

# UNITED STATES PATENT OFFICE.

EDWIN J. FRASER, OF SAN FRANCISCO, CALIFORNIA.

## PROCESS OF OBTAINING PRECIOUS METALS BY SOLUTION.

SPECIFICATION forming part of Letters Patent No. 591,753, dated October 12, 1897.

Application filed September 1, 1896. Serial No. 604,575. (No specimens.)

*To all whom it may concern:*

Be it known that I, EDWIN J. FRASER, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Obtaining Precious Metals by Solution; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to the treatment of gold and silver ores for the purpose of extracting the metal therefrom in solution, and more especially that kind in which the precious metal is found in such a state of minute subdivision in the ore that it cannot be saved by the ordinary process, known as the "amalgamation process."

It has for its object the extraction of the precious metal from the ore by first reducing it to a fluid state in solution, after which the metal is extracted from the solution. For this purpose a solution of cyanid of potassium offers many advantages on account of cheapness, ready solubility, and ease in handling.

I am aware that the use of cyanid of potassium for that purpose is very old, but as the cyanogen of the same cannot unite with the precious metals without first being released from its base (to wit, potassium) reliance has ordinarily been placed upon a supply of oxygen derived from atmospheric air to unite with the potassium in order that the cyanogen could unite with the precious metals, thereby transforming them into soluble cyanids. This process is necessarily very slow and comparatively uncertain.

The special object of my invention is to supply nascent oxygen in the presence of the potassium, the cyanogen, and the metals in the ore, so that the nascent oxygen vigorously unites with the potassium, while the nascent cyanogen vigorously seeks a new base in the form of the precious metals in the ore. For this purpose I am aware that oxygen derived from the dioxids of some of the alkaline metals (notably from the dioxid of sodium) has been used, but I am not aware that before being so used the alkaline metal was first transposed into a sulfate by the addition of sulfuric acid, thereby forcing the oxygen to take up hydrogen as a base.

My invention has for its special object the

transformation of the base of the alkaline metal or alkaline earth-metal dioxid into a sulfate, thereby changing the base of the dioxid from the metal to hydrogen and holding the hydrogen dioxid securely in solution in the presence of an excess of sulfuric acid.

For my purpose of all the dioxids of the alkaline metals and alkaline earth metals I have discovered that the dioxid of barium is far superior to the dioxid of sodium or others of the group on account of its cheapness and stable keeping qualities. The sodium salt being very deliquescent is easily injured by exposure to the air, while the barium is not injured by such exposure.

In carrying out my invention I make two solutions, and when put together I call them my new "combination solvent." These are prepared approximately according to the following formula:

First. In one thousand gallons of water I dissolve from twenty to thirty pounds of cyanid of potassium, and to this solution I add about ten pounds of fresh lime and mix thoroughly.

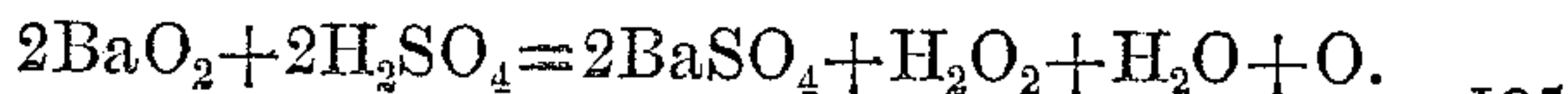
Second. To fifty gallons of water I add about two and a half gallons of sulfuric acid, and to this solution I add about sixteen pounds of the dioxid of an alkaline metal or alkaline earth metal, preferably the dioxid of barium. This is put into a tight cask or barrel and is rolled or agitated occasionally for a period of from four days to a week. The clear liquid is then decanted off and is ready for use.

It may be here noted that the quantities and proportions of the ingredients composing my solutions may be varied to suit the conditions and the quality of ore under treatment.

By the use of sulfuric acid, as stated in the preparation of my solution No. 2, the barium or other metal, as aforesaid, is transformed into a sulfate, leaving a hydrogen dioxid in the solution thus:



While this indicates the reaction so far as the production of hydrogen peroxide is concerned, some free oxygen will be liberated by the action of the acid upon the barium peroxide, which would be indicated as follows:



The excess of sulfuric acid used is for the



purpose of preventing the dioxid of hydrogen from decomposing until it is ready for use.

In the application of my two solutions to the pulverized ore I proceed proportionally as follows: In a tank of suitable size I put, say, one thousand gallons of solution No. 1, and into this put from five to eight tons of pulverized ore. I then put in a quantity of solution No. 2, usually about four gallons, and the whole is agitated together. The first action which takes place is the chemical union of the sulfuric acid in the second solution with the lime in the first solution, thereby transforming it into calcium sulfates. This takes away the acid which has heretofore prevented or retarded the decomposition of the hydrogen dioxid and the extra equivalent of oxygen readily parts with its feeble base and, in a nascent state, unites with a part of the potassium, for which it has a strong affinity, thereby transforming it into potassic oxid. The nascent cyanogen then seeks a new base in the form of the precious metals in the ore.

It may be here stated that should the ore be very rich in metal it may be found necessary to repeat the treatment, as above stated, until all of the metal is extracted.

My process, as above stated, I have found to be quicker in its action and capable of effecting a much larger extraction of metal from the ore than by any method or process heretofore known or used.

When the solution of the precious metal in the ore is completed, the fluid containing it is drained off from the exhausted ore and the metal is separated from its solvent and reduced to a compact form, ordinarily a bar of bullion.

The separation of the precious metal from the solution may be effected by any known

method. I prefer, however, to pass the solution through my patent voltaic filter, No. 543,546, issued July 30, 1895.

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

1. The process of treating gold and silver ores by solution, which consists in converting the metallic bases of the dioxids of the alkaline metals or alkaline-earth metals into sulfates, removing the metallic sulfate and using the solution after the metallic sulfate has been removed in combination with a solution of cyanid of potassium and lime in the presence of the ore, substantially as described.

2. The process of treating gold and silver ores by solution, which consists in converting the metal bases of dioxids of the alkaline metals into sulfates, by the addition of sulfuric acid, so as to produce hydrogen dioxid, preventing the decomposition of the hydrogen dioxid by an excess of acid, separating the solution from the metallic sulfate, mixing the solution with a solution of cyanid of potassium and lime in the presence of a precious metal, and leaching the liquid holding the precious metal.

3. The process of treating gold and silver ores by solution, which consists, in first mixing lime and cyanid of potassium in solution; second, mixing sulfuric acid and the dioxid of barium in solution; and third, combining the two mixtures with the finely-divided ore, substantially as described.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 22d day of August, 1896.

EDWIN J. FRASER.

Witnesses:

L. W. SEELY,  
HENRY P. TRICOU.