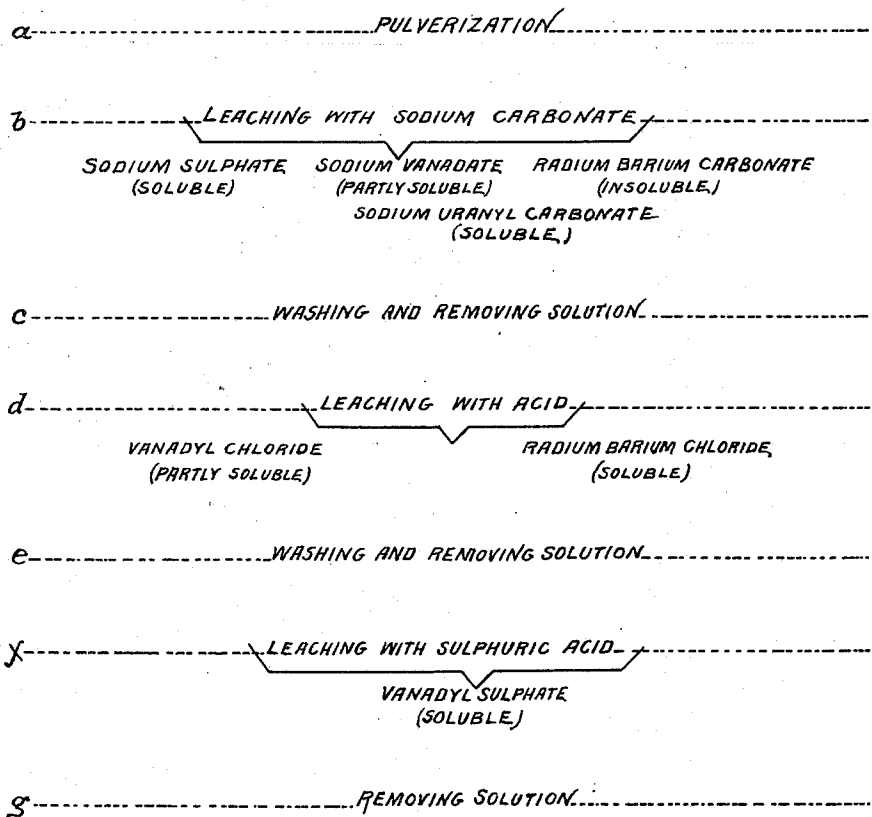


W. F. BLEECKER.
PROCESS OF EXTRACTING VALUES FROM ORES.
APPLICATION FILED MAY 24, 1912.

1,065,581.

Patented June 24, 1913.



WITNESSES

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PROCESS OF EXTRACTING VALUES FROM ORES.

1,065,581.

Specification of Letters Patent.

Patented June 24, 1913.

Application filed May 24, 1912. Serial No. 699,594.

To all whom it may concern:

Be it known that I, WARREN F. BLEECKER, a resident of Canonsburg, in the county of Washington and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Extracting Values from Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved process for treating ores, and more particularly to a process for extracting values from ores, such as carnotite ore, containing uranium, vanadium, and radium.

The object of my present invention is to so treat the ore as to separate the valuable constituents from the ore and from each other and produce separate solutions predominating, respectively, in said values.

A further object is to so treat carnotite ore as to recover separate solutions predominating, respectively, in uranium, radium and vanadium.

With these objects in view, the invention consists in certain novel steps in the extraction of values from ores, as hereinafter set forth and pointed out in the claims.

In the accompanying drawing, my improved process is diagrammatically illustrated.

In carrying my process into effect, I proceed substantially as follows:—The ore (carnotite ore, for example) is first ground or comminuted to a desired degree of fineness, and it is then leached with a hot solution of an alkaline carbonate, such, for example, as sodium carbonate,—the temperature of such solution preferably not exceeding 90° C. The effect of this treatment is to dissolve the uranium contained in the ore (forming sodium uranyl carbonate,—

$(\text{NaCO}_3)_2 \cdot \text{UO}_2\text{CO}_3$),

and also a portion of the vanadium, (forming sodium vanadate of the type

$\text{Na}_2\text{O}(\text{VO})_x(\text{VO}_2)_y$,

probably $\text{Na}_2\text{V}_4\text{O}_7$). This solution is then stored for further treatment to recover the uranium and vanadium. The alkaline carbonate used (preferably a 10% solution) will serve also to decompose radium barium sulfates in the ore

