Patented Mar. 30, 1937

2,075,004

UNITED STATES PATENT OFFICE

2,075,004

COPPER-SILICON-ZINC-TIN-LEAD ALLOY

William H. Bassett, deceased, late of Cheshire, Conn., by Sarah H. Bassett, Cheshire, Conn., executrix; said Bassett assignor to The American Brass Company, Waterbury, Conn., a corporation of Connecticut

No Drawing. Original application November 25, 1933, Serial No. 699,710. Divided and this application December 15, 1936, Serial No. 115,984

3 Claims. (Cl. 75—158)

This invention relates to copper base alloys containing silicon, zinc and tin, and has for its chief object to improve certain characteristics of such alloys, and particularly their machinability or free cutting properties. The free cutting properties of these copper base alloys are secured with little or no depreciation of their physical properties by the addition of lead in relatively small amounts.

This application is a division of the prior application of William H. Bassett for Copper silicon alloys filed November 25, 1933, Serial No. 699,710.

A number of copper base alloys containing silicon have gone into quite extensive use, it being found that the addition of silicon up to certain amounts to copper produced alloys which were highly resistant to the chemical action of certain acids and other corrosive liquids. It was, however, found that the addition of silicon rendered the alloy hard and very brittle and difficult or practically impossible to work, and other elements such as zinc and tin were added to overcome these difficulties and improve other properties of the alloy such as strength, toughness, etc., and still retain the resistance to corrosion. It was found that for practical purposes the range of silicon was up to approximately 6.5%, and my invention therefore relates to copper base alloys, containing from approximately 0.1% to approximately 6.5% silicon, 1% to 12% zinc, and 0.5% to 6% tin.

It has been known to improve the machining qualities of copper or brass by the addition of lead, but it has been generally considered and also the literature would indicate that in alloys containing silicon lead would be thrown out of the mixture by the silicon. This was also indidated where there has been a mixture of leaded scrap with copper silicon alloys. In other words it was generally supposed that with silicon present the lead would settle to the bottom of the crucible or furnace due to its high density. He has found, however, that with small amounts of lead in copper base alloys containing silicon, zinc and tin in the amounts above noted the lead is dispersed as fine particles throughout the mass, greatly improving its machinability or free cutting qualities. He has found that this effect is secured with amounts of lead from approximately 0.1% to approximately 1.5%, the preferred range being from approximately 0.25% to approximately 0.4%, as above about 0.4 or 0.45% lead it is difficult or practically impossible to work the alloy in mill practice.

Zinc was added to the copper silicon alloy to produce alloys which could be worked either hot or cold and therefore were less brittle while still remaining highly resistant to the corrosive action of certain acids and other corrosive liquids. It also rendered the alloys harder, tougher, stronger and more elastic than the common brasses. These alloys with the lower zinc contents are hard, malleable, ductile and tough. Increasing the zinc gives alloys which are stronger, harder, more elastic but less malleable. The addition of zinc also gives sounder castings as the metal has less tendency to absorb furnace gases than copper-silicon alloys containing no zinc and the resistance to the corrosive action of certain liquids is also improved. The hardness as cast increases with additions of zinc up to about 15 percent.

The addition of tin to the alloy increases the corrosion resistance to certain liquids and also adds strength.

The addition of zinc used is from approximately 1 to 12% and the addition of tin is from approximately 0.5 to 6%. There may also be additions of manganese from approximately 0.01 percent to 3 percent to these alloys.

The addition of these elements to copper base alloys composed mainly of copper and silicon produce sound strong alloys which are highly resistant to the chemical action of certain acids and corrosive liquids.

Difficulty, however, was experienced in machining these alloys as among other things the chips were tough and came off in long continuous spirals tending to clog the tools, and the tools would not stand up and cutting speed was relatively low. It was found however that by the addition of the above named quantities of lead to these alloys they were rendered much more free cutting, and the chips instead of coming off in long continuous spirals broke up into short lengths easily clearing the tool, and in short converted the alloys into free cutting alloys with little or no depreciation of their physical properties, such as strength, toughness, workability, and resistance to corrosion.

Having thus set forth the nature of his invention, what he claims is:

1. A copper base alloy which is characterized by free cutting properties and resistance to corrosion comprising approximately 0.1% to 6.5% silicon, 1% to 12% zinc, 0.5% to 6% tin, 0.1% to 0.45% lead, and balance copper.

2. A copper base alloy which is workable and characterized by free cutting properties and re-

sistance to corrosion comprising approximately 0.1% to 6.5% silicon, 1% to 12% zinc, 0.5% to 6% tin, 0.25% to 0.4% lead, and balance copper.

3. A wrought metal article composed of a copper base alloy characterized by free cutting properties and resistance to corrosion comprising approximately 0.1% to 6.5% silicon, 1% to 12% zinc, 0.5% to 6% tin, 0.1% to 0.4% lead, and balance copper.

SARAH H. BASSETT,
Executrix of the Last Will and Testament of William H. Bassett, Deceased.