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NICKEL-COPPER ALLOY AND PROCESS OF MAKING SAME.

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This invention relates to a process of casting alloys and more particularly certain alloys of nickel and copper, by a special kind of casting process; and to the product of the process.

This invention has as an object the making of nickel copper alloys wherein the nickel is comparatively low in total content but yet the alloy posseses in many respects the qualities of an alloy having a high nickel content. Another object of the invention is to provide a comparatively low melting admixture of nickel and copper without the use of large quantities of easily fusible metals such as lead or zinc, and yet obtain a final product that contains solid solutions or alloys having a comparatively high melting point. A further object is to make such an alloy having a close-grain uniform structure throughout the mass without the formation of intercrystalline structure. A still further object is to make such an alloy which will possess higher strength and resistance to corrosion than other similar alloys, and that can be made without the formation of blowholes and without a great scrap loss. Other objects of the invention will appear as the following description proceeds.

Accordingly it is desired to select certain admixtures of nickel and copper, together with smaller amounts of other metals, which can be melted without great difficulty and thereupon cast to provide the results and objects above enumerated. While the proportions of the metals may vary considerably, it is desired in the following to present several preferred embodiments in order to illustrate how the invention may be advantageously carried out.

The following composition may be used in producing the melt for casting. A mixture of nickel 19%; lead 5%; tin 5%; zinc 5% and copper 66%, will provide an excellent proportion by weight of metals for use in making articles like spigots and conduits or pipes that are obliged to withstand the action of heat and of corrosive liquids. It is preferable to use a deoxidizer such as silicon, manganese, zirconium, titanium, aluminum, magnesium, and boron; the amount will generally be 1% or less, and the percentage of copper will be varied to accommodate the quantity of deoxidizer desired.

A mix suitable for golfheads, fittings, valves, superheated steam pipes, etc., would comprise: nickel 30%; lead 2½%; tin 2½%; zinc 2½%; together with a deoxidizer as in the previous example; and the balance copper.

Another example of a mix producing a non-corrosive alloy is: nickel 35 to 40% (about 20 to 40% is possible); tin 2½% (about 1 to 6% is possible); together with a deoxidizer; and the balance copper.

The following mix has been found suitable for superheated steam connections: nickel 30 to 35%; iron 3 to 7%; together with a deoxidizer such as silicon, manganese, and zirconium; and the balance copper.

A mix suitable for forge material comprises: nickel 35%; iron 3 to 5%; with a deoxidizer as in the previous example; and the balance copper.

These various mixes and others may be melted in any suitable way, and they are then cast in a special form of mold. This constitutes a very important part of the invention, for the mold should be one in which the temperature gradient is controlled so that the temperature will fall off rapidly and induce a cored structure in which solid solutions of metals are present in different concentrations. Such a mold would be a permanent mold of iron dusted with graphite; or a mold of a hard non-ferrous alloys, or a permanent, refractory, non-metallic mold. The principle of casting in such a mold consists in drawing out higher melting point solid solutions of metals without forming an intercrystalline structure. In using a nickel copper mix having a fairly low percentage of nickel, the idea is to freeze out, so to speak, the maximum amount of nickel rich constituent as soon as possible in order to obtain a rich solid solution of nickel in copper in the form of a cored structure. In accomplishing this result it will be found that the product will have higher strength and higher resistance to corrosion than other alloys of similar composition, and that in casting, blowholes will be generally avoided and the casting will be sounder and there will be less scrap loss. Furthermore, in casting by such a process a nickel copper mix may be provided that will have a comparatively low melting point without the use of large quantites of lead or zinc, etc. and yet there will be obtained a final product having the qualities of a high nickel alloy. Instead of using monel metal for the mix,

as is customary in this art, it is preferred to use pure metals, thereby avoiding the impurities and small amounts of other metals contained in monel metal.

In general, it may be stated that the percentage of nickel will be within the ranges above described, but that it may go as high as 45% but not higher than 50%. The copper content will vary with the nickel and with the small amounts of other metals added.

The products obtained will have great resistance to corrosion and heat. The absence of intercrystalline structure will prevent collapse under the action of heat of any constituent of the mass and there will, therefore, be no weakening until the actual melting points of the solid solutions are reached. Although the percentage of nickel is lower than in monel metal and similar high nickel alloys; yet by virtue of the high nickel solid solution, the product is fully equal to and even superior to monel metal in the general resistance to various unfavorable influences. Consequently, in achieving the result of cutting down the nickel content not only have the qualities of strength, uniformity, resistance to heat and corrosion, not been lessened, but they have even been increased as against an alloy of a total high nickel content.

As many apparently widely different embodiments of my invention may be made without departing from the spirit thereof, it is to be understood that I do not limit myself to the embodiments described except as defined in the following claims.

I claim:—

1. A cast nickel copper alloy having a total nickel content between 20% and 50%, and including a substantial amount of lead, tin and zinc below 5% each, the exterior portions of the casting having a higher nickel content than the interior thereof and the alloy being in the form of solid solutions without the formation of any intercrystalline structure.

2. A cast nickel copper alloy having a total nickel content between 20% and 45%, and containing lead. tin, and zinc about 2½% each, the exterior portions of the casting having a higher nickel content than the interior thereof and the alloy being in the form of solid solutions without the formation of any intercrystalline structure.

3. The process of making the article described in claim 1 consisting in casting the alloy in a mold wherein the temperature of the exterior portions of the alloy will fall off rapidly in order to solidify high melting point solid solutions of the metals.

4. The process of making the article described in claim 1 wherein the percentage of zinc is not over 5 and the percentage of iron not over 7, consisting in casting the alloy in a mold wherein the temperature of the exterior portions of the alloy will fall off rapidly in order to solidify high melting point solid solutions of the metals.

In testimony that I claim the foregoing, I have hereunto set my hand this 30th day of July, 1923.

WILLIAM F. COCHRANE.