

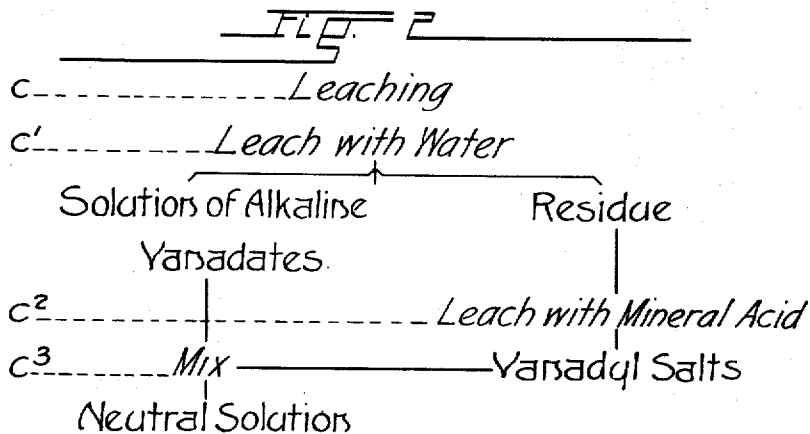
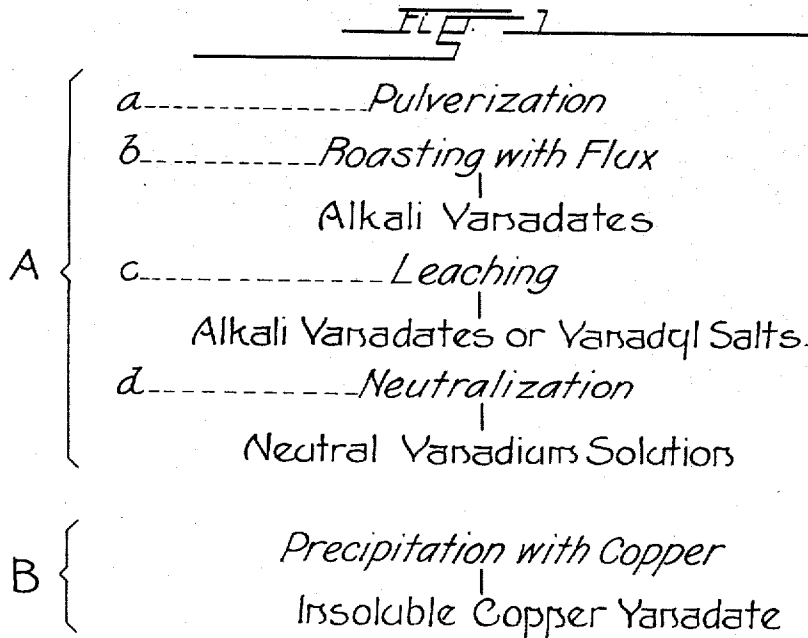
W. F. BLEECKER.

PROCESS OF PRODUCING COPPER, LEAD, OR IRON VANADATE FROM VANADIFEROUS ORES.

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PROCESS OF PRODUCING COPPER, LEAD, OR IRON VANADATE FROM VANADIFEROUS ORES.

1,015,469.

Specification of Letters Patent.

Patented Jan. 23, 1912.

Application filed April 21, 1909. Serial No. 491,341.

To all whom it may concern:

Be it known that I, WARREN F. BLEECKER, a citizen of the United States of America, residing at Boulder, in the county of Boulder and State of Colorado, have invented certain new and useful Improvements in Processes of Producing Copper, Iron, or Lead Vanadate from Vanadiferous Ores, of which the following is a specification.

This invention relates to the process of producing copper, iron or lead vanadate from vanadiferous ores and it has for its object to expeditiously effect a clean separation of the vanadium constituents of ore from the extraneous matter with which they are associated and to transform said constituents into insoluble copper, lead or iron vanadate by precipitation with the respective metal. It should be observed that vanadates other than those mentioned may be produced by the same process, but they are of minor importance and of but little commercial value, and inasmuch as the method of production is the same in each instance with the exception of the substitution of one metallic substance for the other, the process as explained in the following description will relate exclusively to that employed in the production of insoluble copper vanadate.

To facilitate description, reference will be had to the accompanying drawings in which the various steps comprised in the process are diagrammatically represented and in which—

Figure 1, shows successively, the various actions by which the copper vanadate is produced from the vanadiferous ores and Fig. 2, the steps included in the preferred method of leaching.

