

UNITED STATES PATENT OFFICE.

ORR JOHNSON ADAMS, OF GRAND JUNCTION, COLORADO.

METHOD FOR CONCENTRATION OF ORES.

Specification of Letters Patent.

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1,070,313.

No Drawing.

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To all whom it may concern:

Be it known that I, ORR J. ADAMS, a citizen of the United States, and a resident of Grand Junction, in the county of Mesa and State of Colorado, have invented a new and Improved Method for Concentration of Ores, of which the following is a full, clear, and exact description.

In mining for ores of rare metals, such as vanadium, uranium, or the like, the amount of ground to be treated for the small per cent. of mineral obtained is very large. It is therefore necessary to get the maximum of mineral possible out of the treated ground, and to get this I have perfected a method of concentration, which consists in separating finer slimed values by mechanical means, then leaching the remaining substance by a solvent for the mineral in the ore, and then precipitating the dissolved mineral by the addition of the values obtained by the mechanical separation.

By means of my method I do not extract any of the rare metals from the ore but I do remove the majority of the gangue, thereby reducing the cost of transportation of the ore.

To explain the matter, the concentration of vanadium ores will be given here. The ore-bearing rock or sandstone contains the mineral to be separated in the cavities and as a filling between the grains of sand and generally forms the binding element for these grains, consequently to reach the mineral the rock must be disintegrated to minute particles, care being taken not to break up the grains of sand, the disintegrating being done in the well-known way, by means of mills, without the pebbles ordinarily used for fine grinding (the pebbles having a tendency to break the sand grains, which should be avoided). The disintegrated product is then separated by mechanical means, such as screening or blowing, or preferably by water. The floating product being collected by decantation of the slimed values or separated by the apparatus used for separating sand from slime in cyanid processes. With the first removed slime values there is also removed minerals of an acid destroying nature, such as alumina, lime, iron, oxids, potash, soda minerals, etc. The remaining substance, that is, the sand with the values still adhering to it, and the coarser ore particles is in much better condition for treatment. This mass is then treated with a diluted so-

lution of a non-organic acid, preferably sulfuric, which will percolate easily through the mass, due to the coarseness of same. The resultant acid solution, with the dissolved minerals is then decanted or filtered in any suitable way. To the filtrate which is of acid character is then added the fine slimes at first removed mechanically. This will now furnish the necessary and economical precipitant for the leaching wash used on the sand and the heavier ore particles. This precipitates the dissolved rare mineral, which are insoluble in neutral solution and can then be obtained by decantation or filtration. The result of the process is not a chemical product but simply a concentration of values contained in the ore. The amount of diluted acid used depends upon the quantity of soluble minerals to be dissolved by the acid, which must be determined for each lot of ore.

It must be remarked that by removing mechanically the minerals of an acid destroying nature the amount of acid required for leaching is comparatively small; and, this mechanically removed acid-destroying mineral gives the necessary substance to precipitate the required mineral from the solution obtained by leaching.

For illustration a concrete example of the process is given: One ton of raw ore containing 3% of oxids of uranium and vanadium jointly (that is, 60 lbs.) is disintegrated and mechanically slimed. The fine slimed values removed weigh 400 pounds, of which 40 pounds are the oxids of uranium and vanadium, these 40 pounds forming 66.6% of the 3% of the oxids contained in one ton of raw ore. The 360 pounds of the fine slimed value constitutes the major part of the minerals of the acid destroying character of the raw ore. Therefore the remaining 1600 pounds forming the slimed tailing contain mostly sand and 20 pounds of oxid of uranium and vanadium. This slimed tailing is treated with acid for extracting the oxid of uranium and vanadium. From the 1600 pounds of the slimed tailing about 16 pounds of the oxid of uranium and vanadium is extracted by the acid, leaving 1584 pounds behind, which goes to the dump, the 16 pounds of the oxid of uranium and vanadium being in solution. To this solution the 400 pounds forming the fine slimed values are added, neutralizing the acid character of the solution and causing the precipitation from same of the 16

lbs. of the oxid of uranium and vanadium. Therefore, the total weight of the concentric ore is about 416 pounds. Now, since one ton is 2000 pounds and the concentrated product is 416 pounds, the rate of concentration is 5.

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

1. Method for concentrating of ores, which consists in separating a part of the finer or slimed values by mechanical means, then leaching the remaining substance, to remove as much as possible of the remaining values, by a solvent, and then adding to the so-obtained solution the finer values at first obtained, thereby precipitating the mineral from the solution.
2. Method for concentrating of ores, which consists in separating a part of the finer or slimed values by mechanical means, then acting on the remaining substance by a diluted, non-organic acid to remove as much as possible of the remaining values from the ore, and then separating the liquid from the sediment and to the so-obtained solution adding the first obtained finer values, thereby precipitating the mineral from the solution.
3. Method for concentrating of ores, which consists in separating a part of the finer or slimed values by mechanical means, then acting on the remaining substance with a diluted sulfuric acid to remove as much as possible of the remaining values from the ore,

then separating the liquid from the sediment, and then to the so-obtained solution the finer values at first obtained are added, thereby precipitating the mineral from the liquid.

4. Method for concentration of ores, which consists in removing the acid-destroying minerals from the ore, then leaching the remaining substance with a diluted sulfuric acid, and then to the so-obtained solution adding the first-obtained acid destroying minerals, thereby precipitating from the solution the mineral dissolved by the acid.

5. Method for concentration of ores, which consists in separating a part of the finer or slimed values and minerals of an acid-destroying nature by mechanical means, then acting on the remaining substance by a diluted non-organic acid to remove as much as possible of the remaining values from the ore, and then separating the liquid from the sediment and to the so-obtained solution adding the first-obtained final values with the acid destroying minerals, thereby precipitating from the solution the mineral dissolved by the acid.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ORR JOHNSON ADAMS.

Witnesses:

CHAS. E. CHEVINGTON,
D. W. SPERRY.