

# UNITED STATES PATENT OFFICE.

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## PROCESS OF EXTRACTING GOLD FROM SULPHIDE ORES.

SPECIFICATION forming part of Letters Patent No. 474,591, dated May 10, 1892.

Application filed September 20, 1888. Serial No. 285,924. (No specimens.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain  
5 new and useful Improvement in Methods of Extracting Metals from their Ores, (Case No. 801,) of which the following is a specification.

The object of my invention is to provide a simple, economical, and effective process of  
10 working ores of gold which contain sulphur, to extract the gold therefrom. Heretofore, as is well known, no process has been devised by which the gold could be economically extracted from low-grade sulphide ores. Ordinary  
15 amalgamation is not successful because the gold appears to be coated with an invisible envelope of material which prevents amalgamation; and when it is attempted to obviate this difficulty by grinding the gold in  
20 amalgamating-pans, excessive grinding is required and the mercury becomes floured and very little gold is obtained. If it is attempted to roast the ore before amalgamating, the free sulphur formed in roasting will sulphurize  
25 the mercury and flour it, and thus prevent amalgamation.

Another process is that of roasting the ore and dissolving out the gold by means of chlorine gas; but this is an expensive process,  
30 requiring a large investment in plant and highly-skilled experts, and it has, therefore, never been successful to any great extent.

The process which constitutes my invention is based upon the fact that the coating  
35 upon the gold may be removed by the application of weak nitric acid, and that at the same time the surface of the gold may be amalgamated if there is added to the weak acid solution a small quantity of a mercurial  
40 salt, especially nitrate of mercury.

The process is as follows: The gold-bearing ore is first crushed in the ordinary manner to such a degree of fineness as will practically liberate the greater part of the particles of  
45 gold. Then by water concentration, as by the use of jigging or vanning machines, the lighter matters are removed from the pulverized mass and the sulphides are concentrated. When in this state the sulphur is inactive on  
50 the nitrate-of-mercury solution, only the gold being attacked thereby. A suitable quantity of the concentrated ore—several tons of it, if

desired—is then thrown into a suitable vat, and the weak solution of nitric acid, which, preferably contains also a small quantity of  
55 nitrate of mercury, is run onto it, preferably so as to just cover it. I find that the application of the solution for about one hour is sufficient to remove the external film and to  
60 cause all the gold particles to become fully amalgamated upon their surfaces. I then draw off as much of the solution as possible, and the remaining mass of pulp preferably is  
shoveled into a centrifugal drying-machine of the well-known character employed in va-  
65 rious other processes, such as the manufacture of sugar. The pulp being whirled around in the machine with great velocity, the centrifugal force throws the solution off the ore, leaving it entirely dry. The solution, being  
70 collected, is saved to be used over again, a small quantity of acid being added to make up for loss due to evaporation. Instead of this I may employ for the purpose of removing and saving the expensive acid solution  
75 the process of displacement by water. The pulp being placed in a vessel and water admitted above it, and the air exhausted at the bottom of the vessel, the water will, as is well known, filter through the pulp and displace  
80 the acid without mixing with it, the acid passing off through an outlet at the bottom and being preserved for the next operation. The ore being removed from the centrifugal machine or the displacing-vessel may now be  
85 amalgamated in any ordinary manner, either in an amalgamating-pan or by running it over amalgamating-plates, and in a few minutes the gold will combine wholly with the mercury, from whence it will afterward be recovered  
90 in any ordinary manner.

It is evident that the process can be carried out without the addition to the solution of the mercurial salt, the whole amalgamation being  
95 then accomplished afterward in the amalgamating-pans or otherwise; but the previous surface amalgamation makes the final amalgamation more rapid and effectual, and the nitrate of mercury also assists in the removal of the film from the gold particles, and since  
100 the mercury is all retained by the gold, so that it is ultimately saved, it is better to use it. The strength of the solution employed depends to a great extent upon the character of

the ore to be treated. With the ordinary concentrated sulphurets a solution of one hundred parts of water, ten parts of ordinary nitric acid, and five parts of nitrate of mercury will be sufficient; but in some instances the pulp will contain, even after concentration, matters which will reduce the nitric acid as well as the mercury, and thus in such cases a larger quantity of each of these ingredients will be required, the amount of which in each particular instance can be determined only by practice. The solution should, however, always be so weak as not to materially attack the pyrites.

It will be seen that I have thus devised a commercially-practicable method of working low-grade ores, by which the economical use of expensive reagents—such as nitric acid—is made possible, since the use of the centrifugal drier or of the displacing process allows all or practically all of the solution to be removed and saved, and thus the cost of the chemical agents required per ton of ore is reduced to an insignificant amount, and since the chemical amalgamation of the surface of the gold renders all grinding before the final amalgamation unnecessary. As I have stated, the nitrate of mercury helps to reduce the refractory film on the gold particles, and it is

possible, therefore, to use this material alone without any acid. It is, however, much less rapid and effectual.

What I claim is—

1. The herein-described process of treating auriferous sulphurets, which consists in concentrating the sulphurets, acting upon them by an acid solution mixed with nitrate of mercury, removing and collecting the solution, and then amalgamating the gold.

2. The herein-described process of treating auriferous sulphurets, which consists in concentrating the sulphurets, acting upon them by a solution of nitric acid mixed with nitrate of mercury, removing and collecting the solution, and then amalgamating the gold.

3. The herein-described process of treating auriferous sulphurets, which consists in concentrating the sulphurets, acting upon them by a solution of nitric acid mixed with nitrate of mercury, removing the solution by centrifugal action, and then amalgamating the gold.

This specification signed and witnessed this 12th day of September, 1888.

THOS. A. EDISON.

Witnesses:

WILLIAM PELZER,  
A. W. KIDDLE.