Referring to Fig. 1 of the drawings, it will be observed that the process includes two general actions, viz:—A, the production of an approximately neutral vanadium solution and B, the precipitation of the said solution with the metallic substance, in this instance copper which united with the vanadium elements of the solution, produces an insoluble copper vanadate, while the alkali salts and other impurities remain in solution to be subsequently drawn off. The first action, A, is performed in four successive steps, viz:—*a*—pulverization of the ore to a suitable degree of fineness; *b*—roasting the pulverous

matter after having been mixed with a flux to render the vanadium constituents thereof soluble after roasting; *c*—leaching the product of the roasting process to obtain a solution of alkali vanadate or vanadyl salts and *d*—treating the products of the preceding steps to obtain a neutral vanadium solution. The pulverization of the ore may be accomplished by the use of any suitable apparatus and the subsequent roasting process may be performed in a furnace either of the closed or open type in which the pulverized matter is heated to a little above redness and maintained in that state for at least fifteen minutes. The flux by which the vanadium constituents of the ore under treatment are rendered soluble after roasting, is composed of sodium chlorid and a fixed alkali such as potassium hydroxid, sodium hydroxid, potassium carbonate or sodium carbonate, preference being given to the first named substance, and this flux being mixed with the pulverous ore either before or during the roasting process, causes the vanadium constituents of the ore to be transformed into alkali vanadates.

The leaching process (*c* in Fig. 1) is preferably carried on as is shown in Fig. 2. The product of the roaster is first leached with water (*c*¹) either in a dead leaching tank or in an agitation tank, with the result that the soluble alkali vanadates are dissolved. The rich liquor (alkaline solution) is now led to storage tanks; and the residue is again leached (*c*²) but this time with a dilute mineral acid (such as hydrochloric) for the purpose of dissolving such vanadates as were insoluble in water. The residue of the leaching process is now practically free from vanadium and the products of the water-leach (alkaline solution) and of the acid-leach (vanadyl salts) are now mixed (*c*³) to produce a neutral solution. It will be understood that either one or the other of the steps *c*¹ and *c*² may be omitted and a neutral solution obtained either by the treatment of the alkaline solution with acid or of the acid solution with alkali and that should the solutions produced by the steps *c*¹ and *c*² be unproportioned, acid or alkali may be added to neutralize the mixture.

The action B, includes but one step, that is:—the precipitation of the vanadium by

means of copper to obtain an insoluble copper vanadate which is subsequently separated by filtration from the alkali and other impurities which remain in solution.

5 The final action B in my process is accomplished by adding to the neutral solution, copper sulfate or any salt of copper (or any other metal) which produces a copper vanadate which, being insoluble in water, is
10 easily filtered and washed while the residual solution being free from copper, may be used in the place of water in the water leach c¹, so that any vanadium left therein by reason of the precipitation process not
15 having been complete, may be recovered.

As has been mentioned hereinbefore, the only difference between the process above described and that for the production of insoluble iron or lead vanadates resides in the
20 substitution for the copper, in the precipitation step B, of iron or lead or for the copper sulfate or salts of copper, iron or lead sulfate or salts of iron or of lead.

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

1. The process of producing metallic vanadate from vanadiferous ores consisting in extracting the vanadium constituents of the
30 ore, by solution and precipitating the vanadium in said solution with a salt of the respective metal.

2. The process of producing metallic vanadate from vanadiferous ores consisting in
35 roasting the vanadiferous ores with a flux adapted to render the vanadium constituents soluble after roasting, leaching the roasted product, neutralizing the solution and precipitating the vanadium in the solution with
40 a salt of the respective metal.

3. The process of producing metallic vanadate from vanadiferous ores, consisting in roasting the vanadiferous ores with sodium
45 chlorid and a fixed alkali, leaching the roasted product, to obtain a vanadium solution and precipitating the vanadium in the solution with a salt of the respective metal.

4. The process of producing metallic vanadate from vanadiferous ores, consisting in
50 roasting the vanadiferous ores with sodium

chlorid and potassium hydroxid, leaching the roasted product, to obtain a vanadium solution and precipitating the vanadium in the solution with a salt of the respective
55 metal.

5. The process of producing metallic vanadate from vanadiferous ores, consisting in roasting the vanadiferous ores with a flux adapted to render the vanadium constituents
60 soluble after roasting, leaching the roasted product in water, leaching the residue of the last named step with acid, neutralizing the solutions and precipitating the vanadium in the neutral solution with a salt of the respective metal.

6. The process of producing metallic vanadate from vanadiferous ores, consisting in roasting the vanadiferous ores with a flux adapted to render the vanadium constituents
70 soluble after roasting, leaching the roasted product in water, leaching the residue of the last named step with acid, mixing the solutions to produce a neutral solution, and precipitating the vanadium in the neutral solution with a salt of the respective
75 metal.

7. The process of producing metallic vanadate from vanadiferous ores consisting in roasting the vanadiferous ores with a flux adapted to render the vanadium constituents
80 thereof soluble after roasting, leaching the roasted product to obtain a vanadium solution and precipitating the vanadium in the solution with a salt of the respective
85 metal.

8. The process of producing metallic vanadate from vanadiferous ores, consisting in roasting the vanadiferous ores with a flux adapted to render the vanadium constituents
90 thereof soluble after roasting, leaching the roasted product to obtain a vanadium solution, and precipitating the vanadium in the solution with a salt of the respective metal.

In testimony whereof I have affixed my
signature in presence of two witnesses.

WARREN F. BLEECKER.

Witnesses:

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