UNITED STATES PATENT OFFICE.

GEORGE MONTEFIORE LEVI, OF BRUSSELS, AND CHARLES MAURICE KÜNZEL, OF LIEGE, BELGIUM, ASSIGNORS TO CHARLES JAMES ADOLPH DICK, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN ALLOYS OR BRONZES.

Specification forming part of Letters Patent No. 115,220, dated May 23, 1871.

We, GEORGE MONTEFIORE LEVI, of Brussels, and CHARLES MAURICE KÜNZEL, of Liege, Belgium, have invented an Improved Alloy and Mode of Preparing the same, of which the following is a specification:

Nature and Object of the Invention.

Our invention consists of an alloy of copper and tin, with or without other metals, when treated with phosphorus substantially in the manner described hereafter, and when the proportions of phosphorus, in respect to the alloy, are limited, as described hereafter. The object of our invention is to produce an alloy, the prominent features of which are tenacity, elasticity, homogeneity, hardness, and freedom from rust, and castings from which have perfectly true surfaces and edges.

General Description.

We have discovered that in heating with phosphorus or phosphoric substances alloys of copper and tin they acquire many advantageous properties, fully alluded to hereafter, and are thereby rendered available for the manufacture of a great variety of industrial and ornamental objects; provided, that the quantity of phosphorus contained in the perfected alloy does not exceed two and a half per cent. of the total weight thereof; and, furthermore, that when the maximum quantity of phosphorus is used the total component quantity of tin shall not exceed ten per cent. of the total weight of the perfected alloy.

On applying phosphorus or phosphoric substances to an alloy of copper and tin it will be found to eliminate or neutralize the effect of the oxides, if any are therein contained, and the proper quantity for this purpose should be ascertained by preliminary tests or analysis; as the oxides may vary in quantity, in accordance with the character of the metals employed, the absolute resistance of the alloy thus heated is considerably augmented, the fused alloy is rendered more fluid, and the process of running it off into molds facilitated, so that the largest and smallest objects of the most complicated and intricate character may be cast without any material flaw; but an additional quantity of phosphorus over and above that required for the deoxidizing process must be added to bring the alloy to the desired high standard, and this additional quantity we have found, by repeated tests, should not exceed the limits above referred to.

By varying the quantity of phosphorus within these limits, at the same time having a due regard for the quantity of tin used, as indicated above and by the examples given hereafter, the hardness, elasticity, and toughness of the alloy may be regulated with the greatest accuracy, in accordance with the character of the object into which the alloy has to be converted. We prefer to add the phosphorus in the form of phosphuret of copper or phosphuret of tin, the proportion of phosphorus in which has been previously ascertained; and we have found it preferable to make this addition after the alloy of copper and tin is completed, and while the molten alloy is covered with a layer of carbon or is otherwise excluded from the air. The alloy, with its supply of phosphorus, is then well stirred in the furnace or crucible, and may be run directly from the latter into the molds. If cast into chill-molds we have found that the quality of the metal is improved as regards homogeneity, elasticity, and tensile strength. The inner surfaces of the molds should be slightly coated with oil, petroleum, or other equivalent matter. Small quantities of other metals, such as zinc, nickel, &c., may be added to the main ingredients, but as the most important features of the new alloy can be completely controlled by varying the proportions of phosphorus and tin used, the addition of other metals, except in special cases, or for minor considerations, such, for instance, as the attainment of a particular color, sound, &c., had better be discarded.

The application of our improved alloy is so extensive that a full account of the different proportions for different uses would be voluminous and unnecessary; we will, however, give a few examples, which, with the foregoing explanation, will afford a sufficient guide for those skilled in metallurgy to carry our invention into effect.

For fine ornamental objects an alloy very fluid, when melted, and very tenacious, may be composed of one-half per cent. of phosphorus, seven per cent. tin, and ninety-two and one-half per cent. copper. For ordnance, parts of machinery, and such objects as require a great amount of elastic resistance and toughness, we use one and six-tenths per cent. phosphorus, eight and five-tenths per cent. tin, and eighty-nine and nine-tenths per cent. copper. The addition to ordinary gun-metal of nine parts of copper and one part of tin and of two and three-tenths per cent. of phosphorus imparts to the alloy the hardness of steel.

As will be seen from the above examples, the toughness, elasticity, and hardness of the alloy can be regulated by varying the proportions of tin and phosphorus. The almost endless variety of objects and purposes for which the new alloy may be used to advantage makes their enumeration endless, for they would embrace the boat-nail and siege-gun, the cog-wheel, and the finest work of art; in fact, the new alloy is applicable to and may be used in the manufacture of all objects in which tenacity, elasticity, homogeneity, hardness, and freedom from rust on the one side, and on the other hand perfectly fine and true surfaces and edges, are desirable qualities.

We do not in the present application claim the use of phosphuret of copper or phosphuret of tin in the production of the alloy, as this will form the subject of a separate application which we are about to make for a patent.

Claim.

An alloy of copper and tin, with our without other metals, when treated with phosphorus, substantially in the manner described, and when the proportion of phosphorus in respect to the alloy is limited, as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GEORGE MONTEFIORE LEVI.
CHARLES MAURICE KÜNZEL.

Witnesses:
THÉOR PEETERS,
FCOS. VUBRUGGE.