# UNITED STATES PATENT OFFICE.

LEOPOLD BALBACH, OF SAN FRANCISCO, CALIFORNIA.

## IMPROVEMENT IN REFINING BASE BULLION.

Specification forming part of Letters Patent No. **207,937**, dated September 10, 1878; application filed August 9, 1878.

*To all whom it may concern:*

Be it known that I, LEOPOLD BALBACH, of the city and county of San Francisco, and State of California, have invented a Process of Refining Base Bullion; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a process for refining base bullion; and consists in mixing with the silver, gold, and copper bullion, and also argentiferous black copper, in suitable furnaces, certain proportions of galena, (sulphuret of lead,) by means of which the copper and other base metals are readily separated from the precious metals, as is more fully described in the following specification.

My process is more especially adapted for use in refining bullion carrying, in addition to silver, gold, and copper, such metals as lead, antimony, arsenic, &c., and which cannot be profitably manipulated by the use of acids, which is the customary process when the bullion is free from the latter-mentioned metals. By my method the silver, gold, and copper bullion, or argentiferous black copper, are melted in suitable furnaces with certain proportions of sulphuret of lead, commonly known as "galena." During this operation the sulphur in the galena combines with the copper present in the bullion, thus forming sulphuret of copper, (copper mat,) a small portion of the silver combining with the sulphur at the same time, which may be separated by any one of the known methods. The lead in the galena, being freed from its sulphur, combines with the silver and gold, and can be refined by the usual method of cupellation.

In the usual method of cupelling this class of bullion, from sixteen to twenty parts of lead are required to completely oxidize one part of copper, during which operation a considerable loss of silver occurs—that is to say, after finding the fineness of the bullion, and the amount of copper contained therein, it has been necessary to add in the cupel at least sixteen pounds of lead for each pound of copper in the bullion under treatment. If the bullion is in large quantities, the lead is added gradually in the proportion named, in order to get rid of the copper and other base metals. By my method not over two parts of lead are required to one part of copper, and that lead is obtained from the galena, thereby effecting not only a large saving of lead, but the loss of silver is considerably less, and the time required for refining about one-fourth of that usually necessary. The sulphur from the galena combines with the copper and forms the copper mat, that may be removed, and I get rid of the copper, which separates from the lead and silver immediately, the lead taking the place of the copper in the bullion. The mat is lighter than the lead, and comes to the surface, whence it may be skimmed or poured off, or, if left to cool, the layers will crack off readily.

The copper mat may be converted into sulphate of copper, into metal, or may be sold as mat. During the operation the galena is reduced and the lead and silver produced, while the copper is in such a shape that it may be easily worked. By the old method the copper and litharge are together, and have to be separated by two or three processes.

By my method the litharge obtained is nearly free from other metals, and can therefore be converted into lead, and the small amount of silver it contains more easily extracted, the copper being also obtained in one operation in a salable shape, or so that it can readily be converted into sulphate of copper or metal, while by the old method the two metals form a compound which it requires several operations to separate.

A considerable quantity of a certain class of what is known as "base bullion" is produced in the mining regions of the Pacific coast, which cannot be profitably refined there by the process now in vogue, and it is customary to ship it away to Europe or elsewhere to be refined, occasioning expense and loss of time. The reason of this is, that it is necessary to use so large a quantity of lead in proportion to the copper, so that when a great deal of copper is present the bullion is unprofitable to handle unless a quantity of fine bullion is added, so as to reduce the percentage of copper in the mass. Galena, however, is plentiful, and may be easily procured, so that my method makes its use practicable, with the additional advantages hereinbefore referred to—viz., obtaining the copper in a merchantable form, obtaining the lead and silver

in the galena, and refining the metals by fewer operations, and at a less cost than has been usual.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The process herein described for refining gold and silver bullion, consisting in adding to the melted bullion galena, (or sulphuret of lead,) substantially as and for the purpose herein described.

In witness whereof I hereunto set my hand and seal.

LEOPOLD BALBACH. [L. S.]

Witnesses:
CHAS. G. YALE,
FRANK A. BROOKS.