

UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE REDUCTION OF ARGENTIFEROUS ORES.

SPECIFICATION forming part of Letters Patent No. 425,813, dated April 15, 1890.

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To all whom it may concern:

Be it known that I, OCTAVIUS LUMAGHI, of St. Louis, Missouri, have made a new and useful Improvement in Apparatus for the Reduction of Argentiferous and other Zinc Ores, of which the following is a full, clear, and exact description.

This invention has for its object, mainly, an improved means for obtaining the spelter separate from the lead, silver, and gold, for obtaining oxide of zinc, and for saving a large percentage of the silver and gold, which, when ores such as are under consideration are treated in contact with the atmosphere, are liable to be carried off with the oxide of zinc and other volatile metals.

My improvement is in part based upon the familiar construction known as the "Belgian zinc-furnace," in that the retorts employed are arranged and heated as in that type of furnace, and it may also be considered an improvement upon or as related to the zinc-smelting furnace patented to me October 23, 1877, No. 196,369, in that the upper end of the retorts is adapted to be opened to provide for an air-draft.

The essential elements of the improved construction are, first, the furnace-walls, fireplace, and flues, which are constructed so that the retorts can be held and have the heat applied to them in manner substantially as in the Belgian zinc-furnace; second, in the place of applying the condenser to the lower or charging end of the retort the application of it to the upper end of the retort; third, a retort substantially similar to the Belgian-furnace retort and adapted to be charged at its lower end, but also perforated at its upper end to provide for the escape at that end of the gases generated from the contents of the retort; fourth, the manner of combining the retort and the condenser so that the zinc-vapors shall be readily condensed therein, and when condensed the spelter shall not flow back to the retort again; fifth, the means for closing the charging end of the retort; sixth, the mode of constructing that one of the furnace-walls where the condensers are applied to the retorts; seventh, the means for promoting the formation of oxide of zinc and its collection.

To fully carry out the improvement, all the

elements above enumerated are needed in conjunction; but certain portions of the work can be accomplished with but a portion of the elements, as will appear in the following detailed description of the improved apparatus and its operation, aided by the annexed drawings, making part of this specification, in which—

Figure 1 is a vertical cross-section of the improved apparatus or plant; and Figs. 2, 3, and 4, details upon an enlarged scale, Fig. 2 being a view in perspective of one of the retorts with a condenser attached thereto, the view being toward the condenser and the upper end of the retort and looking upward; Fig. 3, a view in perspective, looking sideways thereat, of the condenser and the upper portion of the retort; and Fig. 4, a vertical longitudinal section of the retort and condenser, the stopper used to close the lower or charging end of the retort being shown detached and in side elevation.

The same letters of reference denote the same parts.

A A', Fig. 1, represent the furnaces of the preferred construction and arrangement. Two of the furnaces are shown in combination. They are arranged opposite each other and spaced sufficiently apart to provide a suitable space R for the operatives when attending to the condensers. The space R, by means of a roof C overhead, end walls D D, and doors d d at each end thereof, can be inclosed to form a chamber sufficiently tight to receive the gases escaping from the retorts through the condensers and enable them by means of an exhaust-flue—such as at E—to be withdrawn from the space R and collected in some suitable receptacle (not shown) for receiving and collecting oxide of zinc. The furnaces A A' can be used singly. In such case the space R can be made to connect with the single furnace used.

The furnace, so far as the general shape is concerned, resembles, as stated, the Belgian furnace.

a represents the fire-place of the furnace; a', the front wall; a², the back wall; a³, the roof; a⁴, an end wall; a⁵, the support for the lower end of the retort, and a⁶ the support for the upper end of the retort, all of which elements

are substantially as in a Belgian furnace, saving that the back wall a^2 is perforated to admit the condensers, which project through the wall a^2 , as shown.

5 B B represent the retorts. So far as their size, general form, and composition are concerned they resemble those used in the constructions above referred to. They are adapted to be charged through the opening
10 b in the lower end thereof, and then to be closed by means of the stopper b' . The stopper is in the form of a disk, notched at points b^2 b^3 , equidistant from each other, and when the stopper is placed in the retort one of the
15 notches comes at the bottom and the other notches somewhat above the center of the retort. The upper end b^5 of the retort is closed, saving a central perforation b^4 , which is about two inches in diameter.

20 C represents the condenser, which is of the usual form, and is connected to the retort, inclined forward, and adjusted in accordance to the inclination of the retort in the furnace, so that a considerable portion of its interior
25 C is below the level of the perforation b^4 . Thus owing to the position of the retort and the condenser, both the retort and the condenser, inclining downward from their point of union, the distilled zinc gathered in the condenser
30 cannot flow back into the retort, and any liquid lead or other metal that may have become liquefied during distillation cannot reach the distilled zinc in the condenser, but will find its way to the lower end of the retort, where
35 it may be recovered by tapping the lowest notch of the retort-stopper b' . An additional feature of this part of the construction is that, the perforation b^4 being only about one-third the inside diameter of the retort, the gases
40 generated therein are reduced in volume—that is, concentrated—in passing through the reduced diameter, the velocity of the current of gases being also proportionally increased, thus reaching the condenser in the shape of
45 a jet of concentrated zinc-vapor, which, coming through the perforation b^4 in a straight line, strikes a limited area of the inclined condenser at its upper inner side with impact proportioned to the increased velocity of the
50 current of zinc-vapor, as shown by dotted line, Fig. 4.

