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WILLIAM B. PRICE, OF WATERBURY, CONNECTICUT, ASSIGNOR TO SCOVILL MANUFACTURING COMPANY, OF WATERBURY, CONNECTICUT, A CORPORATION OF CONNECTICUT

NONFERROUS ALLOY

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This invention relates to an improvement in non-ferrous alloys and particularly to an alloy whose principal constituent is copper, this being accompanied in the present invention by zinc, as well as by small but essential proportions of nickel and aluminum.

The alloy of the present invention is particularly suitable for condenser tubes, being resistant to corrosion at high temperatures, has less tendency to season crack and has a relatively high tensile strength particularly at the working temperatures to which condenser tubes are subjected in use. One of the important properties of the present alloy is that it can be extruded into tube or rod form at a lower temperature and with less pressure than alloys heretofore particularly suitable for condenser tubes.

The preferred composition of the new alloy is:

	Per cent
Copper	80
Aluminum	2
Nickel	1

The remainder of the alloy is substantially all zinc, and in no case must there be any appreciable amount of tin present.

In commercial practice an alloy made from commercial material proportioned to give the composition above stated, when analyzed showed the following composition:

	Per cent
Copper	80.16
Aluminum	2.07
Nickel	1.00
Zinc	16.77

The percentage of zinc was determined by difference and of course might include traces of impurities, for example, lead, iron or other ingredients, which, however, if present, were in too small an amount to affect the properties of the alloy.

This commercial alloy when cast in a slab of about ¾ inch thickness had a hardness of 45 Brinell.

The cast slab was rolled to a thickness of 0.151 inches and then annealed for one hour at 750° C. to relieve it of internal stresses. Its hardness then was 53 Brinell. It was then rolled to .050 inch finish gage.

The physical properties of the alloy in its different conditions were found to be as follows:

	Soft annealed	Light annealed	Hard
Yield point	17,000	57,000	116,000
Tensile strength	58,000	78,000	119,000
Elongation	58%	33%	4%

The alloy was tested for tensile strength, elongation (in 2 inches) and reduction of area, with the following results:

Temperature	Tensile strength lbs. per sq. in.	Elongation per cent	Reduction in area, per cent
500 C	16,600	40	49
625 C	7,700	49	52
750 C	4,200	101	89
875 C	2,000	142	100
950 C	1,300	128	100

The alloy of the present invention has a high resistance to corrosion and oxidation, and retains a relatively high resistance to oxidation at elevated temperatures, there being substantially no change in color or evidence of oxidation at temperatures up to 600° C.

It was found that the freedom of the alloy from tin was particularly important in the manufacture of condenser tubes from ingots of the alloy by extrusion methods. When tin was present, even in small amounts, the ingot could not be extruded in a special tube extrusion machine of 900 tons capacity, unless the ingots were heated to a high temperature, for example, above about 950° C., at which the tin liquidated. By omitting the tin the alloy could be readily extruded at the customary temperatures and pressures of working.

Also by omitting the tin the resistance to corrosion and oxidation at elevated temperatures was greater than when tin was present.

Extruded condenser tubes made from the alloy of the present invention gave, when

tested, at normal temperatures, the following results:

	Tensile strength lbs. per sq. in.	Yield point lbs. per sq. in.	Elongation per cent in 2"
Hard	119,900	116,000	4
Relief annealed	78,000	37,000	33
Annealed at 650° C	58,000	17,000	58

What is claimed is:

1. An alloy comprising essential amounts of copper, aluminum and nickel in proportions substantially within the following ranges:

	Per cent
Copper	80 to 85
Aluminum	1 to 2½
Nickel	1 to 2½

the remainder being mostly zinc.

2. An alloy consisting of the following ingredients in proportions substantially as stated:

	Per cent
Copper	80
Aluminum	2
Nickel	1
Zinc	17

In testimony whereof, I have hereunto set my hand.

WILLIAM B. PRICE.