

UNITED STATES PATENT OFFICE.

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ALLOY.

1,352,272.

Specification of Letters Patent.

Patented Sept. 7, 1920.

No Drawing.

Application filed July 30, 1919. Serial No. 314,262.

To all whom it may concern:

Be it known that we, ZAY JEFFRIES and WILLIAM A. GIBSON, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Alloys, of which the following is a specification.

This invention relates to improvements in aluminum alloys and is concerned more particularly with aluminum alloys containing zinc as one of their constituents.

One object of the invention is to provide an aluminum-zinc alloy having high tensile strength and elastic limit and also a sufficiently great ductility to render the alloy suitable for uses where it is subjected to serve strains and shocks.

Another object of the invention is to provide an aluminum-zinc alloy which is susceptible to beneficial heat treatment.

Another object of the invention is to provide an aluminum-zinc alloy having superior physical properties in combination with ease of preparation and good casting, machining and working qualities.

In a co-pending application for patent Serial No. 314,261, filed July 30th, 1919, we have described an aluminum alloy containing zinc, copper and iron and have pointed out the marked advantages possessed by it. Since the development of that alloy we have discovered that the physical properties of an alloy of that character can be improved notably by the addition to the alloy of magnesium in suitable small amounts, and it is this alloy containing magnesium that constitutes the subject matter of the present application.

The advantages of our present invention, in the case of castings, can be secured in substantial measure by keeping the composition of the alloy within the following limits, although the proportions of the various constituents may vary through a considerable range as shown in the co-pending application and still retain to a certain degree the advantages of this alloy:

Zinc	6%	to 8%
Copper	2.5%	to 3.5%
Iron	1.0%	to 1.5%
Magnesium	0.10%	to 0.30%
Aluminum	Remainder.	

The percentages here, as elsewhere in this application, are by weight.

Alloys such as these, but without the magnesium, as we have indicated in our co-pending application above referred to, when cast in ordinary green sand molds have tensile strengths ranging from 24,000 pounds to 30,000 pounds per square inch, elastic limits ranging from 15,000 pounds to 17,000 pounds per square inch, elongations of about 6%, Brinell hardness numbers ranging between 55 and 60 and specific gravities less than 3. The marked effects from the addition of magnesium may be indicated by a specific example representing a preferred composition. An alloy composed of 8% zinc, 3% copper, 1% iron, 0.25% magnesium and the remainder aluminum, cast in green sand as before, we have found to show a tensile strength of over 35,000 pounds per square inch, an elastic limit as high as 30,000 pounds per square inch and elongation of about 1.6%. Thus, the effect of adding the magnesium is markedly beneficial except in the case of the elongation, and we have found it possible to overcome this difficulty by heat treatment, which results in some increase of the tensile strength and the elastic limit and in the very great increase of the elongation from about 1.6% to about 3.25%. We have found that about 0.25% magnesium, in the case of castings, gives the maximum elongation.

Our improved alloys can be prepared in various ways which will be obvious to those skilled in the art but in practice we prefer to proceed as follows in preparing and using the alloys.

Copper and iron in the relative proportions required for the alloy are melted together with sufficient aluminum to reduce the melting point of the mixture to approximately the melting point of aluminum. To this alloy is then added calculated amounts of aluminum, zinc and magnesium. The metal should be thoroughly stirred during the melting and prior to the drawing off of the metal for casting so as to insure a uniform mixture. A pouring temperature of about 1300° F. in the ladle is suitable for this alloy. The alloy can be cast either in sand molds or in permanent molds with good results. In the cast condition it machines well and can also be rolled and otherwise worked. In this connection it is to be noted that when the alloy is to be rolled or otherwise worked, a larger proportion of magnesium, up to 0.50%,

can be used without making the metal unduly hard and brittle, since such mechanical working increases the ductility of the metal.

5 In the heat treatment of castings or articles made of the improved alloys we prefer to use the method of heat treatment which has been developed by one of us, namely, Dr. Zay Jeffries, and which constitutes the
10 subject matter of a separate application for patent. It will suffice here to state that the process in its preferred form consists in heating the castings or articles for one hour (more or less according to the size and thickness of the sections of the article) in a bath
15 composed of approximately equal parts of potassium nitrate and sodium nitrate which is held at a temperature of approximately 900° F. After the heating in this bath, the
20 castings or articles are removed and quenched in a bath of non-oxidizing oil maintained at room temperature. After the quenching, the castings are reheated for about one hour in a bath of non-oxidizing
25 oil maintained at a temperature of approximately 300° F. Following this heating in oil the articles are removed from the oil bath and permitted to cool in the air.

The effects of this heat treatment have
30 been noted above, the most notable effect being the large increase in the elongation, thus adapting the alloys for various structural uses which demand materials capable of withstanding severe shocks and strains.

35 As is well known to those experienced in the commercial working of aluminum, the

metal available in commercial quantities always contains impurities, especially iron and silicon. Iron thus present should be allowed for in making up the alloys and
40 care should be taken to keep the silicon down to a minimum.

It will also be understood that while in the foregoing description we have set forth the preferred compositions of the alloys and
45 the preferred methods of preparing and heat treating them, we do not intend to limit our invention in these respects except as defined in the appended claims.

What we claim is:

50 1. An alloy containing aluminum from 4% to 25% zinc, from 2% to 5% of copper, from .5% to 1.5% iron and an appreciable amount of magnesium.

2. An alloy containing aluminum from
55 4% to 16% of zinc, from 2% to 5% of copper, from .5% to 1.5% of iron, from .10% to .50% of magnesium with aluminum comprising the remainder.

3. An alloy containing 6% to 8% of zinc,
60 2.5% to 3.5% of copper, 1.0% to 1.5% of iron, from an appreciable amount to 0.50% of magnesium and with the remainder of the alloy composed of aluminum.

4. An alloy containing 8% of zinc, 3%
65 of copper, 1.2% of iron, 0.25% of magnesium and with the remainder composed of aluminum.

In testimony whereof we hereunto affix our signatures.

ZAY JEFFRIES.

WILLIAM A. GIBSON.