

UNITED STATES PATENT OFFICE.

THEODORE G. TIMBY, OF CHICAGO, ILLINOIS.

METHOD OF RECOVERING LEAD AND SILVER.

1,056,383.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, THEODORE G. TIMBY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Method of Recovering Lead and Silver, of which the following is a specification.

My invention relates to new and useful improvements in methods of recovering lead and silver from argentiferous lead-bearing ores, particularly sulfid ores containing silver.

By ordinary smelting methods, whether the ore be treated in an open hearth, reverberatory or blast furnace, the silver and lead are recovered together as a mixture or alloy and they can be separated only by costly refining processes or by cupeling the alloy with a conversion of the lead to litharge and recovering the refined silver as a metallic residue; or most commonly by a combination of some of the above mentioned processes. So tedious and costly are the present refining processes that where but little silver is present it is very frequently left with the lead and sold in the pig lead without charge. Also, without regard to the silver, the refining of lead obtained by furnace treatment, particularly blast furnace treatment, of the ore is slow, expensive and entails loss of metallic values. This is so because at the temperature employed in a blast furnace the metal is heated to a temperature where it is actively solvent or absorbent of contaminating metals, as for instance iron, copper, tin, arsenic and antimony. Whether because these contaminating metals are not decomposed from their compounds to such a great extent or because the lead is less absorbent of them at lower temperatures or for some other reason, lead obtained by the open hearth or reverberatory furnace treatments is less impure; but even such lead has to be refined by poling with wood or by steam or by liquation before it is merchantable as the desirable "soft lead."

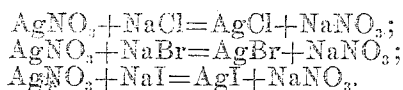
By methods heretofore proposed for electrolyzing argentiferous lead bearing ore, the silver and lead have been recovered together thus requiring subsequent separation, and the treatment would be impractical in the one case, because of the loss or waste of electricity and because of the expense in the other required to maintain the bath at the necessarily high temperature. For example,

it has been proposed to electrolyze such ore in a bath of molten lead compounds, but such treatment would be prohibitive because of the expense necessary to maintain the bath at the required high temperature and at best would produce only an alloy of lead and silver requiring subsequent separation. Also, it has been proposed to electrolyze such ore by a process wherein the ore, usually in the form of lead sulfid, was piled around the anode and partially electrolyzed in such bath. While some electrolysis of the ore can be secured by such procedure, such method must allow the solution of the electrolyte to come in contact with the anode itself by its permeation of the interstices of the piled ore, and this is necessarily wasteful of the electricity for the reason that as the current will to a great extent follow these channels of the solution because of the conductivity of the dissolved electrolyte all such electricity is wasted and has no effect whatever upon the ore, and as both the lead and silver collect on the cathode they must be subsequently separated by refining.

I have discovered that by employing cast argentiferous lead-bearing ore, in any convenient form such as bars or cakes, as the anode of an electrolytic cell containing a solution in water of a suitable electrolyte, I can more quickly and cheaply separate the lead and silver therefrom and also can independently recover them.

In practising my invention I prepare the bars or cakes of argentiferous lead-bearing ore used as anodes by fusing the ore, usually lead sulfid containing silver, preferably in a reverberatory hearth in which the atmosphere of the chamber above the ore is kept practically reducing by allowing it to remain full of the gaseous products of combustion from the fire box, and then casting or molding the fused ore into bars or cakes in suitable molds of refractory material. In practice I find that satisfactory results are obtained when these bars or cakes are in the form of slabs approximately eighteen inches long, twelve inches wide and two inches thick, provided with suitable heads for the positive terminal of the usual electric circuit; it is of course understood that these dimensions and forms may be varied. One or more of such anodes are arranged and supported with their bodies immersed in the liquid of an electrolytic cell containing a suitable electrolyte dissolved in water, and

provided with one or more of the usual cathodes. The bath preferably is slightly acid with nitric or acetic acid to prevent the precipitation of lead hydrate. In practice
 5 I prefer to employ a hydrous solution of sodium nitrate to which is added as required for precipitation of the silver a solution of sodium chlorid, bromid or iodid. The following reactions occur with sodium chlorid, bromid and iodid respectively:—



10 When the cell or apparatus is thus equipped and electric current is passed through the anode in any usual manner and by any suitable means now well known in the art of electrolysis, the cast silver and lead-bearing ore anode is electrolyzed and the silver and lead liberated. The lead and silver are then collected in any suitable manner or by any suitable means. For example,
 20 the lead may be collected upon the cathode in metallic form; or it may be precipitated by using well known lead-precipitants as for example by using potassium bi-chromate and collecting the precipitated lead chromate. The silver may be collected upon
 30 a screen or bag, preferably of filter cloth, surrounding the anode and into which is slowly fed a solution of alkaline halid, such as iodid or bromid or chlorid, that precipitates the silver within the filter as the respective salt; or without using the filter
 35 cloth any suitable precipitant may be fed into the bath between the electrodes and the deposited silver salt collected from the bottom of the cell. The alkaline halid first precipitates all silver in solution before reacting with the lead. Where sodium chlorid

or iodid is used there may at times appear a temporary precipitate of the corresponding lead halid, but because of their solubility these salts again pass into solution and the lead is collected on the cathode without interfering with the operation; where a sodium bromid is used no lead precipitate appears. In any case the silver halid remains unaltered.

By my process all loss through oxidation incident to furnace treatment is avoided, and all the electricity acts directly upon the cast argentiferous lead-bearing ore, so that the latter is more quickly and cheaply decomposed; and, furthermore, as the electrolytic bath is only slowly surcharged with excess of soluble reagents the same bath can be used for a considerable period, although as the water soluble compounds of the ore and the sulfur therefrom gradually accumulate within the bath it may be necessary from time to time to renew the solution or to substitute fresh solution. Also, the silver and lead are quantitatively separated in a state of purity by a single operation.

I claim:—

The process of recovering silver and lead from ore which consists in electrolyzing in a bath of suitable electrolyte a cast argentiferous lead-bearing ore anode in a filtering screen, precipitating the silver within the screen with a solution of an alkaline halid, and collecting the lead liberated by the electrolysis of the anode.

In testimony whereof I affix my signature in presence of two witnesses.

THEODORE G. TIMBY.

Witnesses:

J. McROBERTS,
 H. C. LUST.