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ALUMINUM ALLOY

John Bartow Bates, Euclid, Ohio, assignor to Titanite Alloys Corporation, Euclid, Ohio, a corporation of Ohio

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2 Claims. (Cl. 75—142)

This invention relates to aluminum alloys and more particularly to alloys adapted for making castings that do not require subsequent heat treatment. The invention has for its main object the improvement of the aluminum-manganese-titanium alloy described and claimed in my prior application Serial No. 751,588, filed November 5, 1934, by the addition of other metals thereto, for the purpose of modifying the characteristics of the aluminum-manganese-titanium alloy so as to provide an alloy better adapted for certain types of castings.

A further object of my invention is to provide an improved aluminum-manganese-titanium base alloy that will possess the properties of high tensile strength and sufficient elongation to meet the requirements for certain types of castings that have heretofore been made from other alloys that require subsequent heat treatment in order to give to the castings the desired physical qualities. This results in a material reduction in the cost of manufacture of such castings.

A further object of the invention is to provide an aluminum-manganese-titanium base alloy having copper added thereto for the purpose of increasing the tensile strength and at the same time provide an alloy which, when melted, has sufficient fluidity and melts at a sufficiently low temperature to make satisfactory castings varying widely in cross-section and configuration.

As a result of my investigation of alloys of aluminum, manganese and titanium and made in accordance with my prior invention as described and claimed in my said application Serial No. 751,588, I have found that an alloy containing 1.75% manganese, 0.17% titanium and the balance aluminum, when cast in a graphite test-bar mold, shows tensile strength of 25,000 lbs. per square inch with 20% elongation. The same alloy cast in a sand test-bar mold shows a tensile strength of 23,000 lbs. per square inch and a 10% elongation. I have discovered that by adding 0.5% magnesium to this alloy, a test-bar made in a graphite mold shows a tensile strength of 28,000 to 29,000 lbs. per square inch with 14% elongation, and when cast in a sand mold shows 27,000 lbs. tensile strength with 5% elongation. These results develop after a normal aging period of from two to three weeks.

I have also discovered that by reducing the manganese in the above aluminum-manganese-magnesium-titanium alloy to 1.50% and adding 1.50% of copper this alloy, when cast in a sand test-bar mold, can be made to develop a tensile strength of 30,000 lbs. per square inch with 4.5% elongation after aging.

The silicon in an alloy to be used in a sand mold must be kept low and, as there is sufficient silicon in commercial 99% aluminum to combine with the magnesium, in the aging process, no silicon is added in making the alloy. For a chill-cast alloy the silicon is necessary, up to about 2.5% to overcome the shrinkage characteristics and, while this relatively high percentage of silicon affects the elongation somewhat, the latter is not lowered to a point where the utility of the alloy is destroyed.

I have discovered that the addition of 2.0 to 2.5% of zinc to the above aluminum-manganese-titanium-magnesium alloy improves the casting quality of the alloy considerably without changing its tensile strength or elongation, and the zinc also increases the fluidity and allows a lower pouring temperature. Thus, while the effect of the added zinc is to improve its casting qualities, the physical characteristics of the alloy are not materially changed.

The following is an example of an alloy made in accordance with this invention:

	Per cent
Manganese	1.25
Copper	1.25
Magnesium	0.25 to 0.50
Titanium	0.15 to 0.18

Balance—commercial aluminum with attendant impurities not in excess of 1%.

In making the above alloy the manganese may be introduced in the form of pure manganese or an aluminum-manganese "rich" containing 95% aluminum and 5% manganese, and the titanium may be introduced in the form of an aluminum-titanium "rich" containing 94% aluminum and 6% titanium. The copper may be added either by using an aluminum-copper "rich" or pure copper and the magnesium may be added as pure magnesium.

Another example of an alloy made in accordance with this invention is composed of the following:

	Per cent
Manganese	1.5
Copper	1.5
Magnesium	0.25 to 0.50
Titanium	0.15 to 0.18

Balance—commercial aluminum.

To either of the above alloys pure zinc to the extent of 0.02 to 5.0% may be added with beneficial results as to the casting qualities of the alloy, without affecting the tensile strength or elongation materially. I have also found that alloys made in accordance with my invention may contain up to 1.2% of iron without detrimental effect. While I do not recommend adding iron to the alloy, some iron will be incidentally picked up from iron crucibles and ladles and I have found that, so long as the amount of iron does not materially exceed 1.2% of the alloy, it does not affect its physical characteristics and may be considered as an impurity rather than as an essential element of the alloy.

Having thus described my invention, I claim:

1. A casting alloy consisting of 0.5 to 5.0% of manganese, 0.05 to 0.5% of titanium, 0.5 to 8.0% of copper, 0.1 to 4.9% of magnesium, 0.1 to 4.9% of silicon, the aggregate amount of the magnesium and silicon free and combined as magnesium silicide being limited to 5% of the alloy, and the balance commercial aluminum having impurities not in excess of 1.0%.

2. A casting alloy consisting of 0.5 to 5.0% of manganese, 0.05 to 0.5% of titanium, 0.5 to 8.0% of copper, 0.1 to 4.9% of magnesium, 0.1 to 4.9% of silicon, the aggregate amount of the magnesium and silicon free and combined as magnesium silicide being limited to 5% of the alloy, 0.02 to 5% of zinc, and the balance commercial aluminum having impurities not in excess of 1.0%.

JOHN BARTOW BATES.