

UNITED STATES PATENT OFFICE.

JOHANNES CATHARINUS BULL, OF LONDON, ENGLAND.

ALLOY.

SPECIFICATION forming part of Letters Patent No. 632,233, dated September 5, 1899.

Application filed December 28, 1897. Serial No. 664,090. (No specimens.)

To all whom it may concern:

Be it known that I, JOHANNES CATHARINUS BULL, a subject of the King of Norway and Sweden, residing at Erith, in the county of Kent, England, have invented new and useful Improvements in Alloys, (for which I have obtained Letters Patents in Great Britain, No. 4,899, bearing date the 4th of March, 1896, and No. 13,011, bearing date the 12th of June, 1896,) of which the following is a full and complete specification.

This invention relates to alloys of copper and tin, the object being to produce malleable alloys capable of being rolled or otherwise worked in a red-hot state and having the necessary degree of hardness for commercial utility.

I am aware that copper-tin alloys having not more than about one and one-half per cent. of tin can be rolled and forged in a red-hot state; but such alloys are too soft to be of much commercial value.

According to my invention I use copper as nearly chemically pure as is commercially and practically obtainable, and as the purity of the copper is absolutely essential for the production of my improved alloys I use the best brands of electrodeposited copper, which, so far as I now know, is the purest copper that is commercially obtainable, and to this copper I add from about two to four and three-fourths per cent. of tin, stir well, and pour in the ordinary way into ingots, which are capable of being rolled, forged, or drawn into bars, sheets, tubes, and wire.

In practice I find it useful to add a small proportion of deoxidizing material—for instance, phosphorus, preferably in the form of copper phosphid—to the copper before adding the tin. When phosphorus is used as a deoxidizing agent, it is, however, necessary to take care that the amount added is not so great that any appreciable quantity of it is left unoxidized in the alloy, and in no case should more than .1 per cent. of phosphorus be added to the copper if the highest malleability is desired. In proportion as more phosphorus be added the malleability at a red heat will be reduced and the metal hard-

ened, which for many purposes is disadvantageous.

Sodium may also be used beneficially as a deoxidizing agent in the form of sodium-tin, the purer the better. This deoxidizing agent has the advantage that if an appreciable quantity thereof is left unoxidized in the alloy it does not affect the malleability to the same extent as phosphorus. As a rule not more than .15 per cent. to .2 per cent. of sodium should be added. Where special means are taken to melt and cast the alloy in a non-oxidizing atmosphere, the addition of the deoxidizing agent becomes unnecessary, except where harder alloys are desired even at the cost of some reduction in malleability.

I have also discovered that the addition of mercury in very small quantities greatly improves such alloys of copper and tin, rendering them more tough and malleable. I may here state that I am aware that mercury has already been used in connection with copper-tin alloys to render them more tough or malleable in a cold state; but such alloys contain a large proportion of tin and are not malleable in a red-hot state.

In making my improved alloys containing mercury I prefer to first amalgamate the mercury with the tin, using from two to four per cent. of mercury. I add up to about four and three-fourths per cent. of this tin amalgam to the copper, which may or may not have had a small proportion of deoxidizing material added to it, as and for the purpose hereinbefore mentioned.

I do not limit myself to the proportion of mercury stated, as considerably higher quantities can be added without rendering the alloys non-malleable at a red heat; but I prefer not to exceed the proportions stated.

I do not limit myself to the use of from two to four and three-fourths per cent. of the tin or the tin amalgam, although, so far as I now know, any excess over four and three-fourths per cent. has no further beneficial influence, and alloys containing appreciably more than four and three-fourths per cent. of the tin or the tin amalgam cease to be perfectly malleable at a red-hot state.

By this invention a large range of new and useful malleable alloys of copper and tin can be produced.

What I claim, and desire to secure by Letters Patent, is—

A malleable alloy of copper and tin capable of being worked in a red-hot state composed of copper as chemically pure as can be

commercially obtained with from two to four and three-fourths per cent. of a tin amalgam containing two to four per cent. of mercury.

JOHANNES CATHARINUS BULL.

Witnesses:

A. MILWARD FLASH,
W. M. HARRIS.