

UNITED STATES PATENT OFFICE.

FREDERICK H. BOUSFIELD, OF SAN FRANCISCO, CALIFORNIA.

IMPROVEMENT IN REFINING BULLION.

Specification forming part of Letters Patent No. **150,675**, dated May 12, 1874; application filed March 11, 1874.

To all whom it may concern:

Be it known that I, FREDERICK H. BOUSFIELD, of San Francisco city and county, State of California, have invented a Process for Beneficiating Base-Metal Bullion; and I do hereby declare the following description sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention without further invention or experiment.

It is a well-known fact that in working the ore from the Comstock ledge by pan process, much of the contained precious metals escapes a first amalgamation, as "slimes," tailings, &c., and that the working of these form a distinct and separate branch of the metallurgical industry of the State of Nevada.

In the process of this extraction much sulphate of copper is used, which, by the combined action of the mineralized silver, the iron of the pan, and the quicksilver used, becomes partly or wholly reduced to the metallic state, and is with the precious metals amalgamated.

The resulting bullion comes under the denomination of "base," and may range between $\frac{100}{1000}$ and $\frac{900}{1000}$ fine, according to the quantity of sulphate used, and its subsequent perfect or imperfect reduction and amalgamation. This class of bullion is also produced in working copperized silver ores by the various processes now in use for silver extraction, and it is to the beneficiating of such that my process applies.

The disadvantages which this bullion suffers under, and which is the object of this process to remove, are numerous, among which may be mentioned, first, in its crude state, as it comes from the retorting-house, it is unnecessarily bulky and heavy, enforcing a large extra consumption of time and fuel to run into bars; second, as bars—when the alloy is below $\frac{700}{1000}$ fine no reliance can be placed upon assays taken in the European fashion of chipping a corner, thus necessitating the expense of remelting the whole mass of metal in order to obtain a fair assay sample to determine the value critically; third, the cost of carriage of this bullion from the mines to the market center, and from such to Europe, where this bul-

lion is generally refined, is considerably augmented, the charges embracing both value and weight; fourth, the discount which bankers are obliged to impose on this class of bullion to protect themselves against contingencies of all kinds, and which discount is, for the most part, a clear loss to the producer of bullion.

I claim to be able to remove by my process from sixty to eighty per cent. of contained baseness, thus removing the above objectionable features, and to be able to utilize, at small expense the baseness so removed.

The process consists in subjecting, in suitable vessels, to the combined action of a mixture of nitric acid of a certain specific gravity and weak sulphuric acid, the crude bullion as it comes from the retort, or the metal in a granulated state. The chemical reaction which immediately sets in, even in the cold, but which is also greatly promoted by heat, is as follows: The nitric acid of the mixture is decomposed by the copper of the alloy, furnishing nitric-oxide gas, which is volatile and threeequivalents of oxygen. These threeequivalents of liberated oxygen having an affinity for the copper, at once convert that metal into oxide, which is at once dissolved and held in combination in the weak sulphuric acid.

When the action is sufficiently advanced the liquid may be decanted and evaporated to a certain density, when sulphate of copper will crystallize out, and the granulations of silver, which are not dissolved unless an excess of nitric acid is used, washed, and melted into comparatively fine bars.

In the ordinary process of refining this bullion, all the metals, excepting gold, are oxidized at the expense of the sulphuric acid, which is decomposed into the required amount of oxygen, and an equivalent amount of sulphurous acid. The metals, with the above exception, go into solution, and the silver is recovered by precipitating with metallic copper.

The oxidation in my process takes place without the loss of any portion of the sulphuric acid, the necessary oxygen being supplied, as before explained, by the nitric acid.

Should any of the silver go into solution through mistake in adding more than the calculated amount of nitric acid, it may be recovered without compromising any of the previously-explained advantages, by adding to the solution a sufficiency of the suboxide of copper.

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

The process of using the combined acids as a means of effecting the oxidation of the base metal without interfering with the integrity of the fine metals.

In witness whereof I hereunto set my hand and seal.

FREDERICK HENRY BOUSFIELD. [L. s.]

Witnesses:

J. L. BOONE,

C. M. RICHARDSON.