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MAGNESIUM-BASE ALLOY

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Our invention relates to the preparation of magnesium-base alloys which are suitable for rolling into sheets and drawing into tubes and may also be extruded and treated, in general, in the usual manner in which magnesium or magnesium-base alloys are fabricated.

It is well known that a pure or substantially pure magnesium has a greater resistance to corrosion than magnesium-base alloys and that, of the alloying elements which are conventionally added to magnesium, manganese brings about the least reduction of corrosion resistance. Heretofore, it has been exceedingly difficult to add manganese to magnesium in amounts greater than about 1% to 2% manganese without obtaining a non-homogeneous alloy.

In accordance with our invention, manganese may be incorporated into magnesium in substantial amounts, in a relatively simple manner, without interfering with the desired homogeneity of the resulting alloy. We have found that if lithium is added to magnesium, the amount of manganese which ordinarily can be incorporated with the magnesium without effecting production of a non-homogeneous alloy may be substantially increased. The amount of manganese which may be incorporated with the magnesium to produce a homogeneous alloy is determined, in part, by the amount of lithium which is present. Thus, for example, with 5% lithium, 10% of manganese may be readily incorporated into magnesium with the production of a homogeneous alloy.

In general, the alloys of our invention contain from about 1% to about 10% lithium, from about 2% to about 10% manganese, balance substantially all magnesium.

We have also found that the addition of silver to the lithium-manganese-magnesium alloys, described hereinabove, increases their strength in the cold rolled condition and somewhat improves their casting properties. The amount of silver which brings about these properties is of a small order, from about 0.5% to about 2.0% being sufficient in at least most cases.

The following examples are illustrative of alloys made in accordance with our present invention. It will be understood that various changes may be made with respect to proportions of the alloying ingredients, within the ranges set out hereinabove, and that other changes may be made without departing from the spirit of the invention in the light of the guiding principles which are dsclosed herein.

Example 1

An alloy was made containing 85% magnesium, 10% manganese, and 5% lithium, using redistilled magnesium, electrolytic manganese having a purity in excess of 99.9%, and a highly pure grade of lithium. The alloy was melted in a helium atmosphere. However, fluxes such as are used for the commercial melting of magnesium-base alloys may be used to protect the surface of the metal during melting. The alloy, when cast, had a hardness of 27 when measured on the Rockwell F scale. The alloy may be cold rolled by any of the usual processes. When substantially fully cold worked to form a sheet, it has a hardness of 70 measured on the Rockwell F scale. The alloy is considerably harder and stronger than at least most other magnesium-base alloys which have heretofore been made available. This increased hardness and strength make the alloy particularly valuable for the construction of various parts of airplanes.

Example 2

An alloy was made containing 83% magnesium, 10% manganese, 5% lithium, and 2% silver, said alloy being prepared from the same grade of alloying elements and in the same manner as described in Example 1. The resulting alloy, when cast, is considerably harder than the alloy of Example 1. Thus, in the cast condition, it has a hardness of 40 measured on the Rockwell F scale whereas in substantially the fully cold worked condition it has a hardness of 75 measured on the Rockwell F scale. The density of the alloy was approximately 2.0. This alloy, like that of the first example, lends itself to all of the usual forms of cold working.

As we have indicated hereinabove, in the practice of our invention we prefer to employ alloying metals of high purity. The magnesium, as we have indicated, is preferably a redistilled product. The manganese, for best results, should be at least 99.0% pure and preferably of even greater purity. The manganese utilized may be produced by a vacuum distillation process but we prefer, particularly, to employ electrolytic manganese having a purity of at least about 99.0% and preferably of 99.9%. The lithium, and silver where used, are also preferably of a high degree of purity.

What we claim as new and desire to protect by Letters Patent of the United States is:

1. Magnesium-base alloys containing from about 1% to about 10% lithium, from about 2% to about 10% manganese, balance substantially all magnesium.

2. Cold worked magnesium-base alloys containing from about 1% to about 10% lithium, from about 2% to about 10% manganese, and balance substantially all magnesium, said alloys having a hardness in excess of 40 measured on the Rockwell F scale.

3. Magnesium-base alloys containing about 5% lithium, about 10% manganese, balance substantially all magnesium.

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