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MAGNESIUM-TIN-ZINC ALLOYS

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This invention relates to magnesium base alloys, by which I mean alloys containing about 50 per cent or more of magnesium by weight. Heretofore these alloys have contained as essential alloying elements such metals as aluminum, copper, manganese, and cadmium. So far as I am aware, no one has heretofore produced or investigated alloys consisting of magnesium, tin, and zinc in which the magnesium is the predominating constituent.

I have discovered that alloys consisting of preponderant amounts of magnesium and smaller amounts of tin and zinc possess physical and tensile properties, ease of working or forming, and resistance to corrosion, which make such alloys notably advantageous for many purposes.

The alloys which are the subject of my present invention may be cast, rolled, forged, extruded, and similarly treated according to well known methods. They are also susceptible of improvement by the ordinary heat-treatments familiar to those engaged in the art. The alloys are useful as a light construction material in those applications where the combination of low weight, high strength, and resistance to corrosion is essential.

The amount of tin and zinc which must be added to the magnesium in order to produce such alloys depends to some extent upon the use to which the alloys are to be put. If an alloy capable of being satisfactorily rolled, forged, or similarly formed or worked into some suitable shape is desired, the alloy may contain from about 1 to 15 per cent of tin but the zinc should not preferably be present in amounts greater than about 2 per cent for rolling purposes, and in the case of alloys which are to be forged, I prefer to limit the amount of zinc present to less than 1 per cent, very small amounts of zinc, such as 0.1 per cent or more, having pronounced effect in such alloys. If the alloy is to be extruded, however, the zinc may be advantageously present in amounts as great as 10 per cent and satisfactory results will be obtained. If the final use for the alloy is in cast form, the tin may be added in amounts from 1 to 15 per cent and zinc in amounts of about 0.1 to 5 per cent, or even as much as 10 per cent, and under these conditions, excellent castings can be obtained, but the larger amounts of zinc are apt to make casting more difficult, especially where the production of complicated shapes is desired, and in such cases I therefore prefer to limit the zinc content of the alloys to about 5 per cent or less.

My new alloys may be made according to the usual metallurgical methods of alloying but I prefer to add the tin and zinc to the molten magnesium in the form of an alloy of tin and zinc suitably proportioned in metal content to give the desired final ratio of tin and zinc in the alloys. The magnesium, tin, and zinc from which the alloys are made may or may not contain impurities, depending upon the purity of the metal available, but, in any event, small amounts of impurities, even up to about 1 per cent, may be present in the alloys without seriously affecting their favorable corrosion-resistance and good mechanical properties.

In testing my alloys, I have determined that, in comparison with the magnesium base alloys now commercially available, my alloys are exceedingly resistant to corrosion, and particularly to the action of reagents such as sodium chloride solutions. The tensile strength of my new alloys in the form of castings made in sand ranges from about 17,000 to 24,000 pounds per square inch and the elongation in 2 inches ranges from about 3 to about 8 per cent. If, for instance, castings containing about 5 per cent tin and about 4 per cent zinc are heat-treated by heating for 24 hours at 900° F. and then quenching in water their strength will be increased on the average by about 3,000 to 6,000 pounds per square inch and their elongation will be raised to as much as 6 to 12 per cent in 2 inches. Alloys having a tin content from about 5 to 10 per cent and 1, 2, 3 and 4 per cent of zinc are preferred and are especially advantageous in the heat-treated condition. After heat treatment artificial aging at about 150° C. for 24 hours produces a substantial hardening effect.

It is to be understood that the invention is not limited to the precise ingredient propor-

tions or to the particular method of heat treatment and aging herein described.

I claim—

1. An alloy consisting of magnesium, tin, and zinc, the tin content varying from about 1 to 15 per cent, the zinc content varying from about 0.1 to 10 per cent, the balance of the alloy being magnesium.

2. An alloy of magnesium, tin, and zinc composed of magnesium in preponderating amount and more than about 1 and less than about 25 per cent of tin and zinc, the zinc content not exceeding 10 per cent.

3. A magnesium base alloy consisting of 1 to 15 per cent of tin, and 0.1 to 5 per cent of zinc, the balance being magnesium.

In testimony whereof I hereto affix my signature.

ROBERT THOMAS WOOD.