UNITED STATES PATENT OFFICE.

HARALD DE RAASLOFF, OF NEW YORK, N. Y.

PROCESS OF EXTRACTING PRECIOUS METALS FROM ORES.

SPECIFICATION forming part of Letters Patent No. 636,288, dated November 7, 1899.

Application filed August 9, 1899. Serial No. 726,661. (No specimens.)

To all whom it may concern:

Be it known that I, HARALD DE RAASLOFF, a citizen of the United States, residing at the city of New York, borough of Manhattan, in the State of New York, have invented a certain new and useful Process of Extracting Precious Metals from Ores, of which the following is a specification.

This invention relates to improvements in processes for extracting precious metals from ores.

More particularly, the invention relates to the use of liquid air in connection with cyanid of potassium and other solvents of precious metals to furnish the oxygen which is needed to break up the solvent and set free the active element, which will then dissolve the precious metals, which, for example, in the case of a solution of potassium cyanid, will combine with the alkaline metal, setting cyanogen free to dissolve the gold. The process is intended to be applied to the ore, the concentrates, or the tailings, particularly where the (ore) material to be reduced is ground to a fineness producing what is known as "slimes."

It has been long known that the use of oxygen is highly beneficial in connection with the cyanid process of separating gold and other precious metals from their ores; but heretofore the oxygen has been obtained by the use of chemicals—such as hydrogen peroxid, barium binoxid, and peroxid of manganese—the cost of using which has been so great as to render their use impracticable for low-grade ores. I have, however, found that by using liquid air I obtain the oxygen in an intensely active and efficient condition at a low cost.

My process also has the great advantage that it enables me to apply the cyanid solution to the pulverized ore without previous roasting of the ore.

In applying my invention I may either introduce the liquid air into the vat containing the pulverized ore and solution or may first allow the nitrogen to evaporate and then introduce the active oxygen. In the former case the liquid air is introduced into the vat, and as the temperature of the liquid air rises to 320° Fahrenheit and above the nitrogen evaporates, leaving the oxygen, which does not evaporate until the temperature of the liquid air reaches 300° Fahrenheit, in an intensely-active condition, wherein it immediately combines with the alkaline base of the cyanid, setting more or less of the cyanogen free, which then dissolves the gold. In the latter case an open receiver of liquid air is allowed to stand until the nitrogen has evaporated and the temperature risen approximately to 300° Fahrenheit. The arrival of the liquid air at this condition can be readily determined by pouring off a small quantity and plunging a piece of steel wire heated to redness into it. If the nitrogen has evaporated, the wire will burst into fierce flame. Now the liquid air (or liquid oxygen) is drawn off into another vessel and mixed slowly with the cyanid solution and the ore, such a quantity of oxygen being introduced into the vat as will be certainly sufficient to enable all the gold to displace alkaline metal in the cyanid. The oxygen then quickly combines with the alkaline metal of the cyanid, setting free more or less of the cyanogen, which dissolves the gold.

The beneficial effect of the addition to the potassium-cyanid solution of substances, such as oxygen, which have a strong affinity for the alkaline base of the cyanid is discussed and explained by T. K. Rose, of the Royal Mint, in *Science Progress* for 1898, page 306, and the formula for the general reaction is there given as probably

$$4Au+8KCy+O_2+2H_2O=4KAuCy_2+4KOH.$$

I can of course draw or pour the oxygen into the cyanogen solution directly from the open receiver without first drawing the oxygen off into a separate vessel, and it is desirable to agitate the cyanid solution after the liquid air or oxygen has been added to facilitate the action of the oxygen on the cyanid. Having obtained the precious metal in solution, it is then separated therefrom by precipitation with zinc by electrochemical action or by any other method as now practiced, this present invention relating to improvements in the process of dissolving the precious metal by suitable solutions, not to the particular method of obtaining the gold from such solutions.

Now, having described my improvements, I claim as my invention—

1. The improvement in the process of separating precious metals from their ores, consisting in mixing with the ore a solution consisting of a base and a solvent for precious metals, which solvent is capable of being separated from the said base by oxygen, and adding liquid air to the ore and solution, substantially as described.

2. The improvement in the process of separating precious metals from their ores, consisting in mixing with the ore a solution consisting of a base and a solvent for precious metals, which solvent is capable of being separated from said base by oxygen, evaporating nitrogen from liquid air, and adding the oxygen which remains to the mixed ore and solution, substantially as described.

HARALD DE RAASLOFF.

In presence of—
BERNARD J. ISECKE,
REUBEN F. KATZ.