

UNITED STATES PATENT OFFICE

2,126,246

METALLIC ARTICLE

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No Drawing. Application January 7, 1938,
Serial No. 183,833

3 Claims. (Cl. 75-155)

This invention relates to metallic articles made from an alloy having an unusually high elongation, and more particularly to metallic articles of silicon bronze having elongations of upwards of 40% when made by casting in sand.

There is a myriad of purposes for which metal articles or parts are desired which shall be tough, strong and if put under stress too great for their strength shall yield gradually and extensively before the final rupture occurs.

An object of the present invention is to provide a metal alloy and articles or parts made from such alloy by casting, such that the cast articles or parts shall be ornamental and generally non-corroding as to surface as well as tough and strong in material and in which the material presents an unusually great capacity for elongation before rupture under excessive tensile stress.

With the above and other objects in view, the invention may be embodied in articles made by casting, either in chill molds or sand molds, an alloy consisting of copper with 0.75% to 1.45% zinc and 2.75% to 3.50% silicon, which is found to show elongations of upward of 40% and in some instances as high as 80% to 85% when cast, and without any special heat treatment or other conditioning to produce such character.

Other objects and features of the invention will appear from the following description of embodiments thereof in cast articles of silicon bronze.

Into a clay-graphite crucible in a coal-coke fired pit furnace were charged

Lbs.
Electrolytic grade copper----- 490
Metallic silicon----- 18½

and enough granulated charcoal to make about a two inch cover on the melt. The charge was melted at 200° F.-2100° F. and stirred briefly.

The crucible was lifted out of the furnace, enough charcoal skimmed off to give clear pouring, and there was added 5½ lbs. spelter (metallic zinc). The zinc having been stirred in, the charge was poured at about 2060° F. into ingots, roughly of 25 lbs. each.

These ingots on analysis showed the following composition:

I
Per cent
50 Copper ----- 95.30
Silicon ----- 3.36
Zinc ----- 1.24

Some of this material was chill cast in an iron mold as a bar about nine inches long, three and a half inches wide and three inches deep. Two

specimens were cut from opposite sides at the bottom, and, tested to rupture under tensile stress, gave elongations of 78% and 85% respectively.

Another portion of the same material cast in sand gave specimens showing respective elongations of 42%, 49.5%, 62.5% and 77.5%.

Two other lots of similar alloy were prepared with the following compositions by analysis:

	II Per cent	III Per cent
Copper-----	95.97	96.08 (by difference)
Silicon-----	3.08	2.95
Zinc-----	0.95	0.97

When chill cast in iron molds and tested these gave, respectively, 47.5% and 67% elongation, while, when cast in sand, their respective elongations were 74.5% and 65%.

Alloys of copper, silicon and zinc closely approximating these in composition are well known. For example a well known alloy for casting articles has approximately

	Per cent
Copper-----	94.75
Silicon-----	4.25
Zinc-----	1.00

However, this material, containing silicon in excess of 4%, shows elongations of only 12% to 24%, the best being equivalent to only about one half the worst value of the alloys described above.

It appears that within a closely circumscribed and limited range of values of the silicon and zinc in the series of ternary copper-silicon-zinc alloys, there is the small group with silicon from about 2.75% to about 3.50% and zinc from about 0.75% to about 1.45%, the balance, except for negligible impurities, being copper, which group presents elongations having values from two to seven or eight times as great as alloys of the same series and closely similar composition.

As noted above, these elongations are shown by the alloy as cast without any special subsequent treatment such as annealing or other heat treatment to develop this character. Hence articles cast from the alloy will have this elongation without further treatment.

Articles cast from the alloy described will be of particular value when used in circumstances where sudden shocks of considerable magnitude may be expected. The articles will then deform instead of rupturing. Thus for example, fittings and accessories for plumbing, for communication tubes and the like in battleships and other ships of war would tend to be much less easily put out

of usefulness by exploding shells or other shocks.

It is understood that ternary alloys of 2.75% to 3.50% silicon and 0.75% to 1.45% zinc and the rest substantially all copper fall within a class of alloys which are old and well known in the art. But until the present discovery, it is believed that the unexpected properties of the specific and narrow range herein disclosed were entirely unknown, nor was the peculiar value of articles and parts intended to be subjected to tensile stress known, when these articles are simply, cheaply and reliably made by direct casting from these alloys without need for further apparatus or procedures for subsequent treatment. Hence no claim is being made to the alloy as such, as the invention is believed to pertain only to cast articles made from the specific alloys and having the extraordinary properties described.

What is claimed is:

1. Cast metal articles having elongations before rupture under tensile stress of upwards of 40%, and made of an alloy consisting of silicon 2.75% to 3.50%, zinc 0.75% to 1.45%, and the balance substantially all copper. 5

2. Cast metal articles having elongations before rupture under tensile stress of upwards of 40%, and made of an alloy consisting of silicon 2.95% to 3.35%, zinc 0.95% to 1.25%, and the balance substantially all copper. 10

3. Cast metal articles having elongations before rupture under tensile stress of upwards of 40%, and made of an alloy consisting of about 3.35% silicon, about 1.24% zinc, and the balance substantially all copper. 15

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