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METAL REFINING

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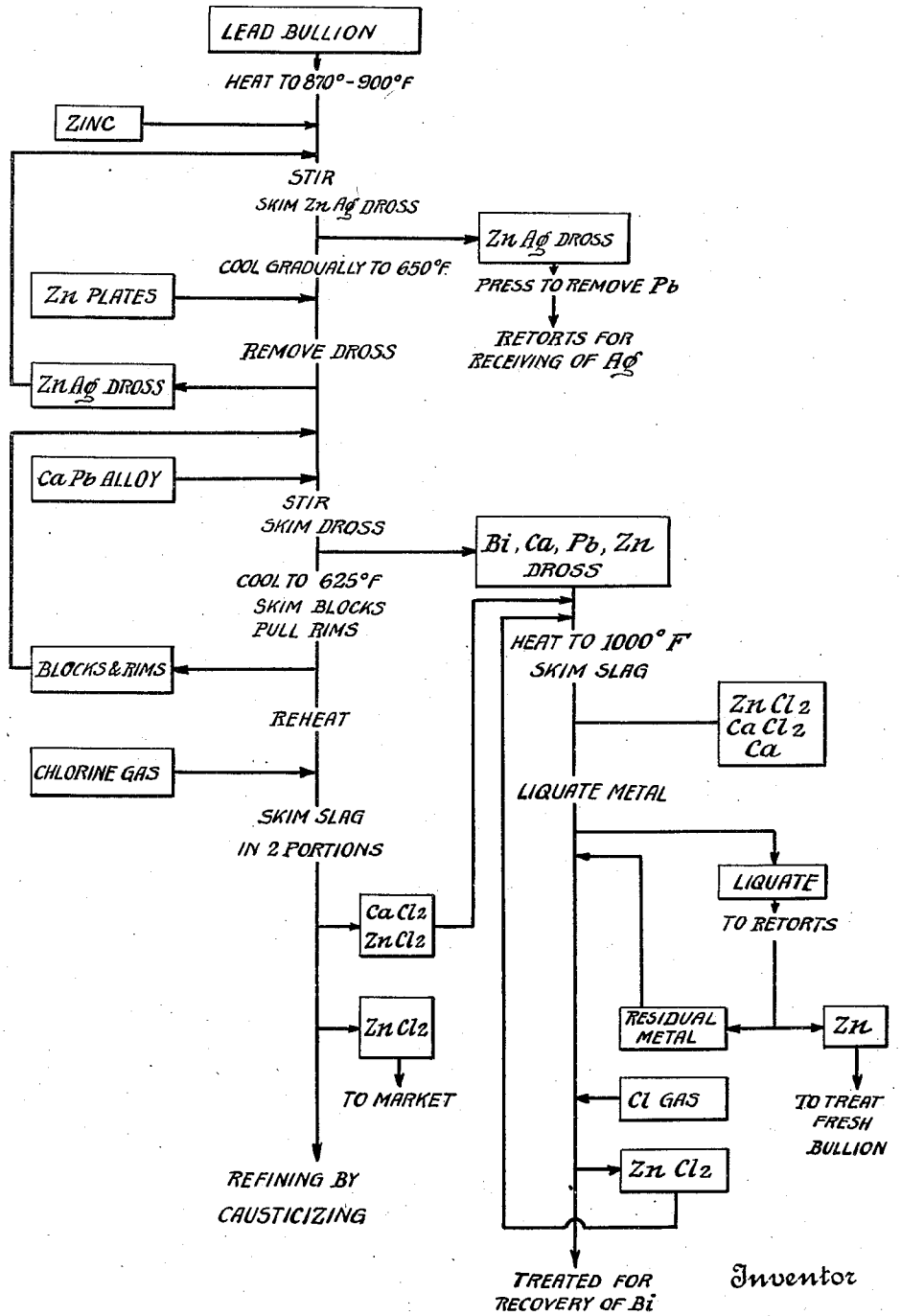

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METAL REFINING

Application filed October 31, 1929, Serial No. 403,920. Renewed September 2, 1931.

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

In accordance with the present invention, silver and bismuth are removed by suitable reagents such as zinc and calcium respectively in continuous operation without intermediate cooling of the bath. After the metal has been suitably treated by the above reagents, the excess of said reagents is removed simultaneously by the addition of suitable amounts of chlorine which combines with the zinc and calcium to form chlorides of these elements. The invention also provides for the selective recovery of the above elements and the selective recovery of the excess reagents whereby the cost of operation is reduced to a minimum.

