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PROCESS OF REMOVING BISMUTH FROM METALS

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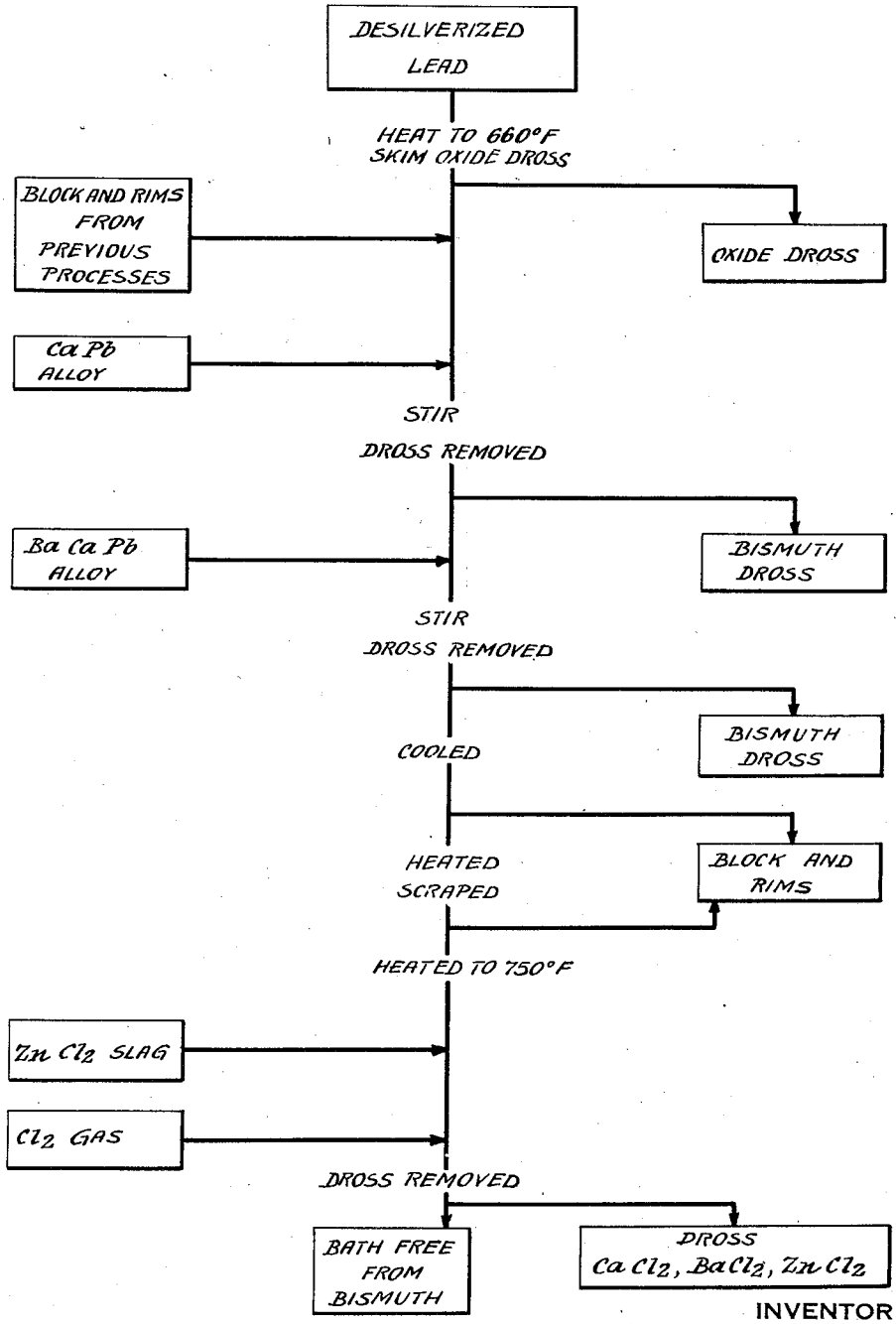

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PROCESS OF REMOVING BISMUTH FROM METALS

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This invention relates to the refining of metals, and more particularly to the removal of bismuth from lead.

