

UNITED STATES PATENT OFFICE.

PAUL W. AVERY AND EUGENE C. KNOWLES, OF DEADWOOD, SOUTH DAKOTA.

PROCESS OF TREATING PRECIOUS-METAL-BEARING MATERIALS.

963,111.

Specification of Letters Patent.

Patented July 5, 1910.

No Drawing.

Application filed October 19, 1908. Serial No. 458,471.

To all whom it may concern:

Be it known that we, PAUL W. AVERY and EUGENE C. KNOWLES, citizens of the United States, residing at Deadwood, in the county of Lawrence and State of South Dakota, have invented certain new and useful Improvements in Processes of Treating Precious-Metal-Bearing Materials, of which the following is a specification.

Our invention relates to an improvement in the art of treating precious metal bearing materials, particularly those ores or tailings which contain precious metals incased in sulfids, and it consists in subjecting the above specified precious metal bearing material to the action of the carbonates and hydroxids of the alkali metals, or the alkaline earth metals, or in the presence of atmospheric air, or other oxidizing agent under pressure, for the purpose of liberating the precious metals from the aforesaid sulfids and subsequently bringing a dissolving solution in contact with said material.

In the usual method of treating ore, tailings, or like precious metal bearing materials with alkaline cyanogen solutions there is often present in the material which is being treated complex sulfids which either by reason of their chemical composition exercise a deterrent effect on the dissolution of the precious metals, or by reason of precious metals being incased therein impede the dissolution of the precious metal by the dissolving solution.

Now we have discovered that if before treatment with the dissolving solution the said sulfids in the materials treated are decomposed by the elimination of sulfur much more efficient dissolution of the precious metals will result. This is accomplished preferably by treating the particles of the precious metal bearing material in the presence of a suitable oxidizing agent, such as air under pressure, with a basic solution which will decompose the sulfids present in the mass, such as a solution of carbonates, or hydroxids of the alkali metals or alkaline earth metals, or a solution composed of a combination of two or more of the same.

The process may be carried out in any form of container in which a contact may be maintained between the basic solution, any desirable oxidizing agent and the particles containing the precious metals, and in practice we employ commercial caustic soda as the most suitable reagent, for the reason that

it is obtainable in sufficient quantities at low cost. Moreover the caustic soda can be regenerated by the addition of the very cheap chemical calcium hydroxid, by agitation with the stock working solution of sodium hydroxid, carbonate, sulfate, etc. After the decomposition has taken place, the solution is then removed from the material in any convenient manner and the latter is subjected to any approved treatment for recovering the precious metals. The effect of this treatment is similar to that resultant from roasting an ore, namely, an oxidized product results, which is chemically and physically different from its original state in the ore.

We claim as our invention:

1. The method of treating precious metal bearing materials containing sulfids, which consists in treating said material in the presence of a suitable oxidizing agent, with a basic solution which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals from said material in any convenient manner.

2. The method of treating precious metal bearing materials containing sulfids, which consists in treating said material in the presence of a suitable oxidizing agent, with a solution containing alkali-metal which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals from said material in any convenient manner.

3. The method of treating precious metal bearing materials containing sulfids, which consists in treating said material in the presence of a suitable oxidizing agent, with a solution containing a mixture of a carbonate and a hydroxid of an alkali-metal which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals from said material in any convenient manner.

4. The method of treating precious metal bearing materials, containing sulfids, which consists in treating said material in the presence of a suitable oxidizing agent with a solution containing a hydroxid of an alkaline earth metal which will sufficiently decom-

pose the sulfids present therein, to enable the precious metals to be readily separated therefrom, then removing the resultant solution, and subsequently recovering the
5 precious metals from said material in any convenient manner.

5. The method of treating precious metal bearing materials containing sulfids, which consists in treating said material in the presence of a suitable oxidizing agent, with a
10 solution of caustic soda which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering
15 the precious metals from said material in any convenient manner.

6. The method of treating precious metal bearing materials, containing sulfids, which consists in treating said material in the presence of a suitable oxidizing agent with a
20 solution containing a carbonate of an alkali metal and caustic soda, removing the resultant solution, and subsequently recovering the precious metals from said material
25 in any convenient manner.

7. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with a
30 suitable gaseous oxidizing agent under pressure in a basic solution which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant
35 solution and subsequently recovering the precious metals from said material in any convenient manner.

8. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with a
40 suitable gaseous oxidizing agent, under pressure in a solution containing alkali metal which will sufficiently decompose the sulfids present therein to enable the precious
45 metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals from said material in any convenient manner.

9. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with a
50 suitable gaseous oxidizing agent under pressure in a solution containing a mixture of a carbonate and a hydroxid of an alkali-
55 metal which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals
60 from said material in any convenient manner.

10. The method of treating precious metal bearing materials, containing sulfids, which consists in agitating said material with a
65 suitable gaseous oxidizing agent under pres-

sure in a solution containing a hydroxid of an alkaline earth metal which will sufficiently decompose the sulfids present therein, to enable the precious metals to be readily
70 separated therefrom, then removing the resultant solution, and subsequently recovering the precious metals from said material in any convenient manner.

11. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with a
75 suitable gaseous oxidizing agent, under pressure with a solution of caustic soda which will sufficiently decompose the sulfids present therein to enable the precious metals to
80 be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals from said material in any convenient manner.

12. The method of treating precious metal bearing materials, containing sulfids, which consists in agitating said material with a
85 suitable gaseous oxidizing agent under pressure with a solution containing a carbonate of an alkali metal and caustic soda which
90 will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution, and subsequently recovering the precious metals from said material
95 in any convenient manner.

13. The method of treating precious metal bearing materials, containing sulfids, which consists in agitating said material with a
100 suitable gaseous oxidizing agent under pressure in a solution containing a carbonate of an alkali-metal and caustic soda, removing the resultant solution, and subsequently recovering the precious metals from said material
105 in any convenient manner.

14. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with atmospheric air under pressure in a basic
110 solution which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals
115 from said material in any convenient manner.

15. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with atmospheric air under pressure in a solution
120 containing alkali-metal which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering
125 the precious metals from said material in any convenient manner.

16. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with at- 130

5 mospheric air under pressure in a solution containing a mixture of a carbonate and a hydroxid of an alkali-metal which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering the precious metals from said material in any convenient manner.

10 17. The method of treating precious metal bearing materials containing sulfids, which consists in agitating said material with atmospheric air under pressure in a solution of caustic soda which will sufficiently decompose the sulfids present therein to enable the precious metals to be readily separated therefrom, then removing the resultant solution and subsequently recovering

the precious metals from said material in any convenient manner. 20

18. The method of treating precious metal bearing materials, containing sulfids, which consists in agitating said material with atmospheric air under pressure with a solution containing a carbonate of an alkali metal and caustic soda, removing the resultant solution, and subsequently recovering the precious metals from said material in any convenient manner. 25

In testimony whereof we affix our signatures, in presence of two witnesses. 30

PAUL W. AVERY.
EUGENE C. KNOWLES.

Witnesses:

AMOS B. WEST,
GEO. F. BAGGALEY.