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UNITED STATES PATENT OFFICE

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LIGHT ALUMINUM ALLOY

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This invention is a new and useful light aluminum alloy, available either for casting or working purposes.

The main object of the invention is to afford a light aluminum alloy which can be subjected to suitable heat treatment to improve its properties of tensile strength or hardness or both, and which alloy also possesses the property of high resistance to corrosion, for example from exposure to air which is moist and briny. Heretofore light aluminum alloys well adapted to heat treatment have possessed but low resistance to corrosion. On the other hand alloys having corrosion resisting properties have been but ill adapted to heat treatment. With the present improvement an alloy is afforded which possesses the property of lightness, is heat treatable to strengthen and harden the same, and is well constituted to resist corrosion. Further objects and advantages of the invention will be explained in the hereinafter following description of illustrative embodiments thereof or will be understood to those conversant with the subject.

The present alloy is composed chiefly of aluminum, which may substantially exceed 90% of the total weight. Certain traces of usual impurities are permissible so long as they do not exceed the limit of such impurities as permitted in commercially pure aluminum, such as traces of copper, silver, tin, nickel, cobalt, iron, chromium, etc.

The components which chiefly insure heat treatability are small percentages of magnesium and of manganese, together with a percentage of silicon in an amount and for a purpose which will be below further described. These components may be referred to as the first group.

The anti-corrosion properties are herein afforded principally by one or more or all of certain components, constituting a second group for the purposes hereof. For example a small percentage of antimony or of cadmium will serve, or a portion of each, and it has been discovered that arsenic may be included in this group with similar effect.

An illustrative formula will first be stated, followed by an explanation thereof, and thereafter a recital of certain illustrative modifications within the scope of the improvement. The formula or composition may be as follows, stated in percentages, by weight:

Magnesium	0.2 to 1.0
Manganese	0.2 to 1.0
Silicon	up to 5.0
Antimony and/or cadmium and/or arsenic	up to 2.0
Aluminum	balance

In explanation of the above formula, the first three components or group represent the strengthening or hardening influence, this being in a general way well known. For the purpose of the present improvement, however, the following condition is important. The silicon has been stated as being used up to 5%, but the proportion of silicon, below such 5%, should nevertheless be sufficiently great, for example above 0.5%, that the entire content of both magnesium and manganese become and are chemically combined with the silicon. By this proportion of silicon it is insured that the magnesium will exist in the finished alloy as silicid of magnesium only, and not in any other form, and it will be as finely distributed and divided as possible.

In fact it was found that only after the whole content of manganese has been chemically combined with silicon to form silicid of manganese the silicon combines with magnesium. The heat treatability is the greatest and the resistance to corrosion is satisfactory only when the entire content of both magnesium and manganese be chemically combined with the silicon. The special combination between magnesium, manganese and silicon which enables the satisfactory combining in the same alloy of the heat treatment components and the non-corrosion components is the basic thought back of the present invention.

The second group content, comprising antimony and/or cadmium and/or arsenic may consist of any one only of the elements in this group, or two of them or all of them, the total percentage by weight thereof to be main-

tained below 2%, being variable however, for example between 0.05 and 1.5% in accordance with the particular component used or with the degree of resistance to corrosion which may be demanded. An excess or deficiency is a detriment to the property desired.

Among modifications falling within the described invention is the addition to the aforesaid second group of metals or elements of another metal, bismuth, and as with the others of this group bismuth may be used alone, or may be combined with any one or more or all of the others of the group, so that the total percentage of this group in the final alloy substantially does not exceed 2%. It has been further discovered that an advantage pertains to the addition of bismuth to the formula in that this component also improves substantially the effect of heat treatment of the alloy.

The improved alloy set forth in the above formula may be subjected to heat treatment, for example in the usual manner of heat treatments, by annealing the article or product at a temperature between 500° C. and 600° C., followed by quenching and then artificial aging at a temperature between 100° C. and 200° C.

As a result of a number of tests of rolled or sheet products prepared from this improved alloy, the average tensile strength has been ascertained as amounting to 34 to 36 kilograms per square millimeter. For cast products or bars in which the silicon content suitably exceeds 1.5% an average tensile strength of about 30 kgs. per square mm. is obtained. When a substantial percentage of bismuth is included in the composition the tensile strength may average as high as 39 to 42 kgs. per square mm. for sheet material.

The resulting alloys and products possess good resistance to corrosion not only by moist and briny air, but also by hydrochloric acid, or by either diluted or concentrated nitric acid, or by fruit acids and the like. The alloys hereof moreover are found to have an increased resistance against corrosion by alkaline agents.

The alloying of the described components may be according to known practise, with due regard to the order of combining the components, the temperatures and the mode of mixing and pouring the product.

There has thus been described a light aluminum alloy according to this invention possessing the properties and advantages referred to. Since matters of proportion, ingredient and method of alloying may be varied within the principles of the invention it is not intended to limit the invention to such matters except to the extent set forth in the appended claims.

What I claim is:

1. A light alloy of aluminum resistant to corrosion and heat treatable for strength or hardness, characterized by a content of approximately 0.2 to 1.0 per cent of magnesium, 0.2 to 1.0 per cent of manganese, 0.05 to 2 per cent of one or more of the elements of the group consisting of cadmium, antimony and arsenic, and with a proportion of silicon not exceeding 5.0 per cent but at least so high that the whole content of manganese and magnesium is combined with silicon, and the balance being substantially wholly aluminum.

2. A corrosion resistant and heat treatable light aluminum alloy as in claim 1, further characterized by the fact that the same contains bismuth instead of or together with one or more of the elements of the group consisting of antimony, cadmium and arsenic, the whole amount of bismuth and the elements of said group not exceeding 2.0 per cent.

3. A heat treatable light alloy of aluminum resistant to corrosion consisting substantially wholly of aluminum but characterized by a content of about 0.2 to 1.0 per cent of magnesium, about 0.2 to 1.0 per cent of manganese, about 0.05 to 2 per cent of one or more of the elements of the group consisting of cadmium, antimony, arsenic and bismuth, and with a proportion of silicon not exceeding about 5.0 per cent but at least so high that the whole content of manganese and magnesium is combined with silicon.

4. A light alloy of aluminum which is both heat treatable and resistant to corrosion, characterized by a content of 0.2 to 1.0 parts of magnesium, 0.2 to 1.0 parts of manganese, 0.05 to 2 parts of one or more of the elements of the group consisting of cadmium, antimony, arsenic and bismuth, with a proportion of silicon not exceeding about 5.0 parts but at least so high that the whole content of manganese and magnesium is combined with silicon, and about 90 to 99 parts of aluminum.

In testimony whereof, this specification has been duly signed by:

MAX BOSSHARD.