

UNITED STATES PATENT OFFICE

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COPPER-SILICON-ZINC-ALUMINUM ALLOYS

No Drawing.

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This invention relates to alloys of copper and silicon containing additions of zinc and aluminum.

The chief object of this invention is to provide a series of alloys composed mainly of copper and silicon and containing additions of zinc and aluminum to produce sound, strong alloys which are highly resistant to the chemical action of certain mineral acids, organic acids and other corrosive liquids.

For the past 30 years or more the so-called silicon bronzes containing from 3.0 to 5.0 percent silicon and from 97.0 to 95.0 percent copper have been known as strong and non-corrosive alloys.

I have discovered that the addition of zinc to copper-silicon alloys brings about a three fold improvement namely:—(1) When the copper-silicon-zinc alloys are remelted such alloys have a less tendency to absorb furnace gases than copper-silicon alloys containing no zinc. Sounder castings are produced when zinc is present. (2) The corrosion resistance to certain liquids is improved. For example: A test made on copper-silicon alloys containing about 3.0 percent silicon and from 4 to 6 percent zinc showed a loss of from .048 to .055 gram per square inch in 10 percent hydrochloric acid in an alternate immersion test of 96 hours. A copper-silicon alloy of about 3.75 percent silicon tested under the same conditions had a loss of .083 gram per square inch. (3) The alloys are stronger when additions of zinc are made. For example: An alloy containing 97 percent copper and 3.0 percent silicon will have a tensile strength, after a 43½ percent reduction in cold rolling and drawing, ranging from 105,000 to 110,000 pounds per square inch with an elongation in two inches close to 14.0 percent. Copper-silicon-zinc alloys containing close to 3.0 percent silicon and zinc from 4 to 6 percent will have a tensile strength ranging from 115,000 to 130,000 pounds per square inch and an elongation in two inches in the neighborhood of 12 percent, after the metal had received the same 43½ percent reduction in cold rolling and drawing.

In order to increase the corrosion resist-

ance to certain corrosive liquids and retain a high tensile strength, aluminum may be added in amounts ranging from about 0.5 to about 5.0 percent to the copper-silicon-zinc alloys. An alloy containing copper about 91.5 to 92.5 percent; silicon about 3.0 percent; zinc about 4.0 percent and aluminum about .5 to about 1.5 percent will have a tensile strength after a 42.3 percent reduction in cold rolling and drawing, ranging from about 115,000 to about 125,000 pounds per square inch.

In preparing alloys for hot working, cold rolling or drawing, alloys containing from about 1.0 percent to about 4.5 percent silicon are used together with a zinc content of from about 1.0 to about 8.0 percent and an aluminum content of about 0.5 to about 5 percent. The castings are first heated for homogenizing at a temperature ranging from 700° to 800° C. for about one hour. They are then removed from the furnace and hot rolled to the desired shape. When the alloys are cold worked they are softened at certain stages by annealing for about 30 minutes to about one hour at temperatures ranging from about 500° to about 700° C. After such anneals, cold working may be continued.

The alloys may be prepared by melting a given weight of copper under charcoal and adding to it the required amount of silicon. After the silicon has dissolved in the copper, the required amount of zinc is introduced, and then the desired amount of aluminum is added. Some of the alloy scrap may be melted with the copper before adding the silicon, zinc and aluminum.

I have discovered that copper-silicon-zinc-aluminum alloys containing about 1.0 to 4.5 percent silicon, about 1.0 to 10.0 percent zinc, and about 1.0 to 6.0 percent aluminum can be easily hot pressed into practically any desired shape when the temperature of the metal is raised from about 700° C. to about 800° C.

The presence of a small amount of manganese has been found beneficial to these alloys imparting added strength, the amount added ranging from about 0.1 percent to about 1.5 percent.

Having thus set forth the nature of my invention, what I claim is:

1. A copper-base alloy containing about 1.0 percent to about 4.5 percent silicon, about 1.0 percent to about 8.0 percent zinc, about 0.5 percent to about 5.0 percent aluminum, manganese within the limits of about 0.1 percent to 1.5 percent, and the balance copper.
2. A copper-base alloy containing about 1.0 percent to about 4.5 percent silicon, about 1.0 percent to about 10 percent zinc, about 1.0 percent to about 6.0 percent aluminum, manganese about 0.1 percent to about 1.5 percent and the balance copper.
- 15 In testimony whereof I affix my signature.
LOUIS P. WEBERT.

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