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PROCESS FOR THE SEPARATION AND PURIFICATION OF METALS AND METALLIC ALLOYS

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One of the objects of this invention is to separate the constituents of metallic alloys from each other in the metallic state. More specifically it relates to the separation of antimony in the metallic state from its alloys with either lead or tin, or both.

Another object of the invention is to adjust or lower the antimony content of antimony alloys to any desirable amount.

A further object of the invention is the purification of lead, tin, or lead tin alloys containing antimony as an impurity.

Heretofore the separation of antimony from its alloys or from metals in which it occurred as an impurity necessitated the oxidation of the antimony, or whatever other methods have been proposed their results were very incomplete. I have succeeded in greatly simplifying the separation of antimony by the use of alkali metals and caustic alkalies. I have discovered that alkali metals alloy or compound with antimony in definite proportions. Thus sodium will combine with antimony, corresponding to the compound of $SbNa_2$, in which the sodium is equivalent to 40% of the antimony. Having therefore determined the amount of antimony present, it is possible to remove any part of the antimony by adding only that proportion of sodium corresponding to the quantity of antimony to be removed.

The alloy or compound of sodium and antimony so formed, has a higher melting point than the remaining metal, and the greater part of it rises to the surface of the liquid metal in form of a slump, when the metal is sufficiently cooled down. However, the crust or slump is intermixed with large quantities of metal, and the molten metal underneath this crust or slump continues to hold in solution a quantity of the antimony-alkali metal compound or alloy. I have further discovered that if the metal, treated as described, is mixed with molten caustic alkali while the temperature of the metal is above the melting point of the caustic alkali, the antimony-alkali compound will dissolve in it, and the resulting solution rises to the surface, from which it can easily be drawn off, thereby obtaining a substantially complete separation of the antimony sodium compound from the remaining metal or alloy.

In carrying out the invention, the metal or alloy to be treated is melted in an ordinary kettle or some other suitable vessel, heated approximately 200° C. or more above its melting point, the alkali metal which ordinarily is sodium on account of its relative cheapness, is stirred into the metal. The quantity of sodium added is predetermined by a chemical analysis. After the sodium has been well admixed with the metal, the temperature of the metallic bath is somewhat lowered, sufficient caustic alkali such as caustic soda is stirred in to dissolve the antimony sodium alloy. The amount of caustic soda used is approximately four times the weight of the antimony extracted. The caustic soda sodium antimony alloy melt is run off, allowed to cool, and then treated. The treatment consists of washing it with a minimum quantity of water necessary to dissolve the caustic soda, and to react with the sodium in the sodium antimony compound to form the hydroxide. The antimony is liberated in the metallic state. The caustic solution is decanted or filtered. The solution is evaporated to dryness, and the dry caustic soda recovered is used over and over again. Excess of caustic soda resulting from the metallic sodium may be electrolyzed to obtain metallic sodium, or otherwise is disposed of.

The following is a specific example of the process. A quantity of solder metal, 10,000 pounds in weight analyzing 35% tin, 60% lead, and 5% antimony, was heated to 450° C., and 200 pounds of sodium were stirred in. After lowering the temperature to 275° C., 2,000 pounds of caustic soda were thoroughly mixed with the metal. The caustic soda melt was drawn off, allowed to cool, and treated with 100 gallons of water. The metal was again analyzed and showed an antimony content of .2%. The antimony recovered from the caustic solution amounted to 530 pounds, and analyzed 92% antimony.

I claim:

1. The process of separating antimony from lead alloys which comprises treating the alloy with an alkali metal to form a less

fusible alloy of antimony and alkali metal dissolving same in caustic alkali in the molten state, separating the caustic melt and treating it with water thereby separating antimony in the metallic state.

2. The process of separating antimony from lead alloys which comprises treating the alloy with sodium and caustic soda to form a less fusible alloy of antimony and sodium dissolving same in caustic soda in the molten state, separating the caustic melt and treating it with water thereby separating antimony in the metallic state.

3. The process of separating antimony from alloys containing tin which comprises treating the alloy with an alkali metal to form a less fusible alloy of antimony and alkali metal dissolving same in caustic alkali in the molten state, separating the caustic melt and treating it with water thereby separating antimony in the metallic state.

4. The process of separating antimony from alloys containing tin which comprises treating the alloy with sodium and caustic soda to form a less fusible alloy of antimony and sodium dissolving same in caustic soda in the molten state, separating the caustic melt and treating it with water thereby separating antimony in the metallic state.

5. The process of separating antimony from alloys containing tin and lead which comprises treating the alloy with an alkali metal to form a less fusible alloy of antimony and alkali metal dissolving same in caustic alkali in the molten state, separating the caustic melt and treating it with water thereby separating antimony in the metallic state.

6. The process of separating antimony from alloys containing tin and lead which comprises treating the alloy with sodium and caustic soda to form a less fusible alloy of antimony and sodium dissolving same in caustic soda in the molten state, separating the caustic melt and treating it with water thereby separating antimony in the metallic state.

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