

UNITED STATES PATENT OFFICE

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ALUMINUM ALLOYS

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2 Claims. (Cl. 75—1)

This invention relates to aluminum base alloys containing substantial amounts of magnesium and to the improvement of the properties of the same.

5 The aluminum base alloys containing 2 to 15 per cent by weight of magnesium are, because of recent developments making them available as commercial alloys, among the most useful of the aluminum alloys. Their light weight, by reason of their content of magnesium, their high strength, and their resistance to corrosion have recommended them strongly as a structural material. In one of the most important uses to which aluminum base alloys can be put, i. e., as moving parts reciprocating at elevated temperatures, the aluminum-magnesium alloys have been found somewhat deficient in strength and ductility. It is to the improvement of such properties at elevated temperatures (i. e., temperatures of about 400° to 700° Fahrenheit) that the present invention is directed.

We have, in the course of an extensive experimentation, discovered that the addition of small amounts of antimony and/or bismuth to the aluminum alloys containing 2 to 15 per cent of magnesium will appreciably benefit such alloys and, in particular, will tend to maintain a substantial part of the tensile strength and elongation of the alloys when the alloys are subjected to elevated temperatures. For this purpose, antimony and bismuth may be considered as a class of metals although we have observed that bismuth is to some extent superior. The amount of antimony and/or bismuth which may be added to the aluminum-magnesium alloys aforesaid to obtain these results lies within a rather narrow range. We have discovered that the effect upon the properties of the alloy is had when amounts of antimony and/or bismuth are added corresponding to 0.05 to 0.4 per cent by weight of the total alloy. But when the antimony and/or bismuth content of the alloy exceeds about 0.4 per cent by weight of the total alloy, the effect produced is the reverse and the alloy loses both tensile strength and ductility, particularly the latter. We have found that the effect of antimony and bismuth is particularly pronounced in aluminum base alloys containing 2 to 8 per cent by weight of magnesium.

50 The antimony and bismuth may be used separately or they may both be present in the alloy, but in any case the total amount of these elements should not exceed about 0.4 per cent by weight. Aluminum base alloys containing 2 to 55 15 per cent of magnesium and 0.05 to 0.4 per cent

of antimony and/or bismuth in accordance with the principles of my invention are considerably improved in their resistance to high temperatures. For instance, a sand cast alloy containing 6.0 per cent by weight of magnesium, balance principally aluminum, after heating for 4 hours at 700° Fahrenheit and then cooled to 600° Fahrenheit, had, when tested at the latter temperature, a tensile strength of about 14,880 pounds per square inch and an elongation in 2 inches of about 7.5 per cent. A sand cast alloy of the same composition except that there was present 0.1 per cent of antimony had, after the same thermal treatment and at the same final temperature, a tensile strength of 15,580 pounds per square inch and an elongation in 2 inches of 9.8 per cent. This example is indicative of the results obtained by the practice of my invention whether antimony or bismuth is the alloying element used. Another example of the beneficial effect of small amounts of antimony and/or bismuth in aluminum-magnesium alloys is shown in the case of a sand cast alloy containing 7 per cent magnesium. This alloy had a tensile strength of 29,700 pounds per square inch, a yield point of 18,000 pounds per square inch, an elongation of 7.6 per cent in 2 inches, and a Brinell hardness of 66. When to this alloy there was added about 0.2 per cent of antimony and about 0.12 per cent of bismuth, the tensile strength of the alloy was increased to about 34,000 pounds per square inch, the yield point was increased to about 18,200 pounds per square inch, the elongation was increased to 11 per cent in 2 inches, and the hardness was increased to 70.

The above-described alloys may be manufactured by any of the well known methods such as for instance by melting the aluminum and introducing into the molten aluminum the proper amounts of the alloying elements in solid form.

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.

We claim:

1. A metallic alloy characterized by high physical and tensile properties at elevated temperatures and consisting of 2.0 to 15.0 per cent by 116

weight of magnesium 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 being aluminum. 80

2. A metallic alloy characterized by high physical and tensile properties at elevated temperatures and consisting of 2.0 to 8.0 per cent by

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