

# UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

## PROCESS OF EXTRACTING COPPER PYRITES.

SPECIFICATION forming part of Letters Patent No. 465,250, dated December 15, 1891.

Application filed February 17, 1890. Serial No. 340,788. (No specimens.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented an Improvement in Processes of Extracting Copper Pyrites, (Case No. 851,) of which the following is a specification.

The object of my invention is to cheapen and simplify the extraction of copper pyrites or chalco-pyrite from the worthless gangue with which it is mixed, and more especially from pyrites of iron.

A further object is to separate copper pyrites and iron pyrites from the gold, silver, or other valuable constituents of the ore.

According to my invention I first crush the ore, then, by vanning, jigging, or other suitable operation, I concentrate the heavy pyrites and free the same from the quartz mixed therewith. The residue is then preferably dried, and if the ore contains pyrrhotite or magnetic pyrites it is run through a magnetic separator. The ore may be passed through the magnetic separator without being first dried with good results. This removes one class of foreign material—namely, the magnetic pyrites. The remainder or non-magnetic material, containing iron and copper pyrites, is then heated to a temperature of from 700° to 800° Fahrenheit, the effect of which is to reduce the amount of sulphur in the copper pyrites to a point where it becomes magnetic; but such degree of heat is insufficient to eliminate the sulphur from the iron pyrites. The material which has been thus heated is then again run through a magnetic separator, whereby the whole of the copper pyrites, which, as above stated, has been rendered magnetic by heating, is separated. The iron pyrites, which constitute the greater part of the non-magnetic material, at this stage of the process may be either thrown away or utilized in the arts—for example, in the manufacture of sulphuric acid. The heating of the ore above referred to is preferably, though not necessarily, done in a closed rotating cylinder or furnace, care being taken not to have the heat sufficient to roast the ore enough to render the whole mass magnetic. The manner of heating is not, however, important, so long as it renders the copper pyrites only magnetic. The temperature should

be such as to eliminate a portion, but not all, of the sulphur from the copper pyrites, so as to make it magnetic, and not sufficient to eliminate any sulphur from the iron pyrites. Since ores vary greatly in quality, it is impossible to give a degree of temperature applicable to all ores. The exact temperature which is best must be ascertained by experiment on each ore. Generally 750° Fahrenheit will be about the heat required, while 1,000° would be too high and would render the whole of the ore magnetic. The magnetic pyrites may be separated magnetically in any well-known or suitable separator—such, for example, as that set forth in the application of Edison and Dickson, No. 337,523.

To illustrate the operation of this process, suppose we have one hundred tons of ore containing forty parts of magnetic pyrites, three parts of chalco-pyrites or copper pyrites, thirty parts of iron pyrites, and twenty-seven parts of silica, all mechanically mixed. If the whole is crushed, say, to forty mesh and run through the magnetic separator, the magnetic pyrites, or forty tons, are eliminated. Then the non-magnetic material is either heated to make the copper pyrites magnetic, and that separated from the other, making three tons, or the jig or vanner is used to eliminate the quartz before heating; but this is not necessary, except where the ore contains such a large quantity of quartz as to render the heating expensive. Thus one hundred tons of raw ore has its valuable contents reduced to three tons, which may be run into a rich matte in the usual manner.

If the ore to be treated is auriferous, I first concentrate it by jigging or the use of a vanning-machine. I then dry the concentrated ore and separate the magnetic portions with a magnetic separator, then heat the further-concentrated ore to 700° Fahrenheit, or otherwise render the chalco-pyrites magnetic and separate the same magnetically, then reheat the undecomposed iron pyrites to a higher temperature, thereby rendering it magnetic, and then separate it magnetically, leaving the whole of the gold, lead, silver, &c., in the residue, which is afterward treated by the usual process.

Having thus described my invention, what I claim is—

1. The method of concentrating chalcop-  
rite ores by eliminating magnetically any  
magnetic material therein while the copper  
and iron pyrites are non-magnetic, and then  
5 heating the remainder to such a temperature  
as to render the chalcop-rite magnetic and  
separating the reduced chalcop-rites mag-  
netically, substantially as set forth.

2. The method of concentrating chalcop-  
rite ores, which consists in crushing the ore to  
10 disengage the chalcop-rites, iron pyrites,  
earthy gangue, and the magnetic pyrites, mag-  
netically separating the magnetic pyrites,  
heating the residue, thereby rendering the  
15 chalcop-rite magnetic, and magnetically sep-  
arating the same, substantially as set forth.

3. The process of separating pulverized  
chalcop-rite and iron pyrites or other mat-  
20 erials which are rendered magnetic by heat  
from other non-magnetic material, which con-  
sists in heating the mass sufficiently to render  
the chalcop-rite magnetic and magnetically  
separating the same, then heating the residue  
to a higher temperature and magnetically

separating the iron pyrites, substantially as 25  
described.

4. The method of obtaining copper and the  
other valuable constituents of chalcop-rite  
ore, which consists in first concentrating the  
whole by vanning or otherwise, separating 30  
the naturally-magnetic material magneti-  
cally, then heating the remainder to a tem-  
perature sufficient to render the chalcop-rite  
magnetic and insufficient to render the iron  
pyrites magnetic, separating the magnetic 35  
chalcop-rite magnetically, then reheating  
the remainder to a much higher temperature  
to render the iron-pyrites magnetic, and sep-  
arating the same magnetically, leaving the  
gold, silver, lead, &c., as a final non-magnetic 40  
residue, substantially as described.

This specification signed and witnessed this  
8th day of February, 1890.

THOMAS A. EDISON.

Witnesses:

THOMAS MAGUIRE,  
A. CLARE.