The invention is especially applicable to the removal of bismuth from refined lead and desilverized lead and provides for the reduction of the bismuth content to corroding lead specifications.

The invention also provides for the elimination of the debismuthizing reagents whereby the metal of the bath may be made to conform to refined lead specifications.

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 in which a particular commercial embodiment thereof is disclosed. It will be understood, however, that the processes and the steps thereof may be modified in various respects without departing from the broad spirit and scope of the invention.

The drawing is a flow sheet illustrating one form of the present process.

In the following description and in the claims the various steps in the process and the details comprising the invention will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

In accordance with the present invention calcium and barium are used as reagents for removing the bismuth. These reagents may be in the form of lead alloys and may be introduced to the bath simultaneously or may be applied in sequence. In the latter case the calcium is first applied and a high bismuth dross skimmed from the bath, after which the barium is applied and a further dross is skimmed. Thereafter the bismuth content may be further reduced by selective freezing to produce blocks and rims and the bath may be treated with a suitable reagent, such as chlorine, for the removal of the calcium and barium.

As a specific example of the manner in which the present process may be carried out, a quantity of lead from which the bismuth is to be removed, as for example, refined lead from the desilverizing process containing .145% bismuth, is heated to a temperature of approximately 660° F. in a suitable kettle. The oxide dross which is formed on the surface of the kettle is then skimmed and blocks and rims from previous processes may be added to the bath and allowed to melt therein. A suitable quantity of calcium, preferably in the form of calcium-lead alloy, is then added to the molten bath which is stirred while maintaining the temperature approximately constant. A high bismuth dross will be formed on the surface of the bath which may be removed and treated for the recovery of the metal values.

The bath is then maintained at approximately the same temperature and a small quantity of barium, preferably in the form of a barium-calcium-lead alloy, is added thereto and allowed to melt in the bath. The bath may be stirred for a considerable length of time to permit the barium alloy to become thoroughly incorporated therewith. A second dross is thus formed which contains further quantities of bismuth and materially reduces the bismuth content of the bath. This dross may also be removed and treated to recover the metal values.

The kettle is then slowly cooled and blocks and rims are formed from the portion of metal which first solidifies. These blocks and rims contain further quantities of bismuth and leave the bath substantially free from this element. In the above mentioned example, the bismuth content of the bath was reduced to .047%. These blocks and rims are removed and added to subsequent baths of lead for retreatment in the manner above mentioned.

After the blocks and rims have been removed the kettle is again heated and scraped to remove the metal which has solidified. The scrapings may be added to the blocks, if

desired. The lead now contains calcium and barium which must be removed to render the lead suitable for the market. This is accomplished by heating the bath to a temperature of 750° F. and adding a slag of zinc chloride in sufficient quantity to completely cover the surface thereof and to form a seal. Chlorine gas is then introduced into the lead in sufficient quantity to unite with the calcium and barium and form chlorides of these elements and, preferably, to produce an excess of lead chloride which may be utilized in treating the bismuth drosses above mentioned.

The slag of lead, chlorides of zinc, calcium and barium may then be removed from the bath and refined lead pumped to a suitable container for subsequent use.

In the above described process it may, in certain instances, be desirable to add the calcium and barium in a single operation. If the process is to be carried out in this manner the refined lead is melted and the oxide dross skimmed as above pointed out. An alloy of calcium, barium and lead may then be added and allowed to melt in the bath. This alloy may comprise, for exampe, 3.07% calcium and 1.12% barium and may be added in quantities representing 1.55 lbs. of calcium per ton of lead, and .56 lbs. of barium per ton of lead. This alloy is stirred into the metal in the manner above mentioned and the high bismuth dross is skimmed from the surface thereof, after which the blocks and rims may be formed to further reduce the bismuth content of the bath and calcium and barium may be removed as chlorides, as above described.

It has been found that in this process the barium is more effective than the calcium in reducing the bismuth content, both on the basis of atomic ratios and on the basis of cost of production. In accordance with this process, it is desirable, however, to use the barium in conjunction with calcium, either mixed with the calcium-lead alloys or as a second application to the lead after previous calcium treatment.

