

# UNITED STATES PATENT OFFICE.

JAMES NAPIER, OF SHACKLEWELL LANE, ENGLAND.

## IMPROVEMENT IN THE REDUCTION OF COPPER ORES.

Specification forming part of Letters Patent No. 5,461, dated February 29, 1848.

*To all whom it may concern:*

Be it known that I, JAMES NAPIER, of Shacklewell Lane, in the county of Middlesex, operative chemist, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Smelting Copper and other Ores; and I, the said JAMES NAPIER, do hereby declare that the nature of my said invention and the manner in which the same is to be performed are fully described and ascertained in and by the following statement thereof—that is to say:

One part of my invention consists of improvements in smelting copper ores by treating them with fluxes, such as common salt and lime and carbonaceous matters; and I also find that when treating copper ores which contain little or no sulphur the process of calcination and disintegration described in the specification of my former patent of the 7th day of June, 1847, may be dispensed with; and some ores I find contain a sufficient quantity of iron, thus rendering the addition of iron, as described in my said specification, unnecessary.

Another part of my invention consists in the treatment of ores containing silver or gold, or both, by the addition of alkaline substances, coal, iron, and galena.

But in order that my invention may be more fully understood, I will proceed to describe the different processes for carrying it out.

My first object is to facilitate the separating of the earths from the copper. To effect this, when I have ores of different descriptions to operate upon I mix them together in relation to the earths or gangue they contain in such proportions as will cause these earths to unite in the furnace and form glass, which is easily effected by any practical copper-smelter. I find a suitable proportion to be when the silica in the ore ranges from fifty to seventy-five per cent. in relation to the other earthy matters or gangue, which matters generally are mixtures of alumina, lime, baryta, fluor-spar, &c. The presence of oxide of iron greatly facilitates the fusibility of the ores.

Should I have occasion to operate upon only one description of ore, and should this, or the mixture of the ores when I operate upon a mixture, not contain silica in the above proportions, sand should be added until that proportion is arrived at. Should I have occasion to

operate upon an ore or ores containing more silica than the above proportions, I add lime or fluor-spar to obtain these proportions.

Having thus prepared the ore or ores, I proceed as follows: Should the ore or ores contain not less than one part of iron and one part of sulphur to two parts of copper, I add to every ton weight of the ore fifty-six pounds common salt and forty pounds slaked lime, with one hundred pounds coal, and put the whole into a melting-furnace and fuse it. The slag or scoria is skimmed off and the furnace tapped into sand molds. The ingots or pigs are proceeded with as hereinafter described. If the ore or ores contain less than one part of iron or two parts of copper, I add sulphuret of iron to make up the proportion, or I proceed as before described until the mass is fused and skimmed and I then add thirty pounds of scrap-iron (in which case I omit the coal) and disperse the iron over the surface of the melted mass as equally as possible, closing the door of the furnace until the whole is melted, as described in my patent of 7th of June, 1847. I then tap the furnace into sand molds. When the ingots or pigs are set I throw them into water, when they will become disintegrated and fall into a fine powder. This powder I throw out into a heap, where I prefer it to remain for forty-eight hours, after which I remove it to a calcining-furnace, and proceed with it in the manner described in my former patent of 7th of June, 1847. I have found that the addition of black oxide of manganese instead of iron effects a similar purpose, but, so far as my experience goes, not with the same advantage when compared with the use of iron.

When I operate upon ores containing little or no sulphur I omit the two processes of disintegration and calcination above described. In this case I commence by preparing the ore or ores in relation to their earthy matters or gangue so as to form glass, as before described. Should the ore or ores contain no iron, I find it advantageous to add a little oxide or carbonate of iron. I then add eighty pounds common salt, fifty pounds slaked lime, and one hundred pounds anthracite coal finely ground to each ton of ore containing ten per cent. of copper. Should the ore be richer in copper, a less proportion of salt and lime will suffice,

and a greater proportion of anthracite coal will be required. I have found with a twenty-five per cent. ore fifty-six pounds common salt, forty pounds slaked lime, and one hundred and fifty pounds anthracite coal to do well. The whole is fused in a melting-furnace, and when melted I tap the furnace into sand molds, and the metal thus obtained I have generally found to be copper ready for the refining operation. The fusing of each charge of twenty-five hundred-weight of ore I have generally found to take from five to six hours. Should a small portion of the produce be regulus, this regulus I roast and afterward refine.

It may be mentioned that soda with several of its salts will serve a similar purpose to common salt, also potash with several of its salts, or mixtures of these free of sulphur.

When operating upon sulphureted ores of copper containing silver or gold, or both, my method is as follows: I first calcine the ore and fuse it, as is done in the ordinary operations of smelting, so as to produce a regulus of about fifty per cent. To every ton weight of this I add fifty-six pounds soda-ash, forty pounds slaked lime, one hundred and twelve pounds coal, one and a half hundred-weight of iron in scraps, and four hundred-weight of galena, (sulphuret of lead.) The whole are well mixed and put into a fusing-furnace and fused until the iron disappears. The whole is then well rabbled and tapped into sand molds, when the lead will be found reduced to the bottom of the first and second ingots, and will contain all or the greater part of the silver or gold, or both, which the ore had contained. These substances are afterward separated from the lead by the usual operations of separating silver and gold from

lead. The regulus of copper is proceeded with in the ordinary manner, or as described in my patent of 7th of June, 1847. Instead of using galena, the oxide of lead may be used, in which case the iron is dispensed with; but I prefer the sulphuret of lead.

When operating upon ores of silver or gold, or both, and which do not contain copper, or which contain copper not in the state of a sulphuret, I add thereto copper pyrites in the proportion of four hundred-weight to sixteen hundred-weight of the ore, and then proceed with them in the same manner as herein described—namely, bringing the metal into the state of a regulus and fusing with galena, iron, coal, and soda, as hereinbefore described.

Having thus described the nature of my invention and the manner of performing the same, I would remark that I do not confine myself to the precise details or proportions of the ingredients used, so long as the peculiar character of my invention is retained.

That which I claim, and for which I solicit Letters Patent, is—

The above-described improvement in the smelting of copper ores, the same consisting in combining them in such manner or with such materials as will cause the gangue or superfluous earthy matter to be separated in a vitreous or glassy state, and afterward treating them under certain circumstances, substantially in the manner as hereinbefore specified.

JAMES NAPIER.

Witnesses:

W. H. RITCHIE,

*Of Lincoln Inn, London.*

JOSEPH MARQUETTE,

*Clerk in the Consulate of the U. States at London.*