass, cobalt, rhodium, gold and platinum; a further coating of zinc, cadmium or manganese may also be deposited, in general but not necessarily on a substratum of zinc.

The film of metal may in particular be silver but other films may be provided, as stated above.

One process in accordance with the invention, referred to by way of example, consists in cleaning the metal, and dipping it in an aqueous solution of zinc chloride. A fairly vigorous reaction ensues which results in the deposition of a black film of finely divided zinc.

Instead of using zinc chloride any simple salt of zinc, manganese, or cadmium may be used or mixtures. The solutions are free from chromic acid ions or intentional additions of any other acids or alkalis. A 5 to 15% e. g., 10% solution of the salt in water is satisfactory and a temperature of 20–30° C. is suitable.

The deposit so produced consists partly of a firmly adherent metallic film and partly of a loose voluminous film. This latter should be washed off with water and the process repeated until the firmly adherent film has become thick enough for subsequent operations to be described below.

The metallic film so produced may be boiled in a 10% solution of chromic acid which has the effect of consolidating the zinc and rendering it uniform. At the same time, it produces a passive condition in which state it is not suitable for electro-plating. After rinsing therefore, the zinc film is immersed in a solution of nitrate or cyanide of mercury which brings about amalgamation or the formation of mercury amalgam on the surface and renders this latter fit for electroplating. In this condition, the surface is suitable for electro-plating by any of the usual plating baths.

The silver cyanide bath will give a satisfactory coating of silver, but other baths may also be used. When using a silver cyanide bath, satisfactory results are obtained if the zinc covered

2

sample is immersed for about an hour at room temperature in a solution containing 13.7 gms. of silver in the form of any soluble salt (preferably in the form of silver cyanide), 26.7 gms. of potassium cyanide and 50 gms. of potassium carbonate per litre, and plated at a current density of 3 amps. per sq. ft. using a silver anode.

Instead of using chloride, any simple zinc salt may be used to produce the initial metallic film.

Several methods of treatment will now be described by way of example:

1. A piece of "Elektron" AZ91 (composition aluminium 9.5%, zinc 0.4%, manganese 0.3%, balance magnesium), suitably cleaned, was immersed in a 10% solution of $MnSO_4.4H_2O$ for 10 seconds, with agitation. It was then rinsed and dipped in boiling 10% chromic acid solution for 15 seconds. After swilling in water, it was quickly dipped in a 1% solution of mercurous nitrate and then plated for 1 hour at a current density of 3 amps./sq. ft. in an alkaline silver cyanide plating bath. The plated surface was finally buffed on a polishing mop.

2. A piece of "Elektron" A8 (composition aluminium 8%, zinc 0.4%, manganese 0.3%, balance magnesium), after cleaning, was immersed in a 10% solution of $CdSO_4$ for 10 seconds. It was then swilled and dipped in boiling 10% chromic acid solution for 10 seconds. After swilling, it was quickly dipped in a 1% solution of mercurous nitrate and then plated for 1 hour at a current density of 3 amps./sq. ft. in the alkaline silver cyanide plating bath. The plated surface was finally buffed on a polishing mop.

3. A piece of "Elektron" AM503 (composition manganese 1.5%, balance magnesium) sheet was immersed in a 10% solution of zinc chloride for a few seconds. It was then rinsed and immersed in 10% boiling chromic acid solution for a few seconds. After rinsing, it was returned to the zinc chloride solution, rinsed, again immersed in the chromic acid solution and this process repeated five times. After a final rinse, it was transferred to the alkaline silver plating solution where it was plated for 1½ hours at 3 amps./sq. ft. An excellent deposit of silver, uniformly deposited, was produced by this means and this withstood the subsequent buffing operations perfectly.

4. The experiment described in No. 3 above was repeated using a zinc sulphate solution of 5% strength. The results obtained were similar, though rather longer periods of immersion in the zinc solution were required to secure an adequate zinc deposit. By repeating the dipping procedure,

it was possible to observe and follow the progressive accumulation of the necessary zinc film.

5. A piece of "Elektron" ZW 3 (composition zirconium 0.7%, zinc 3%, balance magnesium) was treated in a similar manner to No. 3 above, but using a 10% zinc sulphate solution. The results were not to be distinguished from those already described.

6. Similar results were obtained with nickel and cadmium plating baths.

I claim:

1. A process for the treatment of magnesium and magnesium base alloys which consists in immersing the magnesium-containing article in a first solution of a compound selected from the group consisting of the salts of zinc, cadmium, and manganese which are soluble in water and are decomposed by the magnesium to produce a metallic coating of one of these metals on the article, contacting the coated article with an aqueous chromic acid solution which leaves the surface of the metallic coating in a passive condition, and then contacting the coated article with a solution of at least one of the salts of the group consisting of a cyanide of mercury and a nitrate of mercury which leaves the surface of the metallic coating in a condition suitable for electroplating, and thereafter electroplating the coated article.

2. A process as claimed in claim 1 wherein said first solution is a 5–10% solution of the salt and is free from chromic acid ions and free from any

acids and alkalis and wherein the temperature of said first solution is 20 to 30° C.

3. A process as claimed in claim 1 wherein the chromic acid solution is boiling.

4. A process as claimed in claim 1 wherein, after the metal is immersed in the first salt solution, it is then washed with water and contacted with the chromic acid solution, and these three steps then repeated at least once before the electroplating step.

5. A process as claimed in claim 1 wherein the coated article is immersed in an electrolytic solution containing a silver salt, and a cyanide, and wherein the coated article is silver plated.

WILLIAM F. HIGGINS.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,627,900	Hewitson	May 10, 1927
1,827,142	De Trairup	Oct. 13, 1931
2,233,410	Frasch	Mar. 4, 1941
2,526,544	De Long	Oct. 17, 1950

FOREIGN PATENTS

Number	Country	Date
506,466	Great Britain	May 30, 1939
507,342	Great Britain	June 14, 1939

OTHER REFERENCES

"Metal Finishing," vol. 43 (1945), pages 48 and 49.