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.

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.

The present process is carried out by heating the bath of lead to a suitable temperature, after which a quantity of zinc is added sufficient to form a silver dross which may be removed and treated for the recovery of silver therefrom. After the major portion of the silver has been removed zinc plates are added and blocks are formed as the bath is gradually cooled. These blocks contain the further quantities of silver and are used as a source of zinc for the treatment of subsequent baths.

After the desired number of blocks have been formed and the metal has been cooled to a suitable temperature, calcium is added in the form of a calcium lead alloy whereby a lead-calcium-bismuth-zinc dross is obtained which contains substantially the entire bismuth content of the bath. This is removed and suitably treated for the recovery of bismuth and zinc therefrom.

The bath is then further cooled and more blocks containing zinc-silver dross are formed. After these are removed, the bath is reheated and chlorine is applied which combines with the zinc and calcium to produce chlorides of these elements in which form they are removed from the bath. The silver and bismuth content of the bath is thus reduced to the required percentage and the metal is in condition for use in further refining which may be carried out in a manner well known in the art.

The drawing forming a part of this application shows a flow sheet illustrating the process.

As a specific example of a manner in which this process may be carried out, a bath of lead bullion is heated to a temperature of 875° to 900° F., after which zinc and blocks from previous refining operations are added while suitable stirring the bath to produce the desired reaction. A zinc-silver dross is formed which is skimmed and may be pressed to largely remove the lead therefrom. The dross is then sent to the retorts wherein the silver may be recovered in the usual manner.

After the dross is removed the bath is allowed to gradually cool while zinc plates are added. Further quantities of dross are then formed which may be removed and cast in blocks. These blocks may be returned to subsequent baths as a source of zinc in the desilverizing step above mentioned.

In a specific instance the process was carride out until twelve blocks were formed and the bath had reached a temperature of 650°

F. The bath was then maintained at this temperature and a calcium-lead alloy added and stirred into the molten metal. The dross comprising a bismuth-calcium-lead-zinc alloy was then removed and treated for the recovery of the bismuth and zinc contained therein.

Thereafter, by cooling the bath to the freezing point of lead, approximately 625° F., three blocks were formed in the manner pointed out above together with rims as the metal adjacent the sides of the container solidified. These blocks and rims were removed and used for treatment of subsequent baths. The bath was then reheated and chlorine was added in sufficient quantity to unite with the calcium and zinc to form slags of zinc chloride and calcium chloride. The first slags contained all of the calcium as calcium chloride with some of the zinc as zinc chloride, and may be used for treating high bismuth drosses. The final slags are free from calcium chloride and represent the normal zinc chloride salt, which may be used in any well known manner. The first slag may be used for the treatment of the bismuth containing dross for the removal of the calcium and its separation from the zinc and bismuth contained in the dross.

A suitable means of treating the dross which, however, forms no part of the present invention but is covered in my co-pending application Serial No. 424,134, filed January 28, 1930, for metal refining, comprises melting the same under a zinc chloride, calcium chloride slag at a temperature of approximately 1000° F. and skimming the resulting slag which will contain the zinc chloride, calcium chloride and any calcium which may have been contained in the dross. The resulting bath is free from calcium and may be treated by liquation for the removal of the zinc. These liquations are retorted and metallic zinc to the extent of 3.6 lb. per t. original bullion recovered and again used in the desilverizing. The residual metal after retorting the zinc liquations is combined with the bath from which these zinc liquations were removed, and the combined bath treated with chlorine gas for the removing of any remaining zinc. The zinc chloride slag is combined with the zinc chloride, calcium chloride slag mentioned above and the bath may be treated as desired for the recovery of bismuth.

In the above process the bismuth-calcium-zinc dross contains approximately 5% by weight of the bullion treated and is so processed as to allow the recovery of the zinc as metallic zinc which is in suitable condition for further use in desilverization. The quantity of zinc chloride slag which is produced in excess of that which can be used for the above described process is reduced to a minimum and the operating time is materially decreased. In a certain instance the operating time for the debismuthing process amounted to approximately 4 hours which was divided as follows: Charging alloy, 20 minutes; melting alloy, 20 minutes; stirring alloy, 30 minutes; skimming bismuth dross, 2 hours, 50 minutes.

