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COPPER ALLOYS

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1 Claim. (Cl. 75-160)

This invention relates to copper alloys.

This case is a continuation in part of our co-pending application S. N. 164,032, filed September 15, 1937.

An object of the invention is to improve the physical, chemical and electrical characteristics of such alloys.

Other objects of the invention will be aparent from the following description, taken in connection with the appended claim.

The present invention comprises a combination of elements, methods of manufacture, and the product thereof, brought out and exemplified in the disclosure hereinafter set forth, the scope of the invention being indicated in the appended claim.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variations may be made in the method of procedure and the combination of elements, without departing from the spirit of the invention.

The present invention relates to the improvement of alloys of copper and zirconium. According to the present invention the improved alloys are made of the following elements in substantially the following proportions:

	Per cent
Manganese	0.1 to 30
Zirconium	0.05 to 5
Silicon	0.05 to 3
Copper	Balance

Where high electrical conductivities are desired, it is preferred to keep the proportion of manganese within an upper limit of 5%.

The alloys of the present invention may also contain small proportions, or even up to several percent, of zinc, tin, calcium, lithium, magnesium, phosphorus and silver. In some cases a part of the silicon may be replaced by beryllium.

The silicon combines with the manganese or metals to form the silicide and thereby imparts age-hardening characteristics to the alloy.

The addition of zirconium in this type of alloy not only imparts additional age-hardening characteristics, but also produces a material of corrosion resistance, high strength at the elevated temperatures and superior fatigue and impact properties.

The alloys can be made according to standard alloying methods. A preferred method for introducing the zirconium is to prepare a hardener alloy containing a high percentage of zirconium and then introduce a predetermined amount of

this alloy into a copper melt, containing the other ingredients in the desired proportions.

After the alloy has been prepared according to such methods, the material may be heat treated by first quenching the alloy in the form of a billet or sand casting, or any other form, from above 700° C. and subsequently aging at a temperature below 700° C. In certain cases, we have found it also advisable to use one heat treatment only, namely, the low temperature treatment, and eliminate the quenching treatment.

If the materials are processed by rolling, extruding, drawing, forging or any other fabricating methods, we have found it desirable in many cases to quench the materials from the intermediate anneals, cold working same and applying an ageing treatment afterwards. This cold working before ageing hastens considerably the precipitation of the dispersed phase. In addition, a certain amount of cold work may be applied after ageing in order to improve the surface finish of the wrought material.

A preferred alloy range, according to the present invention where high corrosion resistant properties and also good cold working properties are desired is:

	Per cent
Zirconium	0.05 to 5
Manganese	0.25 to 3
Silicon	1 to 4
Copper	Balance

In this composition it is also possible to add up to several percent of zinc or tin or both.

In some instances a part of the manganese may be replaced by an iron group metal, such as nickel, as in the following example:

	Per cent
Zirconium	0.05 to 5
Manganese	15 to 25
Nickel	2 to 12
Silicon	0.05 to 3
Copper	Balance

Such alloys find applications where special thermal, electrical and tensile properties are required.

The addition of zirconium has further beneficial effects, in so far as it raises the annealing temperature, and at the same time provides a very fine grain structure, which is highly desirable if the material is to be worked into sheets, strips, or tubing.

While the present invention as to its objects and advantages has been described herein as

carried out, in specific embodiments, it is not desired to be limited thereby, but it is intended to cover the invention broadly within the appended claim.

5 What is claimed is:

A heat-treated alloy composed of 0.05 to 5% zirconium, 0.1 to 30% manganese, 0.05 to 3%

silicon, and the balance substantially all copper, characterized by high hardness and further characterized by the fact that its hardness is not permanently adversely affected by temperatures in the order of 450° C.

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