G. RIGG.

REMOVING CADMIUM FROM ZINC ORE.

APPLICATION FILED SEPT. 4, 1913.

1,161,885. Patented Nov. 30, 1915.

Fig. 1.

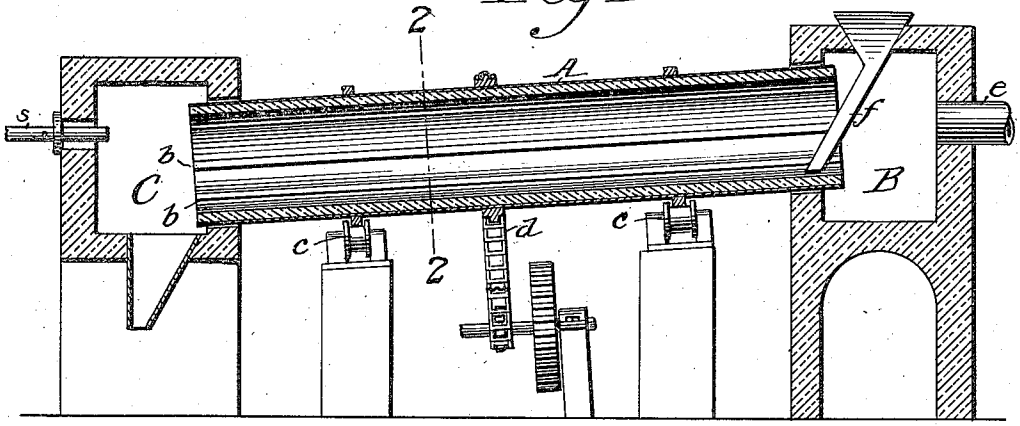


Fig. 2.

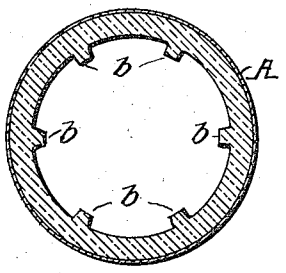


Fig. 4.

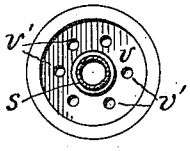
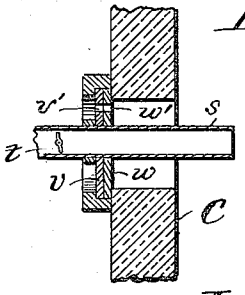


Fig. 3.



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UNITED STATES PATENT OFFICE.

GILBERT RIGG, OF PALMERTON, PENNSYLVANIA, ASSIGNOR TO THE NEW JERSEY ZINC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

REMOVING CADMIUM FROM ZINC ORE.

1,161,885. Specification of Letters Patent. Patented Nov. 30, 1915.

Application filed September 4, 1913. Serial No. 788,057.

To all whom it may concern:

Be it known that I, GILBERT RIGG, a British subject, residing at Palmerton, Carbon county, Pennsylvania, have invented certain new and useful Improvements in Removing Cadmium from Zinc Ore; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

For many purposes, spelter containing cadmium is inferior to spelter free from cadmium, as, for instance, in those cases where, as with galvanized telephone wire, the zinc coating is, in ordinary use, subjected to torsion or bending; so also, where the spelter is to be rolled into sheets or the like and where the presence of cadmium is found to unduly harden the metal.

The object of the present invention is to effect the expulsion of the cadmium from the zinc ore in which it is contained, before any substantial amount of the zinc is driven off, so that practically the whole of the spelter subsequently made from the ore may be cadmium-free.

In carrying out the invention, the roasted or naturally oxidized zinc ore containing the cadmium is raised to a temperature of from 700° C. to 850° C. in an atmosphere of reducing gas, as, for instance, producer gas. Under these circumstances, the cadmium, which has a lower temperature of reduction and a lower boiling point than the zinc, is reduced and passes off with the gas while the zinc remains behind.

