UNITED STATES PATENT OFFICE.

CHRISTOPHER JAMES, OF SWANSEA, ENGLAND.

PROCESS OF REDUCING ZINC.

SPECIFICATION forming part of Letters Patent No. 483,652, dated October 4, 1892.

Application filed December 28, 1891. Serial No. 416,370. (No specimens.) Patented in England July 7, 1891, No. 11,563; in Belgium August 17, 1891, No. 95,768; in Spain September 23, 1891, No. 12,373, and in France November 16, 1891, No. 215,113.

To all whom it may concern:

Be it known that I, CHRISTOPHER JAMES, residing at Swansea, Great Britain, have invented an Improved Method or Process for the Production of Zinc or Spelter from Ores or Compounds Containing the Same, (which has been patented to me under No. 11,563 and dated July 7, 1891, in Great Britain and Ireland; also, in Belgium under No. 95,768 and dated August 17, 1891; in Spain under No. 12,373 and dated September 23, 1891, and in France under No. 215,113 and dated November 16, 1891,) of which the following is a specification.

This invention relates to an improved method of or process for producing metallic zinc from ores or compounds containing the same, and has for its object the diminution of the usual known calcining operations, the utilization of sulphur to assist or effect reduction, the employment of reverberatory or gas furnaces instead of the costly and troublesome retort-furnaces hitherto used, the greater percentage of metallic zinc recovered from the ore, and the better collection of the zinc in a distinct condenser, avoiding the present heavy losses through cracked retorts, imperfect clay connections, and waste of metal in the retort-refuse. In the ordinary methods now in use zinc ores are calcined till all the zinc present either as carbonate or sulphide is changed to an oxide. This is then mixed with coal or other carbonaceous matter, placed in retorts, a large number of which are arranged in the same furnace, and subjected to a great heat. The oxide of zinc formed by the calcination is reduced by the coal added to the charge as expressed by the equation

$$2ZnO+C=2Zn+CO_2.$$

The zinc thus reduced to metal is at once volatilized by the heat at which the furnace is worked and leaves as gas the gangue of the ore and the unconsumed coal. This gas is condensed in the cooler part of the retort and in suitable connections outside the retorts. This process is exceedingly wasteful and expensive. The zinc is only very partially reduced by the coal, and so much zinc is left in the retort-refuse that ores containing a large percentage of zinc cannot be profitably worked. Enormous losses occur through the cracking and breaking of the clay retorts, and the process is generally extravagent in labor, coal, and zinc.

In my present process for the reduction of the zinc, instead of producing an oxide of zinc from the blend by calcination, as described in a companion application, I take any natural or other oxide of zinc and melt the same in a neutral or slightly-reducing reverberatory or refinery furnace with sulphur, sulphide of zinc, or a sulphide of other metal, such as sulphide of iron, (iron pyrites.) The proportion of the said zinc oxide and sulphur or sulphides would be such that the oxygen of the oxide and the sulphur would combine entirely to form SO_2, reducing the zinc to its metallic form, thus:

$$2ZnO+ZnS=3Zn+SO_2$$

or

$$2ZnO+S=2Zn+SO_2.$$

The resultant zinc would be volatilized by the high temperature of the furnace and is conducted into a separate condensing-chamber surrounded by a water-jacket casing or partly filled with tubes, through which the zinc-gas passes, the tubes being surrounded by water. In the chamber or tubes the zinc is condensed and is then ladled out ready for the market.

One great superiority of this process arises from the collection and condensation of the zinc being effected in a large, distinct, and easily-accessible chamber or in an apparatus equally open to frequent examination, so that no loss of zinc takes place through leakage, while the small amount of oxide of zinc which may be formed by any free oxygen which can pass into the furnace I collect in suitable flues and chambers, to be again used as calcined zinc ores. The expense of working such a furnace will be very small compared to the ordinary retort-furnace, the repairs much less, while the labor and loss of time caused by the breaking and consequent changing of damaged retorts are entirely avoided.

By my above method of reduction ores containing less than ten per cent. of zinc can be profitably worked in consequence of the decreased cost following the use to effect reduction of sulphur in lieu of coal, which latter is

not only expensive itself, but renders the retort-refuse unfit for any after treatment for the recovery of other metals than zinc contained in the ore. By my method the refuse from the retorts or furnace will be in a better condition for further treatment, while very nearly all the zinc originally present in the ore is driven off and condensed.

Having now described my invention, what I claim is—

A process for the treatment of zinc ores, consisting of mixing any natural or other oxide of zinc with sulphur or sulphides of any metal, subjecting the same to a melting heat in a neutral or slightly-reducing furnace, the relative proportions of the sulphur and oxides being such that the oxygen and sulphur will mutually react to entirely reduce the zinc to a metallic but vaporized condition, and collecting the latter by condensation, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHRISTOPHER JAMES.

Witnesses:

REGINALD WM. JAMES,

RICHARD A. HOFFMANN.