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REMOVAL OF TIN FROM ANTIMONIAL LEAD AND ALLOY

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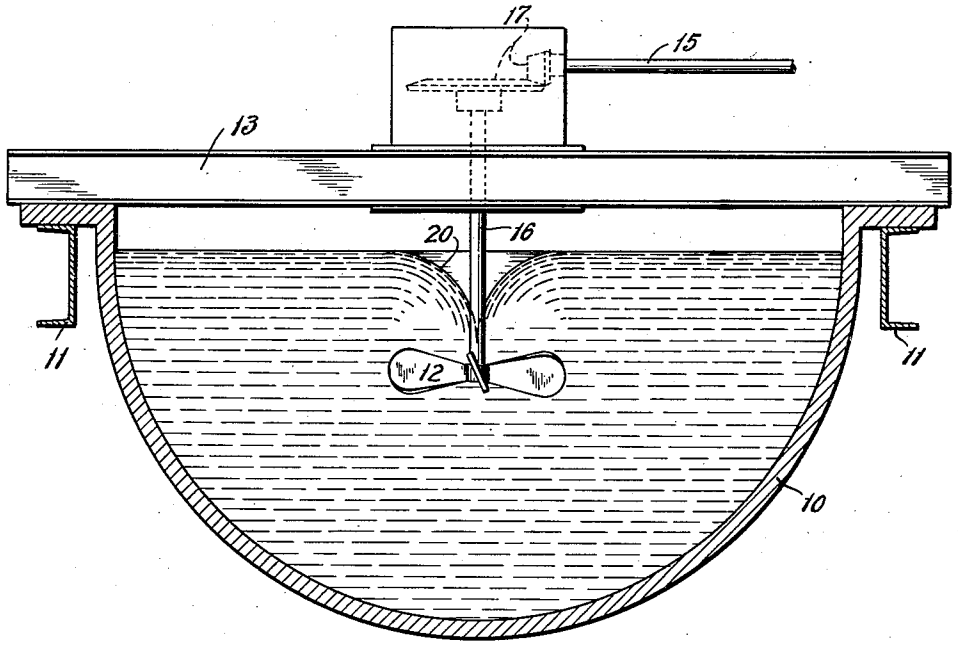

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REMOVAL OF TIN FROM ANTIMONIAL LEAD AND ALLOY

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This invention relates to the separation of metals, and more particularly to the removal of tin from antimonial lead and other alloys. The invention provides specifically for the removal of small amounts of tin from antimonial lead ranging, for example, from 8% to 20% in antimony and .3% to .4% in arsenic. The tin is removed in a simple metallurgical operation involving the use of standard lead refining apparatus and without the use of additional reagents. The operation is so carried on that the arsenic and antimony content of the bullion is not appreciably altered, whereas the tin is removed down to an extremely low percentage, such as .02%.

The invention comprises so treating the lead bullion that the tin becomes oxidized and forms a dross which rises to the surface of the bath from which it may be removed by skimming or other suitable means. The oxidation is carried out by the aid of stirring whereby the tin dross is drawn into the bath and continually recirculated until the oxidation of the metal is substantially complete. During this process the temperature is so regulated that the oxidation of any appreciable amount of arsenic and antimony is prevented.

The invention further consists in the new and novel features of operation and the new and original arrangements and combinations of steps in the process hereinafter described and more particularly set forth in the claims.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which the figure is an elevation, partly in section, of an apparatus for carrying on this process.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

A suitable apparatus in which the present process may be carried on is shown in the drawing as comprising a kettle 10 supported from suitable beams 11. A stirring apparatus comprising an impeller 12 is supported by transverse beam 13 which rests upon the rim of kettle 10. Said impeller is driven by shafts 15 and 16 through suitable gears 17. The particular driving mechanism, however, forms no part of the present invention and has not been shown in detail.

When power is applied to impeller 12 the rotation thereof causes a vortex 20 in the bath of molten lead in kettle 10 and produces a rapid circulation of the molten metal. The surface material is drawn down vortex 20 by impeller 12 where it is mixed with the body of the bath and again rises to the surface near the edges of the kettle. The size of the vortex is determined by the speed of impeller 12 and the pitch of the blades. This may be so regulated as to produce the necessary rate of stirring to effect the desired reaction.

In carrying on the present process the antimonial lead is applied to kettle 10 and raised to a sufficiently high temperature to promote the desired reaction. A temperature of 875° to 950° F. is usually satisfactory. The stirring apparatus is then started and a vortex produced which causes a rapid circulation of the metal in the various parts of the bath. During this circulation the tin becomes oxidized and forms a dross on the surface which is drawn into vortex 20 and again circulated through the bath.

When the process is thus carried out it is found that the tin can be removed before the arsenic and antimony contents of the bath are seriously affected. Hence the product is paricularly adaptable for producing shot metal alloys and for other purposes where an antimonial lead having a substantial percentage of arsenic is required.

As a specific example of a manner in which this process may be carried out, a bath of antimonial lead containing from 8% to 20% of antimony, from .1% to 3% of tin and from .3% to .4% of arsenic was placed in a suit-

able kettle and heated. The dross on the top of the bath was removed by hand skimmers and returned to the blast furnace. This dross contained the bulk of the copper which was originally present in the metal. The bath was then raised to a temperature of 895° F. and the impeller inserted and so operated that a good vortex was obtained.