The zinc chloride cover assists in the elimination of calcium and barium during the chlorine treatment. If the cover is not employed a portion of the lead will be converted into lead chloride and further quantities will be oxidized to litharge. These salts are infusible at the temperature of the bath and consequently a dry dross would be obtained. With the zinc chloride cover the dross forms a mixture with the zinc chloride and produces a fusible salt at the temperature of the bath. No litharge is formed and the calcium reduces the lead chloride to metallic lead thereby assuring that all of the cacium will be removed prior to the formation of lead chloride.

A specific temperature has been given by way of example, but it is to be understood that the temperature may be varied within limits in carrying on the various operations. The temperature disclosed has been found to work satisfactorily in certain instances. It is also evident that the entire process may be carried out as an independent method of treating metals, or it may be combined with other refining processes.

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 bismuth from metals which comprises melting said metals and adding barium thereto, causing said barium to become thoroughly incorporated with the metal of the bath whereby a dross is formed which contains a substantial part of the bismuth, and removing the barium from the bath by introducing chlorine thereto whereby the barium is converted to barium chloride.

2. The process of treating metals for the removal of bismuth which comprises melting said metals, applying barium and calcium thereto, causing said barium and calcium to form an intimate mixture in the bath whereby a high bismuth dross is produced, removing said dross and treating the bath with chlorine whereby chlorides of barium and calcium are produced which form a dross, and removing said dross.

3. The process of treating metals for the removal of bismuth which comprises melting said metals, applying barium and calcium thereto, causing said barium and calcium to form an intimate mixture in the bath whereby a high bismuth dross is produced, removing the calcium and barium by applying a zinc chloride cover to the bath and adding chlorine gas thereto whereby chlorides of calcium and barium are formed, and removing the dross comprising chlorides of zinc, calcium and barium.

4. The process of treating lead for the removal of bismuth therefrom which comprises melting said lead, adding a calcium-barium-lead alloy thereto and causing said alloy to become thoroughly incorporated therein whereby a high bismuth dross is produced and treating the bath with a chloridizing agent to remove calcium and barium.

5. The process of treating lead for the removal of bismuth which comprises melting said lead, applying a calcium lead alloy thereto, removing the resultant high bismuth dross, applying a barium-calcium-lead alloy to the bath and removing a second high bis-

muth dross and treating the bath to remove the calcium and barium.

6. The process of treating lead for the removal of bismuth which comprises melting said lead, applying a calcium-lead alloy thereto, removing the resultant high bismuth dross, applying a barium-calcium-lead alloy to the bath, removing a second high bismuth dross and selectively cooling the bath to further eliminate the bismuth therefrom.

7. The process of treating lead for the removal of bismuth which comprises melting said lead, applying a calcium-lead alloy thereto, removing the resultant high bismuth dross, applying a barium-calcium-lead alloy to the bath, removing a second high bismuth dross and applying chlorine to said bath under a zinc chloride slag to form chlorides of calcium and barium and eliminate the same from the bath.

8. The process of treating lead for the removal of bismuth which comprises forming a bath of said lead at a temperature of approximately 660° F., skimming any oxide dross that may be formed thereon, applying a calcium-lead alloy to said bath and allowing it to melt therein, stirring to produce an intimate mixture, skimming the resultant high bismuth dross, adding a barium-calcium-lead alloy to said bath while maintaining approximately the above temperature, stirring to produce an intimate mixture and skimming the resultant dross, cooling said bath to produce blocks and rims, reheating said bath to a temperature of approximately 750° F., adding zinc chloride thereto in sufficient quantity to completely cover the surface, applying chlorine gas to the bath to form chlorides of calcium and barium and removing the chloride slag.

9. The process of refining lead containing bismuth as an impurity which comprises melting said lead and forming a molten bath thereof, incorporating in said bath a calcium-yielding substance and barium-yielding substance to effect the removal of bismuth as a dross, and introducing a chloridizing reagent in said molten bath to effect a simultaneous removal of calcium and barium as a dross.

In testimony whereof I have hereunto set my hand.

JESSE OATMAN BETTERTON.