UNITED STATES PATENT OFFICE.

ALEXANDER PARKES, OF BIRMINGHAM, ENGLAND.

IMPROVEMENT IN THE REDUCTION OF ORES.

Specification forming part of Letters Patent No. **6,062**, dated January 30, 1849.

To all whom it may concern:

Be it known that I, ALEXANDER PARKES, of Birmingham, in the county of Warwick, experimental chemist, a subject of the Queen of Great Britain, have invented or discovered Improvements in the Manufacture of Metals; and I, the said ALEXANDER PARKES, 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:

My invention relates to the manufacture of metals by the employment of fluxes and in the manner hereinafter described.

In order that my invention may be more fully understood and readily carried into effect, I will proceed to describe the means pursued by me: First, as to lead, my improvements in the manufacture of this metal consist of certain means of employing acids or acid substances, and also alkaline or earthy substances and iron, either in combination or not, with carbon, so as to obtain a fluid flux at comparatively low temperature to float over the ore as it is being reduced.

In carrying out this part of my invention I prefer to proceed as follows: To every ton of sulphuret ore of lead (galena) I employ the following matters as a flux in the proportion of two hundred pounds to a ton of ore: muriate of lime or of baryta, five hundred pounds by weight; carbon, (charcoal, coal, or anthracite,) one hundred parts by weight; metallic iron, twenty-five parts by weight; and I place these matters, mixed with the ore, (which I prefer to have been first roasted in the ordinary manner,) into a suitable furnace, preferring a reverberatory furnace, and fuse them, the flux will float on the surface, and in the course of a few hours the lead contained in the ore will be reduced to the metallic state, and I tap the same off from the flux, and I have found that from three to five hours of fusion have been sufficient for thus obtaining the metallic lead from the ores. A fresh charge of ore may be then introduced into the furnace with a small quantity more of the flux, so as to keep up a complete surface of the flux over the matters in the furnace, and I take care in tapping the metal not to run off more than I can avoid of the melted flux.

I would state that other fluxes composed of acids or acid and alkaline or earthy matters combined with carbon may be employed so long as they are so combined as to offer a fused bath of flux over the ore when being reduced; but I believe the flux above described to be the cheapest and best for the purpose. Thus muriatic or nitric or boracic acid may be used with either caustic, lime, or baryta, or magnesia, limestone or the muriate or carbonate of soda and potash may be resorted to in combination with carbon or carbon and iron to produce a fused flux to cover the ores under process.

Another mode of operating on sulphuret ores of lead is to fuse them with about ten per cent. of alkaline or other salt, and about ten per cent. of iron, and about five per cent. of carbon, in a suitable furnace, (I prefer a reverberatory furnace for this purpose,) stirring the mixture from time to time. When the mass is completely fused I run the same into sand-molds, and when set I apply water thereto, which causes the molded masses to fall into the state of powder, which is to be calcined at a low heat, avoiding fusion till the greater portion of sulphur is driven off. From this calcined product I obtain the lead by the aid of fluxes, as above described, and such lead will be more pure than when made by the ordinary processes now resorted to.

In carrying out the above process the salt I prefer to use is muriate of soda; but I do not confine myself thereto, as other salts may be used, avoiding those containing sulphur.

I will now describe the second part of my invention, which, as above stated, relates to the manufacture of copper, silver, and gold, and supposing the ores of copper to be carbonate or oxide ores containing little, if any, sulphur, I proceed as follows: Having sorted or mixed the ores in relation to their earthy compounds so as to produce a fusible slag, as is well understood, and such is to be the case in respect to sulphuret ores hereinafter spoken of, I mix with the ores a flux composed of an acid or of certain salts, hereinafter stated, com-

bined with carbon, and by preference I employ the following: muriatic acid, one hundred parts by weight; water, two hundred parts by weight; carbon, (charcoal, anthracite, or other coal,) two hundred parts by weight; caustic lime or baryta, four hundred parts by weight; and to every ton of ore containing eighteen to thirty per cent. or less of copper I add about three hundred-weight of such flux. If the ores contain a greater percentage of copper—say from thirty to forty-five per cent.—I increase the quantity of carbon and decrease the quantity of the other ingredients of the flux used, and I place these matters into an ordinary copper-smelting or other suitable furnace, and having smelted these matters in the furnace and kept the same in a state of fusion for about five or six hours, I tap and run the metal into sand or other suitable molds, by which process copper will be obtained which will generally be fit for refining. I have stated that I prefer muriatic acid combined with carbon and other matters for the above process. I would, however, remark that when the cost of nitric, boracic, or hydrofluoric acid will allow of their being used they may be employed either separately or with muriatic acid, in which cases less of these acids will be required; but I recommend in all cases muriatic acid in preference; or, in place of employing an acid combined with carbon as a flux, I can employ chloride or muriate of lime, of iron, of copper, of zinc, of manganese, of lead, or of baryta; or I can employ a nitrate of iron, of zinc, of manganese, of lead, or of baryta combined with carbon; and in the use of either of these matters I employ them at the rate of about ten per cent. thereof to the quantity of copper in the ore. In other respects the description above given, when using muriatic acid with carbon, water, and lime as a flux, will apply to the matters above named. In like manner may chloride or oxide of silver be treated.