Shortly after the vortex was formed a yellow powdery dross rose to the surface of the kettle and was recirculated through the bath by the impeller. When the dross became too thick for the impeller to work freely it was removed by suitable skimmers. This operation was continued until the tin content of the bath was reduced to .01%. During this operation the arsenic and antimony contents were not affected to any appreciable extent.

It has been found in treating mixtures of various compositions, that the dross contains practically the same percentage of antimony and arsenic as the original bath and may contain tin in a percentage as high as 12%. The dross accordingly can be removed to a blast furnace where it is resmelted into an alloy suitable for the babbitt trade which affords a ready market for the tin.

Although it is not desired to limit the invention to any particular theory of operation, it is thought that the removal of the tin is purely an oxidizing reaction and that it is particularly successful on antimonial leads, because neither the lead nor the antimony tends to oxidize appreciably at the temperatures used. When bullions containing less than 4% of antimony are treated in accordance with this process the tin does not concentrate in the skim to as great an extent. This is thought to be due to the fact that the antimony and lead also tend to oxidize with the tin, thus producing large quantities of skim which are much lower in tin content.

The invention is particularly important from a commercial standpoint by reason of the fact that it is adaptable to any plant since the volume of metal treated is solely dependent on the capacity of the kettle employed and the size of the stirring apparatus.

It is to be noted that the invention provides a particularly simple and efficient means for removing tin from the antimonial lead which does not require elaborate precautions to secure the separation of the tin or arsenic and antimony. Since the final product for use in certain arts, such as the shot metal industry, requires a definite percentage of antimony and arsenic, the present process eliminates the necessity for removing these metals with the tin, subsequently separating them and then reintroducing the metals to the bullion in the required percentages. It is obvious that such a process would be considerably more expensive than that of the present invention in which the arsenic and antimony are left in the bullion and only tin is removed.

The invention has been described as applied to antimonial lead for convenience. It is to be understood, however, that it may be applied to the removal of tin from various other metals and alloys with suitable temperature changes to fit the particular case.

Although certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the several steps of the process and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. The process of removing tin from metals containing tin as an impurity which comprises heating the mixture substantially above the fusion point thereof and stirring air into the bath whereby the tin is oxidized and forms a dross which floats on the surface, removing the dross and recovering tin therefrom, and continuing the operation until the tin content is reduced to the desired point.

2. The process of removing tin from antimonial alloy which comprises raising the alloy to a temperature at which it becomes molten and rapidly agitating the bath whereby the tin is oxidized and forms a dross which floats on the surface, then stirring the dross back into the bath whereby the tin is further oxidized, removing the tin dross as the same becomes sufficiently thick to interfere with the operation of the stirring mechanism and continuing the operation until the tin content of the bath is reduced to the desired point.

3. The process of selectively removing tin from antimonial lead containing tin and arsenic which comprises raising the lead bullion to a temperature above the melting point thereof, and rapidly agitating the bath whereby the tin is oxidized and forms a dross which floats on the surface, said dross containing arsenic and antimony in substantially the same percentage as the original bullion but having the tin concentrated therein, then stirring the dross back into the bath whereby the tin is further oxidized, removing the tin dross as the same becomes sufficiently thick to interfere with the operation of the stirring mechanism and continuing the operation until the tin content of the bath is reduced to the desired point.

4. The process of removing tin from antimonial lead without substantially affecting the percentages of antimony and arsenic therein, which comprises heating the lead, removing the copper dross therefrom, raising the lead to a temperature above 875° F., then rapidly stirring said bath to form a vortex, the operation being so carried out that the tin oxidizes to form a dross which rises to the surface and is drawn into the vortex and

recirculated through the bath, periodically removing the tin dross and carrying on the process until the bath reaches the required specifications.

5. The process for producing shot metal which comprises forming a bath of antimonial lead, following a copper dross to rise to the surface, removing said dross and rapidly stirring the bath whereby a tin dross is produced, stirring said tin dross into the bath and continuing the operation with the periodic removal of the tin dross until the bath reaches the required specifications.

6. The process of removing tin from antimonial alloy containing antimony, arsenic and copper, which comprises heating the alloy, removing copper dross therefrom, raising the alloy to a temperature above the melting point thereof, then rapidly stirring said bath to form a vortex, the operation being so carried out that the tin oxidizes to form a dross which rises to the surface and is drawn into the vortex and recirculated through the bath, periodically removing the tin dross and carrying on the process until the bath reaches the required specifications.

7. The process for producing shot metal from antimonial lead containing arsenic, tin and copper which comprises forming a bath of antimonial lead, allowing the copper dross to rise to the surface, removing said dross, raising the bath to a temperature over 800° F., and rapidly stirring the bath at said temperature whereby a tin dross is produced, forming a vortex in said bath whereby said tin dross is stirred into the bath and continuing the operation with the periodic removal of the tin dross until the bath reaches the required specifications.

8. The process of removing tin from metals containing tin as an impurity which comprises heating the mixture of metals to a temperature substantially above the fusion point thereof and rapidly stirring the bath to form a vortex which causes circulation of the metal and draws air into the interior of the bath whereby the tin is oxidized and forms a dross which floats on the surface, removing the dross and continuing the operation until the tin content is reduced to the desired point.

In testimony whereof I have hereunto set my hand.

THOMAS DELBERT JONES.