UNITED STATES PATENT OFFICE.

AUGUSTIN SENTEX, CONSTANTIN MARECHAL, AND ALFRED SAUNIER, OF PARIS, FRANCE.

PROCESS OF MAKING BRONZE ALLOYS.

SPECIFICATION forming part of Letters Patent No. 418,424, dated December 31, 1889.

Application filed March 9, 1888. Serial No. 266,724. (No specimens.) Patented in Belgium September 26, 1887, No. 78,999; in France February 1, 1888, No. 188,473; in England February 8, 1888, No. 1,886; in Italy February 18, 1888, XLV, 364, and in Germany February 15, 1889, No. 46,580.

To all whom it may concern:

Be it known that we, AUGUSTIN SENTEX, CONSTANTIN MARECHAL, and ALFRED SAUNIER, all of Paris, in the Republic of France, have invented an Improvement in Processes of Making Bronze Alloys, (for which we have obtained Letters Patent in France for fifteen years, dated February 1, 1888, No. 188,473; in Belgium, September 26, 1887, No. 78,999; in England February 8, 1888, No. 1,886; in Italy February 18, 1888, Vol. XLV, No. 364, and in Germany February 15, 1889, No. 46,580;) and we do hereby declare that the following is a full and exact description thereof.

Heretofore bronze containing a large proportion of tin has been only partially malleable. It cracks in rolling, splits in the heating-furnace, and plates or flakes of tin often appear at the surface of plates made from such material. These defects are caused by the want of homogeneity due to the tendency of the tin to separate from the copper when in the fused state. They have been overcome in sand castings—such as bells, guns, bearings, and so forth—by the addition of one or two per cent. of phosphorus, which imparts hardness and homogeneity to the metal and serves as a bond or solder for the metals comprising the bronze; but bronze made in that way is always brittle and unsuitable for being rolled or drawn into wire.

By the process forming the subject of the present invention malleable and ductile bronze can be produced containing a large proportion of tin. This result is effected by submitting the alloys as well as the metals composing them to a series of chemical operations which completely modify their properties.

Although the proportions of the metals composing the alloy may vary considerably according to the properties it is desired to impart to the alloy—such as malleability, ductility, tenacity, hardness, sonorosity, &c—the process remains the same unless the metal is not required to fulfill certain conditions—such as inoxidizability, for example, in which case one or more of the operations may be omitted.

By way of example I will now proceed to describe the manufacture of bronze of as perfect a quality as possible and composed of about ten kilograms of copper to one and one-half kilogram of tin. The metals to be employed must be of the best quality and as pure as possible. The tin is prepared by introducing into the fused metal twelve to fifteen per cent. of niter. As soon as the salt is melted by contact with the tin, the mixture is thoroughly agitated and then allowed to cool. The impurities of the metal are taken up by the niter, which solidifies in cooling and is easily separated. The copper is put into a crucible and the temperature raised to the melting-point. At that moment fifty grams of a mixture of equal parts of nitrate of potash and of cyanide of potassium are to be added for the double purpose of reducing the oxides and of enlarging the grain of the metal. After complete fusion of the copper, twenty-five grams of bitartrate of potash mixed with an equal quantity of cyanide of potassium are to be introduced for the same purpose. The tin, prepared and purified as above described, is then added to the copper after poling or stirring with green wood. At that moment fifty grams of a mixture of equal parts of sal-ammonia or hydrochlorate of ammonia and of cyanide of potassium are introduced into the crucible, then an instant after one gram of phosphuret of copper to impart mildness to the metal, and about twenty grams of Marseilles soap, consisting, substantially, of fifty parts of olive-oil, five parts of potash or soda, and forty-five parts of water, which fattens the metal still more. Finally, at the moment of running the liquid metal, after poling or stirring with green wood, a gram of sodium is introduced, which alloys with the mass, further reducing the oxides, and by its affinity for the tin, sal-ammoniac, and other products renders the alloy inoxidizable. This inoxidizability increases as the proportion of tin increases. The quantity of phosphorus and sodium may be increased if the proportion of tin be reduced.

Bars or plates of bronze cast in this manner are entirely free from cracks and blow-

holes, and if prepared in the ordinary way they may be rolled and drawn with the greatest ease. The metal obtained has the appearance and sonorosity of gold and resists all atmospheric action.

The same metal, when cast in sand, and which in that case may be richer in tin, gives fine castings which, when pickled, resist oxidation as well as the alloys of gold.

We claim—

The process of manufacturing bronze, which consists in previously purifying the tin by adding thereto while it is in a state of fusion a suitable proportion of niter and then letting it cool, in melting the copper and maintaining it in a state of fusion and adding thereto nitrate of potash and cyanide of potassium, in adding to the copper thus prepared the previously-purified tin, then introducing into the fused alloy sal-ammoniac or hydrochlorate of ammonia, cyanide of potassium, phosphuret of copper, and Marseilles soap, in adding sodium after poling or stirring with green wood, and finally in casting the metal so treated into the required shape, as hereinbefore described.

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