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COPPER ALLOY

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1 Claim. (Cl. 75-153)

This invention relates to a new copper base alloy of improved characteristics. The present application is a continuation in part of prior filed co-pending application S. N. 258,187, filed February 24, 1939.

An object of the invention is to improve the electrical characteristics of the alloy, such as the electrical conductivity.

Another object is to improve the temperature resistant characteristics of such an alloy, such as the annealing temperature and the hardness values of the alloy at temperature.

Another object of the invention is to improve the hardness and tensile properties of copper base alloys of the type disclosed.

Still further objects are to improve the pouring qualities and handling characteristics of the alloy during casting, and later operations.

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

The present invention comprises the 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 variation may be made in the method of procedure and the combination of elements, without departing from the spirit of the invention.

The present invention contemplates an alloy formed, by the combination in suitable proportions, of copper, silver and lithium.

The alloy may preferably contain the essential ingredients, in the following proportions:

	Per cent
Silver.....	5 to 15
Lithium.....	.002 to 1
Copper.....	Balance

Within these composition ranges, there are a number of specific alloys which have been found to be of particular importance. Several of these alloys are listed below:

	Per cent
1 Silver.....	5
50 Lithium.....	.002 to .01
Copper.....	Balance
2 Silver.....	7.5
Lithium.....	.002 to .01
Copper.....	Balance
55 3 Silver.....	8 to 12
Lithium.....	.1 to .25
Copper.....	substantially the balance.

In some instances, it may be desirable for certain uses, to effect an improvement in the alloy

by adding small percentages of additional ingredients, such as:

Cadmium	Calcium	Chromium	
Zinc	Zirconium	Cobalt	5
Magnesium	Thorium		
Beryllium	Uranium		

Copper-silver alloys have heretofore been used for many purposes, particularly where high electrical conductivity was of importance, or where it was necessary to improve the physical properties of pure copper.

One of the outstanding effects of silver in copper is that the annealing temperature of such materials is raised considerably. At the same time, silver has a variable solid solubility in copper and therefore, by proper heat treating, or by a proper combination of working and heat treating, almost all of the silver can be made to precipitate from the copper solid solution and therefore, the electrical conductivity can be raised to very high values. While at 779 degrees C., 8% of silver is held in solid solution, this amount is decreased at lower temperatures. The electrical conductivity is decreased by the formation of solid solutions. Whenever a solid solution is formed, the conductivity will be decreased greatly, due to the specific molecular arrangement of the solid solution crystals. If these solid solutions are decomposed by heat treatment or by a combination of cold work and heat treatment, then the resulting alloy will consist primarily of two ingredients and the electrical conductivity can be determined by applying a simple rule of mixtures. In cases where the two ingredients have extremely high conductivity, such as copper and silver, then the resulting electrical conductivity will be proportionally very high.

We now have discovered that this precipitation of silver from a copper solid solution, is greatly enhanced by the addition of lithium. The lithium forms a series of alloys and compounds with silver, while it is almost completely insoluble in copper, therefore tending to promote a more complete precipitation of the silver phase from the copper matrix.

The addition of lithium eliminates impurities and particularly oxides which may be contained in the melt, and it therefore eliminates the use of such highly detrimental deoxidizers as phosphorus, silicon, etc., which will decrease the electrical conductivity very materially, if present even in small proportions, which are generally classified as impurities.

We do not, however, contemplate the addition of lithium as a deoxidizer only. Sufficient lithium is added to the copper base to insure that the residue thereof, retained in the copper-silver alloy, does not amount to less than the certain desired percentage.

For deoxidizing purposes only, it is also possible to add other elements of the alkali group, or alkaline earth group, or alloys thereof, such as, for instance, sodium or calcium.

5 The improvements of the alloys of the present invention, characterized by the addition of lithium are very pronounced also in the case where higher silver contents are used in order to obtain higher strength alloys.

10 We have also found that materials of the type described will lend themselves very excellently for brazing purposes, if the lithium content is increased to about .05%, or higher due to the high fluidity in the molten condition thus produced in the alloy. An excellent combination is 15 an alloy containing 10% silver, .2% lithium, and the balance predominantly copper.

We have also found that alloys of this type give excellent performance, if used for electrical 20 contacts and more particularly, contactor contacts. The lithium will tend to keep the surface of the alloy clean, and therefore reduce the contact resistance to a minimum, while the presence of silver improves the hardness and wear resistance of the contacts against mechanical abra- 25 sion.

The alloys also are useful for any applications where high thermal conductivity is required, such as parts of internal combustion engines or parts in firearms, soldering irons, structural parts of electrical machinery, and the like. The alloys are furthermore very useful for applica- 5 tions where increased fatigue and creep strength at elevated temperatures, is necessary. The alloy is exceptionally well adapted to the production of resistance welding electrodes, seam weld- 10 ing wheels and welding dies and fixtures in general.

While the present invention as to its objects and advantages has been described herein, as carried out in specific embodiments thereof, it is 15 not desired to be limited thereby, but it is intended to cover the invention broadly, within the spirit and scope of the appended claim.

What is claimed is:

An alloy of 5 to 15% silver, .002 to 1% lithium 20 and the balance substantially all copper, characterized by greater hardness than that obtainable with pure copper and very high electrical conductivity.

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