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ALUMINUM ALLOYS

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2 Claims. (Cl. 75—1)

The invention relates to aluminum base alloys containing magnesium which are characterized by good casting characteristics and good properties at elevated temperatures and the invention has as its general object the provision of such alloys.

The aluminum base magnesium alloys have general properties which recommend their use for many purposes, including their use as reciprocating parts operating at elevated temperatures. They are somewhat deficient, however, in tensile strength at elevated temperatures (i. e., temperatures of about 400 to 700° Fahrenheit). In order to increase the strength of these alloys at elevated temperatures, it is necessary to add to the alloy other alloying elements, but the difficulty is that most elements when so added destroy to a large extent the necessary alloy property of ductility and likewise impair the casting properties of the alloy. Since it is an important property in alloys designed for higher temperature use that they cast readily in sand or permanent molds to form intricate shapes, any impairment of the casting properties is a decided disadvantage.

In experimenting to the end of providing suitable alloys of the above nature, we have discovered that the addition of certain elements to certain of the aluminum base alloys containing magnesium produces an alloy which has a good tensile strength at elevated temperature and an adequate ductility and combines with these necessary properties such casting characteristics as allow of casting the alloy in intricate shapes in either permanent or sand molds. The alloys which we have discovered and to which we now refer contain about 3.0 to 8.0 per cent by weight of magnesium, about 1.0 to 6.0 per cent by weight of copper, about 0.5 to 3.5 per cent by weight of chromium, and about 0.05 to 0.4 per cent by weight of antimony and/or bismuth, the balance of the alloy being principally aluminum.

In experimenting with such alloys we have found the small amount of antimony and/or bismuth to be an important part of the alloy, particularly in its effect in maintaining an adequate ductility in the alloy at elevated temperatures. For this purpose, antimony and bismuth may be defined as a class although bismuth is, we have found, somewhat superior. The antimony and bismuth may be used separately in the alloy or may both be present therein. Their amount, either separately or in total, should not, we have found, exceed greatly about 0.4 per cent by weight of the total alloy because in greater amounts their tendency to favorably affect the ductility of the alloy disappears and the ductility becomes adversely affected.

In the manufacture of our alloys, any of the well known methods of making alloys may be used. For instance, the aluminum may be melted and the other alloying elements added, in desired proportions, to the molten aluminum.

Another property of these alloys is their improved fluidity as compared with the alloys which have, heretofore, been widely used as a material for parts operating at elevated temperatures. Comparative tests, based upon the distance that the molten alloy, originally heated to a given temperature, will flow through a spiral formed in a sand mold, have shown that our novel alloys are very superior with respect to fluidity.

The aluminum used in the manufacture of the alloys may be of the highest purity or it may contain amounts of usual impurities, and the term "aluminum" as used herein and in the claims designates the aluminum of commerce. It is an incidental property of our alloys that the presence of iron in amounts as high as 2 per cent by weight is not harmful to the high temperature properties of the alloys and, therefore, a wide choice between the various grades of commercial aluminum is possible.

An example of the excellent properties of our new alloys at elevated temperatures is the case of a sand casting made of an alloy containing 6 per cent by weight of magnesium, 3 per cent by weight of copper, 1.5 per cent by weight of chromium, and 0.05 per cent by weight of antimony, the balance being principally aluminum. This sand casting was heated for 4 hours at 700° Fahrenheit and then cooled to 600° Fahrenheit and tested at the latter temperature. The tests proved the casting to have a tensile strengh of 17,100 pounds per square inch and an elongation of 3.5 per cent in 2 inches.

These properties may be compared with those of a sand casting of a composition exactly similar to the above with the exception that it contained no antimony. This sand casting was heated for the same time at the same temperatures and tested in a similar manner. The tests showed the casting to have a tensile strength of 16,600 pounds per square inch and an elongation of only 1.5 per cent in 2 inches.

Having thus described our invention, we claim:

1. A metallic alloy consisting of 3.0 to 8.0 per cent by weight of magnesium, 1.0 to 6.0 per cent by weight of copper, 0.5 to 3.5 per cent by weight of chromium, and about 0.05 to 0.4 per cent by weight of at least one of the class of elements antimony and bismuth, the total amount of the antimony and/or bismuth being not greater than 0.4 per cent by weight, the balance of the alloy being substantially aluminum.

2. A metallic alloy consisting of 6 per cent by weight of magnesium, 3 per cent by weight of copper, 1.5 per cent by weight of chromium, and 0.05 per cent by weight of antimony, the balance being substantially aluminum.

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