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ZINC BASE ALLOY

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This invention relates to a new zinc base alloy of superior strength and permanence developed more particularly for casting purposes and especially for die casting purposes.

Die casting alloys have been developed within recent years which show considerable improvement in physical properties and more particularly superior permanence of size and shape as compared to alloys widely used in the die casting industry but a few years ago. These newer alloys, however, require the use of a special zinc of a very high degree of purity and consequently extreme care must be used in the preparation and handling of the alloys in the manufacture of castings therefrom to avoid contamination.

The new alloy disclosed herein has the special advantage that it combines high strength with considerable permanence even when made with zinc of less special quality. It is to be distinctly understood, however, that the alloy described herein may be made with zinc of the highest purity obtainable and that the use of such zinc will add to those superior properties generally associated with the use of such pure zinc. It is intended that this patent shall cover the alloy disclosed when the zinc used therein is either of the special high purity grade (99.98+% zinc content) or the more widely used high grade or No. 1 as specified by the American Society for Testing Materials.

A zinc base alloy commonly in use at the present time contains about 4% aluminum, about 3% of copper and about 0.1% of magnesium. In fact a committee of the American Society for Testing Materials is recommending an alloy of this composition for adoption as a standard alloy by the society.

It is well known that this alloy has the disadvantage that the physical properties of tensile strength, elongation and impact strength decrease with time even at normal atmospheric temperatures and more rapidly at elevated temperatures. This change in physical properties is considered to be due to a phase change in the alloy. Zinc-aluminum-copper alloys of the type represented by the composition 4% aluminum, 3% copper and remainder zinc form a rather complex ternary system which has been studied in detail by various investigators. It is considered that due to the rapid freezing and cooling of alloys in the die casting process that casting alloys of the above type are left in a phase of unstable equilibrium and that the alloy consequently tends to change with time to that form which is stable at normal temperatures. This change involves the precipitation within the alloy of a relatively hard and brittle compound of copper and aluminum. It is the precipitation of this hard and brittle compound within the alloy that causes the decrease in physical properties known to occur in castings with time, that is upon "aging".

Study of the ternary equilibrium diagram of zinc-copper-aluminum shows that the presence of the copper-aluminum compound under equilibrium conditions at normal temperatures is dependent on the ratio of copper and aluminum in the alloy.

Based on these facts and laboratory investigation I have discovered that a zinc base alloy containing from about 15% to about 35% aluminum and from about 0.01% to about 0.2% magnesium has superior physical properties to other alloys at present used in die castings. The alloy is improved in certain respects, particularly by increased tensil strength and hardness, by additions of small amounts of copper. The aluminum is preferably from about 20% to about 24% and it is desirable to keep the magnesium as low as possible but sufficient to prevent inter-crystalline corrosion. Where copper is added it is preferred from about 0.01% to about 5%. I have discovered that a zinc base alloy containing around 20% aluminum and about 0.1% magnesium has very superior physical properties to other alloys at present used in die castings. The same was found to be true of a similar alloy containing about 20% aluminum, about 1% copper and about 0.05% magnesium.

I have discovered further that the physical properties especially the ductility and impact strength increase with time. I have discovered still further that this increase in physical properties may be obtained and hastened by suitable heat treatment. It is intended that this beneficiation of physical properties by heat treatment shall form a part of this patent. I have found that with these alloys by heating for various lengths of time depending on the temperature certain improvement in their properties can be secured particularly the ductility and impact resistance, and the higher the temperature the more rapid the effect up to temperatures slightly below the transformation temperature of the alloy. The maximum temperatures to which the alloy can be heated to secure this improvement depend in a large measure upon the casting conditions, the design of casting and the composition of the alloy. The beneficiation by heat treatment, that is improvement in physical properties by heat treatment is very important.

Having thus set forth the nature of my invention, what I claim is:

1. A zinc base alloy containing above 15 and up to about 35 percent of aluminum, about 0.01 to about 0.2 percent of magnesium, and the remainder zinc metal.

2. A zinc base alloy containing about 20 percent aluminum, about 0.1 percent magnesium, and the remainder zinc metal.

3. A zinc base alloy comprising from about 20% to about 24% aluminum, about 0.01% to about 0.2% magnesium, and the balance zinc metal.

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