UNITED STATES PATENT OFFICE.

AUGUSTE J. ROSSI, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO THE TITANIUM ALLOY MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF MAINE.

TIN AND METHOD OF PURIFYING AND IMPROVING THE SAME.

1,020,515. Specification of Letters Patent. Patented Mar. 19, 1912.

No Drawing. Application filed January 6, 1911. Serial No. 601,166.

To all whom it may concern:

Be it known that I, AUGUSTE J. ROSSI, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Tin and Methods of Purifying and Improving the Same, of which the following is a specification.

Tin, while in molten state, absorbs, as is well known, gaseous elements or compounds, which are dissolved in the metal and retained therein as it solidifies during cooling. For instance oxygen from the atmosphere is thus absorbed and, to an extent, combines chemically with other elements present forming oxids thereof, as for example oxids of tin, which together with oxygen if any remaining uncombined are found occluded in the mass of the solidified metal. Moreover throughout said mass are also found, to greater or less extent, other substances, or compounds, foreign to tin, as for instance slags which owing to their comparative infusibility or lack of fluidity or both are unable to rise out of the molten metal and consequently remain entangled therein after its solidification. The aforesaid foreign elements and compounds are usually unhomogeneously distributed in uncontrollable locations throughout the mass of the metal, thus producing "blow-holes" or other cavities devoid of tin which proportionately, and undesirably, impair the density and metallic continuity of the mass, thus diminishing its hardness and tensile strength. I believe that it has hitherto proved impossible to produce or melt tin, at least on an industrial as distinguished from a laboratory scale, without incorporation and retention in the resulting metallic mass of such foreign elements and compounds and to such extent as to preclude its possession in theoretically normal degree of desirable physical properties to be expected as characterizing pure tin.

The object of my present invention is to provide methods of treatment whereby with such economy, simplicity and speed as to be practicable on an industrial scale, tin possessing superior properties may be produced in masses substantially devoid of undesired foreign elements and compounds including slags. I attain said objects by means of my novel procedure hereinafter described, viz:—I have discovered that if to tin, as now produced in the arts, and while it is melting or molten, there be added merely enough titanium to satisfy chemical affinity therefor of all such undesired elements present, whether in free or combined state, all these, including slags, and, besides, such titanium so added, will be eliminated from the molten mass, the resulting product being substantially solid pure tin.

My said invention comprises the following procedures: In a bath comprising the melting, or molten, tin to be treated, I may impart the presence of metallic titanium in such small quantity, proportioned as nearly as possible, as is sufficient merely to satisfy the chemical affinities therefor of the said undesired elements and compounds present. The said proportion of titanium required may be determined in any convenient manner, as, for example, by usual calculations based on the kinds and proportions of said undesired elements and compounds as disclosed by preliminary chemical analyses of specimens of the mass of any given type of commercial or other tin desired to be treated; or by varying tentatively the proportions of titanium so added until attainment of a final product containing substantially neither said undesired elements and compounds nor substantially any titanium, the proportion of latter used with such result being that required for purification of the particular type of tin mass so tested. The titanium is so added preferably in its elemental or metallic form, as, for example, an alloy of titanium with some metal, preferably in most cases an alloy of titanium with tin having a content of 10% to 12% or thereabout of titanium and producible on an industrial scale for example by means of the method specified in my Letters Patent No. 979,394 of Dec. 20, 1910, or in any other convenient manner. In some instances, where presence of some metal other than tin in the final product is not objectionable or is desired, the titanium may be added in the form of its alloy with such other metal, as, for example, with iron, this being the alloy of my Letters Patent No. 609,466, dated August 23, 1898; or with

copper, this being the alloy of my Letters Patent No. 700,244, dated May 20, 1902, reissued March 17, 1908, No. 12,764.

Addition of the titanium in other forms, as for instance that of its oxid may, where conditions are developed enabling the same to ultimately yield to the tin the required proportion of metallic titanium, be practiced without departing from my invention. The titanic material employed may be preferably added in such sub-divided state as will facilitate to an extent its distribution relatively to the mass of molten tin.

The titanic material may be charged into the crucible or other container of the bath prior to introduction thereinto of the melting or molten tin, or it may be charged upon the latter, in which case a covering of molten slag or the like may be superimposed as per my Letters Patent No. 877,518, dated January 28, 1908, to prevent reactions with constituents of the atmosphere. It appears, however, that, notwithstanding the higher melting point and the lower specific gravity of titanium as compared with tin, elemental titanium, in the aforesaid proportion, however added, is able to reach, and react upon, or chemically combine with, all undesired elements and compounds present in the mass of molten tin. After addition of the titanium, the temperature of the bath is maintained fully at that of the melting point of tin, and will be found to be somewhat heightened by the said chemical reactions and combinations attributable to the presence of the titanium, and until these have fully taken place, the time required for these being usually but a few minutes.

The titanium appears to not only combine chemically with undesired elements present, such as free oxygen and nitrogen, but also, by reason of its intenser affinity for such elements, to reduce compounds thereof, such as oxid of tin for example, and to combine with the oxygen thus liberated to form oxid of titanium, the presence of which in the bath imparts to therein occluded slags sufficient fluidity to insure their rising properly to the surface of the molten mass.

After the aforesaid operations the molten tin may be tapped out and cast in the usual manner.

It will be understood that while a final tin product free from titanium as well as the impurities mentioned is primarily desired and represents one feature of my present invention, nevertheless, for some purposes, presence incidentally of some little titanium in the resulting product may be unobjectionable or desirable. Such instances may be those in which the proportion of titanium remaining in the final product is less than say 1%, being an amount insufficient to justify its designation as an "alloy" of titanium in the usual commercial sense, or dependence on such small amount of titanium for purposes other than to improve said product itself. Such instances I regard as being within the purview of my present improvements, the presence of such small percentages of titanium imparting improved physical properties to the tin. To retain said small percentages of titanium in the final product it is only necessary to increase accordingly the proportioned amounts of titanium added as hereinbefore described.

The treatment of tin as per my above described invention results in a novel final product which is characterized as being a continuously solid mass consisting throughout of substantially pure metallic tin; as being substantially devoid of undesired elements or compounds including slags; as containing less than 1% of titanium; as free from blow-holes and other physical imperfections due to presence or action of elements and substances other than tin, and as of greater density and tensile strength besides other desirable qualities than tin heretofore produced on an industrial scale.

What I claim as new and desire to secure by Letters Patent is the following, viz:—

1. The method of improving the properties of tin which consists in adding thereto while molten titanium in amount sufficient to result in a final product containing titanium not to exceed 1%.

2. The method of improving the properties of tin which consists in adding thereto while molten an alloy containing titanium in amount sufficient to result in a final product containing titanium not to exceed 1%.

3. The method of improving the properties of tin which consists in adding thereto while molten an alloy containing tin and titanium in amount sufficient to result in a final product containing titanium not to exceed 1%.

4. As a new article a metallic body composed preponderatingly of tin and containing titanium not to exceed 1%.

5. As a new article tin containing titanium not to exceed 1%.

AUGUSTE J. ROSSI.

Witnesses:
WALTER D. EDMONDS,
GEORGE G. MEASURES.