cl. 204

Published June 22, 1943

Serial No. 257,762

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PROTECTION OF MAGNESIUM-BASE METALS

Jean Frasch, Clichy, France; vested in the Alien Property Custodian

No Drawing. Application filed February 21, 1939

The object of the present invention is a process for the protection of magnesium and magnesium-base alloys by means of a superficial coating.

The anodic or electrolytic treatment of magnesium and its alloys has heretofore generally been effected in alkaline solutions with a view to depositing coatings of oxide, silicates or aluminates, the said solutions sometimes containing in addition other alkaline salts such as borates, chromates, phosphates and molybdates. But coatings so obtained have never given entire satisfaction.

Up till now acid solutions have not successfully been employed for the anodic or electrolytic treatment of magnesium and its alloys. Such solutions have only been used in the form of bichromates to which concentrated nitric acid has been added in order to deposit a golden surface film, or of boiling chromic acid for the purpose of cleaning the surface of the metal and dissolving the oxide deposit which is generally present.

Recently attempts have been made to protect magnesium and its alloys anodically or electrolytically by means of solutions of phosphates, sulfates or other alkaline salts to which CrO^3, $K^2Cr^2O^7$ or $KCrO^4$ have been added. Such solutions deposit on the surface of the metal, in addition to an oxyde of chromium, on oxyde or salt of magnesium which is only moderately resistant to corrosion.

I have now discovered that it is possible to deposit on magnesium or its alloys coatings highly resistant to corrosion, by treating such metals in a bath containing chromic acid in the presence of alternating current.

No other salt or oxide capable of taking an active part in the electrolytic treatment may be present.

The solution used may preferably consist of 5 to 30% of CrO^3 in water. One may also add to such a solution small quantities of sulfuric acid or chromium sulfate, preferably in the ratio of 0.5 to 3%, calculated as SO^3 to CrO^3 present.

The pH of the bath should be maintained at less than 2. This may be done by the appropriate addition from time to time of chromic acid and if necessary of sulfuric acid.

I have found that when magnesium or its alloys are treated with alternating current in such a bath a dark brown or black coating is deposited on the surface of the metal. This film consists of an oxyde of chromium, intermediate between Cr^2O^3 and CrO^3, and contains practically no metal other than chromium.

I have further made the surprising discovery that the above mentioned protective film is porous and far from being of an insulating nature, easily permits the passage of alternating electric current. The voltage across the bath only falls slightly during the electrolytic treatment and remains almost constant for its duration.

Thus, for example, if one applies a potential of 2 to 10 volts between the electrodes, regulating the current at from 2 to 15 amps. per dm^2, I have observed, in contradistinction to all other heretofore known electrolytic processes for protecting magnesium and its alloys, that the current only falls slightly during the treatment, the dark film formed on the metal offering but little resistance to the passage of the current. For example an initial voltage of 5 volts will fall to about 4.5 volts at the end of the treatment.

I give below the composition of two baths particularly well suited for putting my present invention into effect, but these baths are cited merely by way of example, and all baths which conform to the characteristics previously cited are capable of being utilised.

Example I

Composition of bath	CrO^3 ... grs. per litre	300
	H^2SO^4 ... grs. per litre	5
Voltage	volts	4
Current	amp/dm^2	8
Time	minutes	10
Temperature	Room temperature.	

Example 2

Composition of bath, CrO^3	grs. per litre	50
Voltage	volts	8
Current	amp/dm^2	4
Time	minutes	15
Temperature	Room temperature.	

After the electrolytic treatment the objects are withdrawn from the bath, copiously rinsed and dried, preferably hot. Subsequently the objects can be subjected to a finishing treatment, for example by means of paraffin, paint, etc. . . . which increases the resistance of the protective coating to corrosion.

In particular, since the protective film is porous, one obtains excellent results by means of immersion of the pieces in hot paraffin, for example at about 180° C.

The previously described bath containing chromic and sulphuric acids has moreover the advantage of being one well suited to the preliminary pickling of the metal objects to be electrolytically treated, with the result that no prior pickling is necessary.

I have also discovered that magnesium or magnesium-base alloys assembled with an other metal such as iron or aluminium, can be satisfactorily treated in the above mentioned bath.

My invention covers, as new industrial products, not only baths as specified for the electrolytic treatment of magnesium and magnesium-base alloys with a view to producing protective coatings resistant to corrosion, but also all objects in magnesium or its alloys which are covered with the afore described protective coating consisting substantially of an oxyde of chromium, and this protective coating itself.

JEAN FRASCH.