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ALUMINUM-BASE ALLOY.

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This invention relates to the provision of an aluminum base alloy having a low copper content, and also containing small quantities of magnesium and silicon, which is possessed of very desirable physical properties in its cast condition, is of very light weight in proportion to its strength, and is capable of a very simple heat treatment by which its physical properties are substantially improved. This heat treatment consists of heating for a period of time at a high temperature, subsequently quenching in water or other suitable medium, and then artificially aging at a comparatively low temperature for a few hours.

More specifically an object of my invention is to provide for use in the cast condition an aluminum base alloy containing about 2.5% copper, 1.25% iron, .5% magnesium, and about .3% silicon, the balance of about 95.5% being aluminum.

Further objects will be more fully set forth in detail in the following description and in the claims.

The approximate composition of the alloy in accordance with this invention is as follows: Copper, 2.5%, iron 1.25%, magnesium .5%, silicon .3%, and the balance aluminum. Such an alloy is particularly useful in aircraft or aircraft engine and automotive construction, since it has a specific gravity of about 2.7% and an ultimate strength of about 24,000 lbs. per sq. in. as sand cast, and elongation of about 5% as cast, which is an extremely good combination of strength and ductility, and not ordinarily obtainable in other alloys without heat treatment.

The copper content may be varied between 2.25% and 3.25%. Alloys with lower copper content than 2.25% do not respond materially to heat treatment. If the copper content exceeds the maximum stated, the ductility drops off rapidly.

The iron content may be between the limits of .5% and 1.5%. Its effect is to increase the ductility apparently without modifying the tensile strength. The magnesium and silicon are present in the ratio of about 1.7 to 1. The magnesium content may be varied from .25% to .75%, the silicon being varied between .2% and .75%. The effect of increasing the magnesium is to embrittle the alloy. Decreasing it below .4% prevents a complete response to heat treatment. The aluminum content varies from 94.7 to 96.5%. It will be observed that as the copper content decreases, the total content of magnesium and silicon together is increased in a fairly constant manner, although not according to any arithmetical ratio, according to the following table:

Copper content.	Silicon.	Magnesium.
2.	.5	.85
2.5	.3	.50
3.	.25	.40
3.5	.2	.35

The amount of iron present may be varied according to the characteristics of the metal desired. The alloy, being free from zinc has desirable casting properties and strength at elevated temperatures.

The best results are obtained by having the copper present in quantities between 2.3 and 2.7%, the iron between 1 and 1.4%, the magnesium between .4% and .65%, and the silicon between .25% and .5%, the balance of course being aluminum.

This aluminum alloy may be very materially affected by heat treatment. The preferred heat treatment consists in heating the alloy to about 950° F. for about two hours, then quenching in water and artificially aging for about two hours at a temperature of about 212° or up to 300° F. It has been found that the ultimate strength will be increased by this heat treatment to about 30,000 lbs. per sq. in., the elongation being then from 3 to 5%. Aging at higher temperatures than as above noted may sometimes be used, but such higher temperatures increase strength and hardness at the expense of ductility.

I am aware that my invention is susceptible of modifications within limits and intend that the invention be defined by the following claims:

1. An aluminum base alloy containing copper between 2.25% and 3%; iron, .75% to 1.5% and containing a few tenths of a per cent each of magnesium and silicon, the ratio of the magnesium to the silicon being about 1.7 to 1.

2. An aluminum base alloy containing copper between 2.25% to 3%; iron, between .75% and 1.5% and containing a few tenths of a per cent each of magnesium and silicon, the magnesium being present in larger quantities than the silicon.

3. An aluminum base alloy containing aluminum between 94.7 and 96.5%, copper between 2.25% and 3%, iron .75 to 1.5%, magnesium .25 to .75%, silicon .2 to .75%, the sum of the magnesium, silicon and copper being between 3.25% and 4.25% of the whole.

4. An aluminum base alloy containing copper 2.3 to 2.7%, iron 1 to 1.4%, magnesium .4 to .65%, silicon .25 to .5% and the balance aluminum, the sum of the magnesium, silicon and copper contents being less than 4.25%.

5. An aluminum base alloy comprising the following elements approximately according to the following proportions: Aluminum 95.47%, copper 2.5%, iron 1.25%, magnesium .5%, and silicon .3%.

In testimony whereof, I affix my signature.

SAMUEL DANIELS.