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## COPPER-SILICON-IRON-LEAD ALLOY

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1 Claim. (Cl. 75-160)

My invention relates to copper base alloys containing silicon and iron and has for its object to improve certain characteristics of such alloys so that they may be readily machined, especially in high speed machine tools, such as screw machines, turret lathes, etc.

Copper, silicon and iron or copper silicon iron and zinc alloys are well known to the art and are characterized by high tensile strength and ductility freedom from season cracking and resistance to corrosion and corrosion fatigue failure but when machined the chip made by the cutting tool is long and tough. When used in automatic machines this chip is liable to clog the cutting tool thus necessitating a more constant supervision of the machine.

I have discovered that by the addition of lead to such alloys I secure a product which is readily machined, giving off a short free cutting chip, without impairment of the desirable properties of the non-leaded alloy which includes high tensile strength, ductility, hot or cold working properties and resistance to corrosion and corrosion fatigue failure and freedom from season cracking.

I have also found that to secure free cutting without impairing the desirable physical qualities it is necessary to limit the amount of lead to not over a maximum amount, and that this maximum amount of lead depends on the amount of cold working to which the metal is subjected.

I find that alloys of copper, iron, silicon, with or without zinc, with the addition of lead not to exceed 2% can be hot worked, that this addition of lead does not impair the physical properties characteristic of such alloys in the hot worked state, that the product is not liable to season cracking and corrosion fatigue failure, and is characterized by good machining properties.

I also find that if such copper, iron, silicon lead, alloy with or without zinc, is subjected to cold working operations, the amount of lead added must be less than 2%, this amount varying with the degree of cold working to which the metal is subjected.

In particular, I have found that the product

made by addition of lead not to exceed 0.5% to alloys containing silicon up to 5%, iron up to 3%, balance copper, with or without zinc up to 10%, can be hot or cold worked satisfactorily, is characterized by high tensile strength, ductility, corrosion resistance, good machining properties, and is not susceptible to season cracking and failure for corrosion fatigue.

As an example, compositions of silicon 2.5%, iron 0.5%, lead 0.3%, copper balance, drawn 25% hard, tested 85000# tensile strength, 35% elongation in 2", 63% reduction of area at fracture, and did not crack on immersion in aqueous solution of mercurous nitrate (ASTM Standard) for 15 minutes.

In the claim, I specify the range of the copper, silicon, iron and lead which I intend to use in my alloy, said percentages will vary within this range in accordance with desired results. In each instance I intend to use either virgin metals or suitable alloy scrap of commercial standards of purity. Such relatively small percentages of impurities as occur in the commercial grades of the above mentioned metals (Cu, Fe, Si, pb) or in the suitable alloy scrap have no adverse effect upon the properties of the alloy and their presence therein falls within the meaning and scope of this invention.

I wish it distinctly understood that my alloy herein described is set forth in the proportions which I desire to product it and that changes or variations may be made as may be convenient or desirable without departing from the salient features of my invention and I therefore intend the following claim to cover such modifications as naturally fall within the lines of invention.

I claim:

A copper-silicon-iron base alloy characterized by good machining properties in addition to inherent high tensile strength, ductility, good hot or cold working properties, resistance to corrosion and corrosion fatigue failure, freedom from season cracking comprising approximately 0.25 to 5.0% silicon, 0.10 to 3.0% iron, .05 to 2.0% lead, the balance copper.

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