Patented June 27, 1933

1,916,087

UNITED STATES PATENT OFFICE

COURT C. TITUS, OF NEW YORK, N. Y.

ALUMINUM ALLOY

No Drawing. Application filed April 29, 1933. Serial No. 668,666.

My invention relates to a series of aluminum alloys of novel composition and properties. The alloys of my invention are particularly characterized by the presence of boron, magnesium and silicon.

Alloys consisting principally of aluminum and containing substantial amounts of boron, magnesium and silicon are characterized by being lighter, harder and stronger than aluminum. The amount of magnesium in the new alloys may vary from about 0.25 to about 5.0%, although it is generally desirable to add not more than about 1.5% of magnesium. The amount of boron may vary from about 0.05% to about 2.0, although at least 0.25% is preferable, and in many cases it is preferable to add not more than 1% of boron due to the increased brittleness caused by higher amounts. The silicon may advantageously be present in amounts of from about 0.5% to about 7.5%, and in general it is preferable that not more than about 4.5% of silicon be present. The amount of aluminum should in general be at least about 90%. For many purposes it is advantageous to use aluminum in amounts of from about 93% to about 96%.

While the alloys consisting substantially solely of aluminum, magnesium, boron and silicon are valuable for many uses, the alloys are particularly valuable when they also contain other metals. Alloys of aluminum, magnesium, boron and silicon containing such metals as copper, nickel, cobalt, zinc, vanadium, tungsten, molybdenum and chromium provide a series of alloys characterized by their light weight, together with high hardness, tensile strength, and resistance to corrosion. In general, the new alloys have a surprisingly high electrical conductivity.

The following specific formulæ are illustrative of the wide range of compositions of the invention:

An alloy which is particularly valuable for the manufacture of electrical conductors, because of its high conductivity and tensile strength, has the following composition:

	Percent
Magnesium	0.50
Boron	0.25
Silicon	0.65
Aluminum	Remainder

An alloy of high malleability and good conductivity is represented by the following composition:

	Percent
Magnesium	0.75
Boron	0.50
Silicon	3.50
Copper	3.00
Aluminum	Remainder

The following alloy is characterized by its high tensile strength:

	Percent
Magnesium	1.00
Boron	0.50
Silicon	3.50
Nickel	3.00
Aluminum	Remainder

Another alloy of high tensile strength has the composition:

	Percent
Magnesium	1.50
Boron	0.75
Silicon	3.00
Cobalt	2.25
Aluminum	Remainder

The presence of vanadium in alloys of the invention increases their tensile strength and toughness and decreases the tendency to crystallization in use. An example of a useful alloy of the invention containing vanadium is the following:

	Percent
Magnesium	0.50
Boron	0.35
Silicon	2.75
Nickel	2.65
Vanadium	0.75
Aluminum	Remainder

Metals other than aluminum, magnesium, boron and silicon may, in general, be present in the alloys of the invention in amounts of from 0.25 to 7.5%, although the presence of not more than 5% of such other metals is frequently desirable.

In general it may be said that a principal function of boron in the alloys of the invention is to increase the hardness and conductivity of the alloys and to increase their resistance to corrosion, a principal function of the magnesium is to decrease the specific gravity and increase the resistance to corrosion, while a principal function of the silicon is to increase the tensile strength and corrosion resistance and to decrease the specific gravity.

As indicated above, other metals may be added for the purpose of increasing tensile strength, malleability, resistance to corrosion, electrical conductivity and other special properties.

Alloys of the invention as described above have been obtained having a specific gravity of from 2.60 to 2.80, more generally 2.66 to 2.74, a tensile strength when cast of 27,000 to 35,000 pounds per square inch, and when mechanically worked of from 36,000 to 55,000 pounds; and an electrical conductivity as high as 56 (Ag=100). Rolled sheets of alloys of the invention have shown an elongation at break as high as 26%.

The metals may be utilized in the cast condition or they may be rolled, drawn or otherwise worked. Mechanical working is advantageously carried out at a temperature of 150–450° C. and such working effects a material increase in the tensile strength of the alloys.

An advantageous method of producing the alloys of the invention is as follows: The aluminum is melted in a crucible and covered with a layer of powdered charcoal. The charcoal serves to protect the metal from oxidation and to reduce those metals which are added in the form of oxides. The magnesium and silicon are added as metal and the boron as oxides. Other metals may be added as such or in the form of their oxides, according to the nature of the particular metal. The added metals or their oxides are advantageously added enclosed in aluminum capsules. The boron oxide is preferably added to the melted aluminum first. The other metals or oxides may be added together.

I claim:

1. Alloys consisting principally of aluminum and characterized by containing from 0.05% to 2.0% of boron, from 0.25% to 5.0% of magnesium, and from 0.5% to 7.5% of silicon.

2. Alloys consisting principally of aluminum and characterized by containing from 0.25% to 1.0% of boron, from 0.25% to 1.5% of magnesium, and from 0.5% to 4.5% of silicon.

3. Alloys consisting principally of aluminum and characterized by containing about 0.25% of boron, about 0.50% of magnesium, and about 0.65% of silicon.

In testimony whereof, I affix my signature.

COURT C. TITUS.