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ALLOY

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The present invention has for its object an unalterable white alloy, permanently malleable and ductile, possessing great resistance, autogeneously weldable metal to metal, without the aid of an auxiliary metal, and readily worked hot or cold.

This alloy is characterized by the fact that it is composed of the following elements: copper, nickel, pure zinc, aluminium, magnesium, silicon, manganese and cadmium.

In this composition the quantities of the five last elements, namely, aluminium, magnesium, silicon, manganese and cadmium are slight with respect to those of the first three components (copper, nickel and zinc), the proportion of the copper being between 65 and 75%, that of the nickel between 18 and 22% and that of the zinc between 5 and 15% of the total alloy.

This alloy may replace the alloys known under the name of inoxidizable steel, alpaga, nickel silver, argentant, and the like, but it has been created mainly for the purpose of replacing brass coated with nickel or chromium or brass coated with a more or less unalterable metal by processes of galvanization, metallization (by the Scoop or Gerba gun process), parkerization or cementation. The composition of the alloy has been realized to give it at least all the mechanical qualities of brass, whilst effecting the elimination of the drawbacks of this metal, such as the numerous annealings necessitated by its mechanical treatment and the great tendency to hardening which is the most conspicuous defect in its industrial utilization.

The proportions of the components Al, Mg, Si, Mn and Cd are within the following limits:

Al between 0.010 and 0.200.
Mg between 0.010 and 0.200.
Si between 0.010 and 0.080.
Mn between 0.010 and 0.200.
Cd between 0.010 and 0.100.

These components are indispensable for imparting to the alloy its characteristic properties.

Below is given by way of example the composition of a white unalterable alloy, leaving the mould in a clean state, homogeneous, capable of being rolled (immediately after pouring) between cylinders or mixing rollers (rolling train) with reductions greater than those of brass, of being compressed against impact, by drilling, and of being drawn, all at a temperature equal to that for working brass (750°) without the white unalterable alloy showing cracks.

	Per cent
Cu	66.554
Ni	18.2
Zn	14.5
Al	0.190
Mg	0.190
Cd	0.098
Si	0.078
Mn	0.190
	100.000

In order to manufacture this alloy the following procedure is adopted:

The basic alloys are melted down, the first called A composed of Cu-Ni in the proportion of 666.6 parts cathode copper and 333.3 of Ni; the second called B composed of Cu-Zn in the proportion of 829.3 of cathode copper and 170.7 pure zinc. The unalterable white alloy is then prepared in the following order, the quantities being indicated per cent:

There is placed in the crucible alloy A 59.189; alloy B 40.391. When the mass has been brought into liquid state there are introduced into the crucible, simultaneously: 100 gr. Cu-Mn (commercial alloy Cu-Mn 30%); 100 gr. Cu-Si (commercial alloy Cu-Si 30%). The mixture is then stirred, there being added to the crucible 100 grams aluminium; 100 grams magnesium.

Stirring is repeated; the crucible is taken out of the furnace, there being finally added to the mixture 100 grams copper-cadmium 50%. Stirring is repeated thoroughly, the surface is skimmed and the casting is effected rapidly to prevent an accentuated cooling of the molten alloy.

All the operations indicated above and more particularly the latter, which is effected when the crucible has been withdrawn from the furnace, must take place rapidly.

By proceeding in the manner which has

just been described it is possible to reduce the melting loss to an average of 1.2% as against the higher loss of 2% of all similar alloys.

In addition it is recommended to cast the alloy Cu-Cd by utilizing 50 parts copper-cathodes and 50 parts cadmium, the commercial alloys not being sufficient to guarantee the accuracy of the requisite proportions and particularly the absence of deleterious impurities.

The action of the Al, Mg, Si, Mn and Cd is important in the limits of the proportions indicated above; thus by way of example 100 grams more than the utmost quantities indicated, of any of the constituents Al, Mg, Si, Mn and Cd would give an incomplete alloy, breaking under hot rolling; the absence of one of these constituents would likewise impair the mixture as a whole; the "ideal" combination would no longer be obtained and the structure of the metal would be defective.

It is known that the addition of cadmium to copper may form a brittle alloy or a malleable and ductile alloy according to the proportions used. The addition of cadmium to copper, in small quantities, increases its malleability and its ductility.

This action is still further increased in the presence of small quantities of manganese.

The constituents Al, Mg, Si, Mn and Cd, primarily by their reaction on the basic alloy Cu-Ni-Zn and then on themselves, have the effect of ensuring an alloy having a permanent malleability nullifying the effects of hammer hardening whilst still preserving the energetic reducing action of the metallic salts which are formed and which would subsist without the intervention of the whole of these five constituents; for example a combination composed solely of Cu-Ni-Zn-Al-Fo-Si-Mg would show a good malleability in the cold state, by means of suitable annealing, but it would crack in the hot state and lose numerous oxides to the detriment of the converting equipment. It would thus have the following drawbacks:

Increase in melting losses, increase in loss of material (waste) in course of successive conversions, it would impair hot conversion and consequently increase the costs of same; it would impair the preservation of the equipment by imparting oxides to the rolling cylinders and consequently render frequent rectifications necessary for the latter; it would necessitate a high temperature for its conversion in the hot state (1000° C.), which burns the metal.

On the contrary the combinations of unalterable white alloy according to the present invention permit:

Clean casting of the metal, the gases being eliminated; an ideal powerful treatment as easy as, if not easier than, that of a pure metal such as copper for example, at the same working speed and at a normal temperature (750° C.) which does not burn the metal.

By way of proof, the following example may be cited: An ingot, 90 mm. round or square, of 100 kilos cast in ingot mould is immediately scraped and reheated for 30 minutes, then rolled on the mill between section-rollers, which mix the metal whilst rapidly reducing it, for example in 3½ minutes to wire of 8 mm. diameter (maximum reduction 22 mm. at a time, from 40 mm. round to 18 mm. oval). This wire of 8 mm. round, once cooled, was then drawn, without annealing, either previously or during drawing to a few hundredth millimetres. This same wire of 8 mm. drawn to 3 mm. showed a tensile strength of 83 kg. per sq. mm. with 4% elongation.

The malleable white metal according to the present invention can be autogeneously welded metal on metal without the need of pickling or of auxiliary foreign metal or metal specially prepared for welding purposes, which proves the perfect homogeneity of the alloy.

What I claim and desire to secure by Letters Patent of the United States is:

1. An unalterable white alloy, permanently malleable and ductile, with a very slight tendency to hardening, high strength, capable of being autogeneously welded metal to metal without the aid of auxiliary metal, easily worked hot or cold, this alloy comprising 65 to 75% copper, 18 to 22% nickel, 5 to 15% zinc, 0.010 to 0.200% aluminium, 0.010 to 0.200% magnesium, 0.010 to 0.080% silicon, 0.010 to 0.200% manganese and 0.010 to 0.100% cadmium.

2. A white alloy comprising the following elements in the following proportions:

	Per cent
Cu	66.554
Ni	18.2
Zn	14.5
Al	0.190
Mg	0.190
Cd	0.098
Si	0.078
Mn	0.190

In testimony whereof I have affixed my signature.

CHARLES PHILIPPOSSIAN.