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ALLOY

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3 Claims. (Cl. 75—155)

This invention relates to new and useful improvements in metallic alloys and more particularly to alloys of the nickel silver or German silver type having as their principal elements or constituents copper, nickel and zinc.

Alloys comprising the aforesaid principal elements in varying proportions have heretofore been used and the principal object of the present invention is to provide an improved copper-nickel-zinc alloy which is characterized by its greatly increased resistance to corrosion.

Another object of the invention is to provide an alloy such as that described which is characterized by its hardness and high tensile strength, and at the same time is workable and ductile.

These and other objects of the invention and the various features and details thereof are hereinafter fully set forth and described.

The invention consists essentially in the discovery that by adding small amounts of phosphorus to a copper-nickel-zinc alloy of the nickel silver or German silver type it is possible to produce an alloy of that type which is characterized by its high resistance to corrosion, and has a relative high degree of hardness and tensile strength, yet it is workable and ductile.

The particular proportions of copper, nickel and zinc in an alloy made in accordance with the present invention may vary within certain limits depending upon the use that is to be made of the alloy, and these limits are—copper approximately 55% to 75%—nickel approximately 5% to 30%—and zinc balance, usually from 5% to 27%.

The percentage of phosphorus that is added to the aforesaid copper-nickel-zinc alloys in accordance with the invention may, of course, vary within certain limits and satisfactory results are obtained by additions of phosphorus in amounts from approximately 0.001% to 0.02%, and preferably of the order of approximately 0.006% to 0.01%. It is to be understood, however, that the amount of phosphorus present may be higher than the upper limit recited, if desired; but usually it is unnecessary to increase the phosphorus content to obtain the improved results herein described. The upper limit of phosphorus present is generally determined, in any particuar case, by the production of an alloy of undue brittleness for the intended use thereof.

The phosphorus may be added in the elementary state or in alloy form such as, for example, phosphor-copper, and in practical commercial production of the alloy, this latter method is preferably employed because of the facility with which phosphorus may be handled in the solid alloy form in contrast to the difficulties presented and precautions required in the handling of that metal in its elementary state.

However, whether the phosphorus is added as elementary phosphorus or in alloy form is otherwise of no importance since it is only necessary that the phosphorus is present. Also, since copper is a principal constituent of the alloy, the incorporation of the phosphorus in phosphor-copper alloy form makes possible the easy addition of phosphorus without the addition of other metals not already present in the principal alloy.

Production of the alloy of the present invention may be carried out by first melting the copper, nickel and zinc constituents thereof and then adding the phosphorus to the resulting molten mass in the percentage required to give the phosphorus content desired in the particuar alloy, the phosphorus or phosphorus-containing alloy being added to the molten copper, nickel and zinc mass and thoroughly stirred into the latter just before it is poured.

While the invention is applicable for use in the production of the various copper-nickel-zinc alloys of the nickel silver or German silver type as previously stated, the addition of small amounts of phosphorus in alloys containing 60% to 70% copper; 10% to 20% nickel and 5% to 25% zinc, is particularly advantageous. As an example, a typical alloy embodying the present invention may contain 65% copper, 15% nickel and the balance zinc together with 0.01% phosphorus. Tests performed with this alloy by immersing it in concentrated sulphuric acid at 20° C. for a period of five hours showed a loss in the weight of the alloy of only 0.021%, while immersion in concentrated hydrochloric acid under like conditions, produced a loss in the weight of the alloy of only 0.026%. Similarly, immersion of the alloy for three hours in a 10% solution of concentrated sulphuric acid at 80° C. produced a loss in weight of only 0.034%, while immersion for a period of fifteen hours in a boiling 10% ammonium chloride solution produced a loss in weight of only approximately 0.20%.

In addition, tests on the above alloy made in the usual manner according to the standards of the American Society for Testing Materials gave the following results:

Yield point	(pounds per square inch)	85,800
Tensile strength	do	86,600
Elongation in 2 inches	per cent	12
Reduction in area	do	46
Brinell hardness		179

From all of the foregoing, it will be observed that the present invention provides an alloy of the type herein described which has greatly improved corrosion resisting properties and which is characterized also by its hardness and high tensile strength, thus making the alloy useful for

many engineering and other purposes where non-corrosive metals are desired.

Furthermore, the cost of producing alloys embodying the present invention, apart from the cost of the constituent materials, is such as to render them competitive with existing alloys and metals having even less efficient non-corrosive and other properties.

While a typical example of an alloy embodying the present invention has been given above together with an illustrative range of the percentages in which the different elements may be incorporated in the alloy, it is not intended to limit the invention to those percentages otherwise than, or except as set forth in the appended claims. It is also to be understood that other elements in addition to those recited herein may be present in small amounts in the alloy without departing from the essential features of the invention.

I claim:

1. A copper base alloy of the German silver type having high resistance to corrosion, increased hardness, high tensile strength and being workable and ductile and composed of about 10% to 20% nickel, 5% to 25% zinc, 0.001% to 0.02% phosphorus, and balance copper.

2. A copper base alloy of the German silver type having high resistance to corrosion, increased hardness, high tensile strength and being workable and ductile and composed of about 15% nickel, 20% zinc, 0.001% to 0.02% phosphorus, and balance copper.

3. A copper base alloy of the German silver type having high resistance to corrosion, increased hardness, high tensile strength and being workable and ductile and composed of about 15% nickel, 20% zinc, 0.006% to 0.01% phosphorus, and balance copper.

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