Patented Dec. 1, 1953

2,661,329

UNITED STATES PATENT OFFICE

2,661,329

METHOD OF TREATING ELECTROPLATED MAGNESIUM CASTINGS

Herbert K. De Long, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich., a corporation of Delaware

No Drawing. Application April 13, 1951, Serial No. 220,981

3 Claims. (Cl. 204—37)

1

The invention relates to the treatment of castings of magnesium and the magnesium base alloys on which has been deposited an electroplating and has among its objects to provide a method of removing the tendency for the electroplate to blister when the castings are subjected to elevated temperatures. As used herein, the term "magnesium base alloy" means an alloy of magnesium containing at least 80° of magnesium by weight.

In some applications of electroplated castings of magnesium and the magnesium base alloys, for example in some parts of internal combustion engines, the castings are subjected to temperatures above 450° F. At such temperatures it is observed that the electroplated castings become blistered. That is the electroplate becomes separated from the surface of the casting at a number of small areas and is raised up as by gas pressure generated between the electroplate and the casting. Such blistering generally militates against the usefulness of the plating. Electroplated wrought articles of magnesium and its alloys, unlike the cast articles, do not blister on being heated to temperatures which cause the electroplated castings to blister. Insofar as I am aware no method of overcoming the foregoing blistering effect is commercially available.

I have now discovered that by subjecting electroplated castings of magnesium or magnesium base alloy to a prolonged heat treatment at a moderately elevated temperature, below that causing blistering of the electroplating, the electroplated castings so treated do not become

2

blistered when subsequently subjected to much higher temperatures, as in use where the environment is above about 450° F. The invention then consists of the method herein fully described and particularly pointed out in the claims.

The invention may be carried out by heating the electroplated casting at a temperature between 250° and 450° F. for a sufficient length of time. Within the aforesaid range of temperature the tendency to blister is removed, the more rapidly the hotter the casting during the heat treatment below the blistering temperature. A generally preferred temperature for the heating operation is about 375° to 400° F. and the electroplated casting is maintained at a temperature within this range for about 4 to 16 hours.

The following tabulation of tests is illustrative of the blistering effect of relatively high temperature heating on electroplated castings and the removal of the blistering effect by the application of the above described heat treating method. In the tests, cast panels 3 inches wide 8 inches long and ⅜ inch thick, of conventional magnesium base alloys, having the nominal composition indicated, were electroplated. The electroplates had a total average thickness of 0.0017 inch. The electroplated cast panels were generally subjected to two different heatings, viz: an initial or conditioning heat treatment in accordance with the invention, and a final or test heat treatment, the latter being for the purpose of indicating the tendency for the panel to blister.

Electroplated cast test panel		Initial conditioning heat treatment		Test heat treatment		Results
Alloy [1]	No.	Temp., ° F.	Duration, hours	Temp., ° F.	Duration, hours	
A	1			600	0.5	Many fine blisters and large ones.
A	2			600	0.5	Do.
A	3	375	16	600	0.5	No blistering.
A	4	375	16	600	0.5	Do.
B	5			600	0.5	Many fine blisters.
B	6			600	0.5	Do.
B	7	375	16	600	0.5	No blistering.
B	8	375	16	600	0.5	Do.
C	9			600	0.25	Bad blistering.
C	10	400	16	600	10	No blistering.
D	11			600	0.25	Bad blistering.
D	12	400	16	600	1	No blistering.
D	13	350	16	600	10	Do.
D	14	375	4	600	10	Do.
D	15	375	16	800	1	Do.
D	16	200	16	600	0.25	Slight blistering.

[1] Alloy composition:
A, 3% Ce, 0.5 Zr, balance Mg.
B, 1.8% Mn, balance Mg.
C, 8.5% Al, 0.1% Mn, balance Mg.
D, 9% Al, 2% Zn, 0.1% Mn, balance Mg.

In the tests set forth in the above table each panel was buffed to a high luster, and cleaned, thereafter the panels were given an immersion coating of zinc followed by a thin electroplating of copper, nickel, and chromium superimposed, as set forth in an article by the applicant entitled "Electroplating Magnesium and Its Alloys," published in the proceedings of the 36th annual convention of The American Electroplater's Society, at pages 217 to 227. The coating of zinc, referred to above, is first applied to the clean buffed casting in order to provide a base for the electroplating. The zinc coating is produced by immersing the buffed and cleaned casting for 3 to 5 minutes in a zincing solution held at 180° F. having, for example, the following composition:

Tetrasodium pyrophosphate $Na_4P_2O_7$	16 oz./gal.
Zinc sulfate, $ZnSO_4 \cdot 7H_2O$	5.3 oz./gal.
Potassium fluoride, KF	1.0 oz./gal.
Potassium carbonate, K_2CO_3	0.7 oz./gal.
pH	10 to 10.4.

The zinc coated casting is rinsed in water and then electroplated in conventional manner. In the tests set forth in the table the zinc coated castings, after rinsing, were copper plated 0.0005 inch thick in a copper cyanide bath with a current density of 15 to 20 amperes per square foot. The copper plating was followed by a nickel plating 0.001 inch thick produced in a conventional nickel sulfate-nickel chloride bath containing

boric acid. The nickel plating was followed by a chromium plating 0.0002 inch thick produced in a conventional chromic acid-sulphuric acid plating bath at a current density of 150 amperes per square foot, the bath being at 110° to 115° F. during the chromium plating.

I claim:

1. In a method of treating a casting of a metal selected from the group consisting of magnesium and the magnesium base alloys, said casting having an electroplated metallic coating thereon, so as to prevent blistering of the coating when the temperature of the casting is raised above about 450° F., the step which consists in subjecting the electroplated casting to a heating for 4 to 16 hours at a temperature between 250° F. and 450° F.

2. In a method according to claim 1, carrying out the heating at a temperature between about 350° and 400° F.

3. In a method according to claim 1, carrying out the heating at a temperature between about 375° F. and 400° F.

HERBERT K. DE LONG.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,219,738	Copson	Oct. 29, 1940
2,437,612	Osborg	Mar. 9, 1948