My invention also applies to sulphuret or arsenuret ores of copper; and if such ores be rich—say containing twenty per cent. of copper—it will not be necessary to fuse the same before reducing the ore to powder; but I prefer under all circumstances to fuse the ores in order to decrease the bulk and then to reduce the same to powder, and it is important to the well carrying on of this part of my invention that the ore should be reduced to very fine powder; and I cause the powder to be sifted through a sieve of thirty-six meshes to the linear inch. Whether the ores have been fused or not before reducing them to powder, they are next to be calcined till as much of the sulphur as possible is driven off by heat. The calcined ore may then be reduced to the metallic state, as above described in respect to carbonate or oxide ores; but I prefer to deprive the ore of any remaining sulphur while in the calcining furnace, for which purpose, if the ore has not been fused before calcining, I employ a chloride salt or an acid and continue the process of calcination. For this purpose I prefer to use muriatic acid or chloride of calcium, of barium, or of soda, and I apply either at the rate of about five to ten per cent. of the ore, together with about five per cent. of carbon, and I add these matters gradually. Toward the end of the calcining process—that is, after as much of the sulphur has been driven off as possible—other chloride salts, whether of the earths or metals, may be used in like proportions; but the chloride salts above given are, I believe, the cheapest and most convenient for this purpose. If the ores have been fused before calcining them, I can, in addition to the acid and salts above mentioned, use nitric acid or the nitrates in place of the others or in combination therewith; and I have found that when the ores are completely calcined they may be reduced into a metallic state by continuing the heat and adding five to ten per cent. of carbon, or by preference with five to ten per cent. of either of the acids or salts above mentioned.

I would remark in respect to this point of my invention that I am aware that muriate of soda (common salt) has before been employed in the process of roasting ores, in some cases to produce the chloride of silver by the muriatic acid, while the soda is converted into sulphate of soda, and it has also been the practice to apply large quantities of salt to make sulphate of soda when roasting copper ores, and I mention these facts in order that this part of my invention may be most clearly ascertained, which consists in the use of acids and salts combined with carbon toward the end of the process of calcination in order to volatilize the remaining sulphur arsenic and antimony, and also to produce metallic copper. If an acid be employed, I prefer to use muriatic acid; but nitric acid, hydrophoric acid, or acetic acid may be used in the same proportions and of the ordinary commercial strength. The calcined products thus obtained are to be removed into an ordinary copper-smelting or other suitable furnace, and are there to be treated with ordinary fluxes, as heretofore, or, what I prefer, according to the means described in respect to carbonate and oxide ores. I would, however, state that it is not absolutely necessary that the acid or chloride salts should have been used in the calcining process, but may, according to my invention, be used only in the smelting process, in which case I also procced according to the manner described in respect to carbonate or oxide ores; by all which means I obtain the metal suitable to be refined.

Another part of my improvements consists of so treating sulphuret ores of copper as to obtain metallic copper in one smelting after calcination.

In carrying out these improvements I take native sulphuret ores of copper, or such ores as have been fused to reduce their bulk, and grind them fine and sift, as above described,

and having driven off as much sulphur as may be by calcination by the ordinary means I then remove such ores into a copper-smelting or other suitable furnace and smelt the same with acids or with alkaline or earthy salts, together with carbon, preferring muriate of lime or soda in the proportion of about one hundred-weight of muriate of lime or soda and about one to two hundred-weight of carbon to a ton of ore. If I employ an acid, I take by preference one hundred-weight of muriatic acid of commerce, together with one to two hundred-weight of carbon. The other acids may be used, avoiding the acids of sulphur, and the calcined ores with these matters are to be smelted, as before directed.