The method may be practised in various ways. For instance, it may be carried out to advantage in a rotating furnace of the cylindrical type, heated internally by the combustion of the producer gas or other reducing gas employed. By this means, the ore is kept agitated and stirred up in the presence of the gas thereby facilitating the expulsion of the cadmium. It will be found suitable and convenient to admit the gas through a suitable burner or burners at one end of the furnace, axially thereof, and to carry off the products of combustion together with the reduced and volatilized cadmium (either in the form of metallic vapors or oxidized fumes), at the opposite end provision being made for separately regulating the supply of gas and air to the burners so as to correspondingly regulate the character of the flame. Thus, when the temperature of the furnace and its contents tends to decrease, the supply of air may be increased to restore the heat required, and the supply of air may thereupon be reduced in order to give an excess of reducing gas to act upon the cadmium. In fact, it will be found, in most cases, to be desirable, to alternate these two operations, that is to say, to alternately raise the temperature to a point near the higher limit of the proposed range, by supplying an appropriate amount of air for that purpose, and then to decrease the admission of air so that there may be an excess of gas until the temperature approaches the lower range; whereupon the supply of air will again be increased, and subsequently diminished, and so on, until the cadmium has been removed. The zinc ore, thus deprived of its cadmium, may then be reduced in any suitable manner for the production of spelter. The cadmium may be recovered, either in the metallic state or as an oxid, or both, in any suitable condenser. If sulfur or other volatile constituents are present in the charge, the cadmium, under the conditions of the practice of the process, may pass off, wholly or in part, in combination with such constituents, as cadmium compounds thereof, and can be collected as such.

I prefer the employment of producer gas, for the reason that in addition to its relative cheapness and general availability, I have found it particularly satisfactory on account of the ease with which practically uniform conditions of temperature can be obtained from end to end of the furnace.

In the accompanying drawing, I have illustrated apparatus appropriate to the carrying out of the process.

Figure 1, represents a longitudinal sectional view, partly in elevation; Fig. 2 represents, on a somewhat larger scale, a section taken on the line 2—2 of Fig. 1; Fig. 3 represents a sectional view of the burner, in its relation to the front wall of the apparatus; and Fig. 4 represents a front view of the burner.

Referring to the drawing, A indicates the outer metallic sheet of a rotary furnace or kiln, having a refractory lining from which project the longitudinal ribs *b*, whose function is to raise the ore and drop it through the atmosphere of the kiln. The kiln is in-

clined horizontally, and is supported by suitable bands upon supporting rollers c, or the like, and may be driven in any suitable way, as, for instance, by the sprocket chain d actuated from any appropriate source of power. At its upper end, the kiln may discharge into a settling chamber B, from which an exit pipe e may pass to a condenser. The kiln may conveniently receive its charge of zinc ore, continuously or otherwise, from a feed-hopper f, and, at its discharge end, the kiln may communicate with a combustion chamber or hood C having a bottom discharge chute for the zinc ore after it has parted with its cadmium. In the forward wall of the hood or chamber C is located a burner of a regulable character. This burner may consist, as shown more fully in Figs. 3 and 4, of a gas tube s having a regulating damper t and damper plates, v, w, provided respectively with like series of air-controlling apertures v', w'. By appropriate manipulations of the valve or damper t, and by rotating one of the damper plates with respect to the other, the appropriate ratio of gas and air can be obtained, suitable to the practice of the invention in its varying phases hereinbefore described.

What I claim is:

1. The method of removing cadmium from roasted or naturally-oxidized zinc ore, which comprises subjecting the ore to the reducing action of a current of reducing gas at a temperature sufficient to reduce and volatilize the cadmium without reducing and volatilizing any substantial quantity of the zinc, and carrying off the cadmium thus expelled from the ore; substantially as described.

2. The method of removing cadmium from roasted or naturally-oxidized zinc ore, which comprises subjecting the ore to the reducing action of a current of producer gas at a temperature sufficient to reduce and volatilize the cadmium without reducing and volatilizing any substantial quantity of the zinc, and carrying off the cadmium thus expelled from the ore; substantially as described.

3. The method of removing cadmium from roasted or naturally-oxidized zinc ore, which comprises heating the ore to a temperature ranging between 700° C. and 850° C. and subjecting the ore while within that range of temperature to the reducing action of a current of reducing gas, thereby expelling the cadmium from the ore without substantially affecting the zinc; substantially as described.

4. The method of removing cadmium from roasted or naturally-oxidized zinc ore, which comprises heating the ore to a temperature ranging between 700° C. and 850° C., subjecting the ore to the reducing action of a gas flame in which the reducing gas is largely in excess of the air necessary for complete combustion, meeting any consequent drop in temperature by periodically increasing the air supply and reverting to the original ratio of gas to air when the temperature approximates the upper limit specified; and so on, alternately, until the cadmium is expelled from the ore; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

GILBERT RIGG.

Witnesses:
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