

UNITED STATES PATENT OFFICE.

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METHOD OF CONCENTRATING ORES.

SPECIFICATION forming part of Letters Patent No. 509,058, dated November 21, 1893.

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To all whom it may concern:

Be it known that we, ELWYN WALLER and CHARLES AUGUSTUS SNIFFIN, both citizens of the United States, and residents of the city, county, and State of New York, have invented certain new and useful Improvements in Methods of Concentrating Ores, of which the following is a specification.

The methods ordinarily employed for concentrating ores depend chiefly or entirely upon the difference of specific gravity between the ore or free metal and the gangue with which the ore is associated, whereby, when the finely pulverized material is agitated with air or water, or by some mechanical means, the material having the higher specific gravity is conveyed to or deposited in one place, while the portion having the lower specific gravity is conveyed to or deposited in another place. Thus a rough sort of separation is effected and the major portion of the gangue disposed of. These methods are designed to separate the metal-bearing ore or free metal from the gangue or rock, and not to separate one metal in the ore from another metal contained therein. Some ores are found to contain both a base metal and a precious metal, the percentage of baser metal being usually much the larger, and in order to concentrate the precious metal, it is desirable to remove the baser metal from the crude ore or material. Our invention has reference more especially to this latter class of concentration.

Our method of concentrating has for its object to remove from the ore certain portions thereof which portions are brought into solution, thus affording compounds valuable in the arts, while other portions of the valuable material are thus concentrated in the residue or undissolved gangue. This method may be employed either separately, or in conjunction with some other method or methods of separation and concentration, dependent upon specific gravity alone.

With the carbonate ores of lead, containing the mineral cerussite more or less mixed with other minerals, we are able by our process, when silver is present, to dissolve out the lead and leave the silver in the residue with the other undissolved substances, the result being a concentration of the silver in such argen-

tiferous ores. It may be desirable to remove all of the lead, or to leave a portion of the lead with the silver in the residue from the concentration, in order to facilitate the extraction of the silver present; and the proportion of lead left in the residue may be regulated either by the strength of the solvent solution used, or by the length of time which said solution is permitted to act, or by the proportion of the solvent to the amount of ore treated, or by the character of the solvent employed.

The solvents we have found very effective are acetic acid and solutions of acetate of lead. Practically all acetates, as well as acetic acid, when in aqueous solution, will, with the aid of heat, dissolve out the lead from lead carbonate ores. The action of all is the same in kind but different in degree.

Our process may be carried out by mixing together in a suitable vessel acetic acid, water and argentiferous ore containing lead carbonate, and heating this mixture up to the point of ebullition. The acetic acid combines with the lead, forming lead acetate, and gaseous carbonic acid is set free. The solution of lead acetate is drawn off and the argentiferous residue reserved for treatment by any known process for the extraction of the silver.

It will be obvious that no exact proportions of the several ingredients can be prescribed, nor are any exact proportions essential. If the proportion of acid is equal to or greater than one hundred and twenty pounds of real acetic acid to two hundred and seven pounds of lead, as carbonate, in the ore, neutral lead acetate will be formed and will pass into solution. If the proportion of lead in the ore is greater than that given above, basic lead acetates will be formed by the action of the neutral acetate upon the lead carbonate remaining. This action is somewhat slower than when acetic acid is used, but at a boiling temperature the action is rapid, becoming gradually slower as the solution becomes more and more basic.

When a solution of the neutral lead acetate is subjected to prolonged boiling, some of the acetic acid passes off with the steam and watery vapor and may be condensed and utilized again as a solvent for concentration, on a fresh lot of ore. By this treatment the so-

lution is converted into a solution of basic lead acetate.

If acetic acid be used in a proportion greater than one hundred and twenty pounds of real acid to two hundred and seven pounds of lead as carbonate in the ore, and if, as may sometimes occur, the ore contains silver carbonate, some silver acetate may be formed and go into solution. In such a case the silver may be put back into the undissolved residue by the addition to the charge of a small amount of metallic lead in a subdivided condition. The action which takes place is the substitution of lead for the silver in the solution, the silver separating out in the metallic state. The carbonic acid evolved in the process will be collected and utilized, and in order to recover this acid the process is carried on out of contact with the air.

The action of other acetates than lead acetate, at the boiling temperature, will be to form, chiefly, neutral lead acetate; a portion of the carbonic acid from the carbonate ore is driven off with the steam and a portion combines with the base of the acetate employed to form a carbonate.

We do not claim the manufacture of acetates by sprinkling the ground ore with acetic acid and exposing them to the air, nor do we claim the recovery of metals from ores by the combined action of the oxidizing influence of air and that of acetic acid. Our process excludes the air and has for its object the concentration of the precious metal in the residue by the extraction of the baser metal, lead.

Having thus described our invention, we claim—

1. The herein described method of concentrating argentiferous lead carbonate ores which consists in dissolving out lead from the ore with the aid of acetic acid, real or combined, and water, out of contact with the air whereby the lead and carbonic acid eliminated from the ore are rendered capable of utilization in the arts, and the undissolved silver is concentrated in the residue, substantially as set forth.

2. The herein described method of concentrating argentiferous lead carbonate ores, which consists in removing the lead, or the major portion thereof, from the ore with the aid of water, acetic acid and heat, and out of contact with the air whereby the undissolved silver is concentrated in the residue, substantially as set forth.

3. In the treatment of lead carbonate ores, the method of recovering acetic acid from neutral acetate solutions, which consists in boiling the solution, whereby it is converted into a solution of basic lead acetate, and condensing the vaporized acetic acid, substantially as set forth.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

ELWYN WALLER.

CHARLES AUGUSTUS SNIFFIN.

Witnesses:

HERBERT BLOSSOM,

JAS. KING DUFFY.