In the above description of this the second part of my invention I have confined myself to the ores of copper. I would, however, state that so far as the above description relates to sulphuret ores of copper the same is also applicable to the manufacture of silver and gold from sulphuret ores of these metals; and I can also manufacture silver and gold from the sulphuret ores of those metals in a similar manner to what I have described in respect to the manufacture of lead, where I direct the use of iron with other substances, so as to produce a mass which is reducible into the state of fine powder on the application of water; and it should be stated that for this mode of treatment the ores should contain two parts of iron to one of silver or gold. If such should not be the case, iron is to be added to make up this proportion, and the ore should also contain two parts of sulphur to one of silver of gold; and if such is not the case sulphur is to be added. The powder obtained, being calcined, is reduced to the metallic state by smelting with flumes, and then refined in the usual manner; or the calcined powder may be treated with quicksilver, as is now practiced when treating ores, as is well understood.

My invention also relates to the refining copper, and this part consists of the use of fluxes in this process. In carrying out this part of my invention I employ a metallic or alkaline or earthy salt and add such flux immediately after the copper has become melted. I prefer to use nitrate or muriate or a cyanide of potash or soda, and in the proportion of from five to ten pounds to each ton of copper. The refining process in other respects is to be carried on as heretofore, the introduction of any one of these salts alone, or of any one or more of these salts combined, facilitating the process of the refinery.

I will now describe the third part of my invention, which relates to the manufacture of iron.

In carrying out this part of my invention I roast the ores in the ordinary manner, and then in charging the furnace, in addition to the ordinary fluxes, I employ muriatic acid, the chlorides or muriates of the earth, and of manganese and iron; also, nitric acid, nitrate of baryta, and nitrate of iron. I prefer to employ muriatic acid prepared into a flux by mixing it with the following ingredients: muriatic acid of commere, one hundred parts by weight; water, two hundred parts by weight; charcoal, coal, or anthracite, two hundred parts by weight; caustic lime or magnesian limestone, or baryta, (either with or without chloride or oxide of manganese, about twenty to forty parts,) four hundred parts by weight. To each ton of roasted ore I add about two hundred-weight of such flux, and the effect will be that the quality of iron will be improved. If the nitrate of baryta, or of iron, or of manganese be combined with the other ingredients, less will be necessary—say about one-half. If nitric acid be used, about fifty pounds of commercial acid with one hunpred pounds of water is to be added for each ton of roasted ore. I do not, however, confine myself to the quantities above given, but they will be found as near as may be convenient quantities for the ore worked in this country. When acting with the matters above mentioned on metallic iron I use from ten to twenty per cent. thereof in the puddling or remelting furnaces, and I can also improve the manufacture of iron by melting therewith from one per cent. and upward of metallic manganese.

I will now describe the fourth part of my invention, which relates to the manufacture of manganese into the metallic state, which consists of employing fluxes which are capable of bearing the high temperature necessary for the reduction of such metal, and by which I am enabled to obtain the metallic manganese in such form that it will retain its metallic character when exposed to the atmosphere, and does not readily, as heretofore, become again converted into an oxide. For this purpose I prefer to employ a flux composed as follows: muriatic acid of commerce, one hundred parts by weight; water, two hundred parts by weight; charcoal, coke, or anthracite, two hundred parts by weight, and caustic lime or baryta or magnesian limestone, four hundred parts by weight. I take the oxides or carbonates of manganese and place them in crucibles, and apply about ten per cent. of silica to the quantity of manganese, together with ten per cent. of the above flux, and I heat the crucibles with such mixture in a suitable furnace from three to five hours at as high a temperature as I can obtain in an ordinary casting or air furnace. Other fluxes capable of bearing high temperatures may be employed in like manner in combination with carbon and silica—such as the chlorides of the earths and alkalies—and the nitrates of the earths and alkalies may be used in like manner; but I believe the preparation above given to be the best.

Having thus described the nature of my invention and the best means I am acquainted with for performing the same, I would remark that I do not confine myself to the precise details herein described so long as the peculiar character of either part of my invention be retained; but

What I claim as my invention is—

The above-described flux composition to be used in the manufacture of metals, as specified, the same consisting in muriatic acid or any chemical equivalent therefor, water, charcoal, coal, or anthracite, or any carbonaceous equivalent therefor, and caustic lime, magnesian limestone, baryta, or any alkaline or earthy chemical equivalent, the same being combined and used in the proportions above represented or in any others which will produce like results.

ALEXANDER PARKES.

Witnesses:

JNO. G. UNDERHILL,
U. S. Vice-Consul.

JOHN CADLEY.