The cooler temperature of the inside of the condenser as compared to the same in the retort, together with the increased impact consequent to the increased velocity of the current of zinc-vapor as it strikes the cooler surface of the condenser, causes the complete condensation of the zinc-vapor into liquid metal and avoids the formation of zinc powder, which is the result of a too slow supply of zinc-vapor.

65 Another feature of this invention is in the construction of the dam C' , made out of material from the charge mixed with blue powder, which is placed inside the small opening of the condenser—such as is in common use

in this art—to regulate the flame and hold the spelter temporarily, that, the condenser being properly adjusted and inclined, the highest point of the dam be somewhat lower than the lower margin of the perforation b^4 , so that the distilled zinc cannot flow back into the retort when suffered to remain in the condenser until it overflows.

Another feature is forming a circular groove b^5 in the upper end of the retort, which in diameter disagrees with that of the end c^4 of the condenser, the aim being to provide a ready means for insuring the proper relation of the condenser and retort, for however the
80 retort or the condenser may be turned around the condenser end c^4 can enter the groove b^5 but at one point only and at other points be excluded therefrom, and as that point is naturally the lowest point the condenser, however hastily it is adjusted, will always assume the proper inclination for effecting the
85 above-enumerated results.

The operation is as follows: The retorts are placed in position in the furnace, as shown in
90 Fig. 1, and duly charged with the ores or other material and closed with the stoppers and luted, and the furnace is fired, all in the customary manner. The condensers are applied
95 as described and the joint between the condenser and retort luted. The spaces in the front and back walls of the furnace around the retorts are also suitably luted. That portion of the zinc which is to form spelter is
100 distilled through the perforation b^5 into the condenser, where it is condensed, the operation being hastened by reason of the gaseous current being caused to encounter the upper inner side of the condenser, as indicated by
105 the arrow in Fig. 4. The usual small opening c^5 is left above the dam in the outer end of the condenser for the usual flame to be burnt at that point. Owing to the position of the
110 condenser and its relation to the perforation b^4 , the liquefied spelter cannot flow back into the retort and such lead and silver as may liquefy in the retort cannot enter the condenser. The spelter can be withdrawn from
115 the condenser in any suitable manner and the liquid lead and silver, if any there be, can be tapped from the retort by opening the lowest notch in the stopper. The contents of the retort can be reached with a poker, as
120 when it is desired to scrape the shell of the retort to separate therefrom anything which may collect upon it, by introducing the poker through a perforation b^2 . When the spelter has been obtained and the stage of the operation at which the remaining zinc is to be recovered in the form of an oxide, one of the
125 upper notches b^2 in the stopper b' is opened to admit the outer air, which then passes into and through the retort and then through the condenser, in its route coming in contact with the ores and forming oxide of zinc. The gaseous current passes out into the space R, whence
130 it is withdrawn into the flue.

Any suitable means—such as an exhaust-fan (not shown)—may be used to promote the movement of the air into the retorts and the discharge and delivery of the oxide of zinc into the flue. While this is going on, the doors to the space R should be closed. Such silver or gold as passes off with the zinc-oxide current is carried along with it and is ultimately collected with the oxide. Thus with the same means, and, if desired, without changing any part thereof, all the above-described operations are carried on. The spelter is separately collected. The lead and such silver as liquefies are collected by themselves. The zinc oxide is formed and obtained, and the volatilized precious metal is saved. It may be added that the ore material remaining within the retort has in effect (and by reason of the heating to which it has been subjected) been roasted, and thus made ready for subsequent treatment elsewhere and according to any of the well-known methods for the recovery of gold and silver. The roof to the space inclosed at the back of the furnace may have the shape indicated by the broken line 4, Fig. 1.

Any suitable means—such as fragments of bricks or retorts carefully luted—may be used to close the lower end of the retort, provided the described perforation b^4 is formed.

The opening b^6 in the stopper b' is merely to receive a handle in manipulating the stopper. It is luted when the stopper is in place. The opening b^6 in the retort-stopper should be slightly above the center of the disk, so that on being manipulated with a handle one

of the notches comes necessarily to the bottom.

Having thus fully described my invention, I claim as new and I desire to secure by Letters Patent—

1. The combination, with a furnace having openings at the front and back walls of the inclosure, connected to a suction device and having a tight roof and doors, of the retorts having their butt-ends perforated and the condenser applied thereto, as described, and for the purposes specified.

2. The combination of the retort, the condenser, and the retort-stopper, said retort at its upper end being perforated centrally and having an annular groove surrounding said perforation, and said condenser at its upper end being of a different diameter from that of said groove, and being applied to the upper end of said retort and to said groove, substantially as described.

3. The combination of the retort and the retort-stopper, said stopper being inserted and luted in the lower end of the retort and being in the shape of a disk notched at the periphery and having an opening slightly above the center, so that when the stopper is placed in the retort one of the notches comes at or near the bottom, substantially as described, and for the purposes specified.

Witness my hand.

OCTAVIUS LUMAGHI.

Witnesses:

C. D. MOODY,
B. F. REX.