(forming radium barium carbonates,— $\text{RaCO}_3 \cdot \text{BaCO}_3$) and rendering the radium content soluble in acid as presently explained. The ore will be next washed to free it from sulfates originating from the radium barium sulfates above mentioned, and also to free the ore from soluble carbonates. The resultant solution will contain sodium uranyl carbonate and vanadium salts, such as sodium vanadate. This solution is then withdrawn and stored for any approved subsequent treatment to recover the values. The ore will then be leached with an acid and then washed with water. Any suitable acid may be used in this step of the process and it may be either hot or cold. Good results may be obtained with the use of an 8% solution of hydrochloric or nitric acid, for example. This treatment of the ore dissolves the radium (forming radium barium chlorid,— RaBaCl_2) and some of the vanadium in the ore (forming vanadyl chlorid VOCl_2), and the solution will be drawn off and stored for any approved subsequent treatment to recover the values. If desired, the ore may finally be leached with dilute sulfuric acid. I prefer to employ a solution of substantially 10% H_2SO_4 , and this solution should be hot, preferably at a temperature not exceeding 90° C. This treatment dissolves the vanadium remaining in the ore (forming vanadyl sulfate,— $(\text{VO})_2(\text{SO}_4)_2$), and the solution is stored for proper subsequent treatment to recover the vanadium.

It will be seen that products of my improved process comprise a uranium solution containing but a small amount of vanadium, resulting from the first leaching step; a radium solution containing a small amount of vanadium, resulting from the second leaching step, and a vanadium solution (containing the vanadium left in the ore after the previous treatments), resulting from the third leaching step.

In the drawing I have represented the various steps diagrammatically by the reference characters *a b c d e f g* and I have also indicated the products of the steps which involve chemical action.

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

1. The herein described process of extracting values from ores containing ura-

2. The herein described process of extracting values from ores containing uranium, radium and vanadium, consisting in reducing the ore to a comminuted state, treating the same with an alkaline carbonate and recovering a uranium solution; then treating the ore with an acid other than sulfuric, and recovering a radium solution.
3. The herein described process of extracting values from ores containing uranium, radium and vanadium, consisting in reducing the ore to a comminuted state, treating the same with heated sodium carbonate, recovering a uranium solution, treating the ore with an acid other than sulfuric, and recovering a radium solution.
4. The herein described process of treating carnotite ores, consisting in reducing the ore to a comminuted condition, then treating the ore with an alkaline carbonate, recovering the resultant solution, treating the ore with a dilute solution of acid other than sulfuric and recovering the resultant solution, and finally treating the ore with a dilute solution of sulfuric acid and recovering the resultant solution.
5. The herein described process of treating carnotite ore, consisting in reducing the ore to a comminuted condition, then treating the ore to dissolve the uranium and a small amount of the vanadium and converting the radium into a form which is soluble by subsequent treatment, and recovering the resultant solution, and then treating the residual ore to dissolve the radium and some of the remaining vanadium, and recovering the resultant solution.

6. The herein described process of treating carnotite ore, consisting in reducing the ore to a comminuted condition, then treating the ore to dissolve the uranium and a small amount of the vanadium and converting the radium to a form which is soluble by subsequent treatment, and recovering the resultant solution, then treating the residual ore to dissolve the radium and some of the remaining vanadium and recovering the resultant solution, and finally dissolving the remaining vanadium in the ore and recovering the resultant solution.

7. The herein described process of extracting uranium, radium and vanadium from ores containing the same, consisting in reducing the ore to a comminuted condition, and then by successive steps, treating the ore to dissolve the uranium and convert the radium into a form which is soluble by subsequent treatment, then dissolving the radium and then dissolving vanadium, and recovering separate solutions predominating, respectively, in uranium, radium and vanadium.

8. The herein described process of extracting uranium, radium and vanadium from ores containing the same, consisting in reducing the ores to a comminuted condition, and then, by successive steps, treating the ore to dissolve uranium and vanadium and convert the radium into a form which is soluble by subsequent treatment, and then dissolving the radium, and recovering separate solutions containing respectively uranium and vanadium, and radium and vanadium.

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

WARREN F. BLEECKER.

Witnesses:

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HARRY A. KRAELING.