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 forms and details of the devices illustrated 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 treating lead which comprises heating a bath of said lead, adding zinc to said bath whereby a zinc-silver dross is produced, skimming said dross, adding a calcium-lead alloy thereto whereby a bismuth-calcium-lead dross is produced, removing said dross and treating the bath with chlorine for the removal of calcium and zinc therefrom.

2. The treatment of lead bullion for the removal of silver and bismuth which comprises removing the silver as a zinc silver dross and removing the bismuth as a calcium-bismuth dross and subsequently removing the zinc and calcium by means of chlorine.

3. The process of treating lead bullion for the removal of silver and bismuth which comprises heating said bullion, adding zinc thereto and stirring to produce a zinc-silver dross, removing said dross, adding calcium-lead alloy and stirring to produce a calcium-lead-bismuth dross, removing said dross, adding further quantities of zinc and forming blocks and rims as the bath is further cooled, and adding chlorine gas to the bath to form a slag of calcium chloride and zinc chloride.

4. The process of treating lead bullion for the removal of silver and bismuth which comprises heating said bullion, adding zinc thereto and stirring to produce a zinc-silver dross, removing said dross, adding calcium-lead alloy to produce a calcium-lead-bismuth dross, removing said dross, adding chlorine gas to form a slag of calcium chloride and zinc chloride, removing a first slag containing substantially the entire calcium content and removing a second slag which comprises essentially zinc chloride.

5. The process of treating lead bullion for the removal of silver and bismuth which comprises heating said bullion, adding zinc thereto and stirring to produce a zinc-silver dross, removing said dross, adding further quantities of zinc while the metal is slowly cooled, removing further quantities of dross, adding calcium-lead alloy and stirring to produce a calcium-lead-bismuth dross, removing said dross, and adding chlorine gas

to form a slag of calcium chloride and zinc chloride.

6. The process of treating lead bullion for the removal of silver and bismuth which comprises heating said bullion, adding zinc thereto and stirring to produce a zinc-silver dross, removing said dross, adding further quantities of zinc while the metal is slowly cooled, removing further quantities of dross, adding calcium-lead alloy and stirring to produce a calcium-lead-bismuth dross, removing said dross, adding further quantities of zinc and forming blocks and rims as the bath is further cooled, and adding chlorine gas to form a slag of calcium chloride and zinc chloride.

7. The process of treating lead bullion for the removal of silver and bismuth which comprises heating said bullion to a temperature of 870° F., adding zinc thereto and stirring to produce a zinc-silver dross, removing said dross, allowing the bath to cool to a temperature of approximately 650° F., adding calcium-lead alloy and stirring to produce a calcium-lead-bismuth dross, removing said dross, and adding chlorine gas to form a slag of calcium chloride and zinc chloride.

8. The process of treating lead bullion for the removal of silver and bismuth which comprises heating said bullion to a temperature of 870° F., adding zinc thereto and stirring to produce a zinc-silver dross, removing said dross, adding further quantities of zinc while the metal is slowly cooled, removing further quantities of dross, allowing the bath to cool to a temperature of approximately 650° F., adding calcium-lead alloy and stirring to produce a calcium-lead bismuth dross, removing said dross, adding further quantities of zinc and forming blocks and rims as the bath is further cooled, reheating the bath to a proper molten state, adding chlorine gas to form a slag of calcium chloride and zinc chloride, removing a first slag containing substantially the entire calcium content and removing a second slag which comprises essentially zinc chloride.

9. In the process of desilverizing lead by the addition of zinc as a reagent and debismuthizing lead by the addition of a reagent capable of forming a bismuth-containing dross, the improved steps which comprise adding the debismuthizing reagent to the lead in the presence of the residual zinc remaining from desilverization and subsequently treating the bath to effect the removal of the zinc and the debismuthizing reagent as a dross.

10. The process of refining lead containing silver and bismuth which comprises melting said lead to form a molten bath, incorporating a zinc yielding substance in said molten bath to effect the removal of silver, subsequently adding calcium to said lead containing residual zinc remaining from the desilverization of said lead to effect the removal of bismuth, and then introducing a reagent capable of removing calcium and zinc as a dross from said bath.

11. The process set forth in claim 10 in which the bath is maintained in a molten condition throughout the desilverizing and debismuthizing operation.

In testimony whereof I have hereunto set my hand.

JESSE OATMAN BETTERTON.