(No Model.) 2 Sheets—Sheet 1.

J. C. NEWBERY, J. L. MORLEY & B. CLEVELAND.

FURNACE FOR REDUCING AND SMELTING ORES.

No. 303,586. Patented Aug. 12, 1884.

Fig. 1.

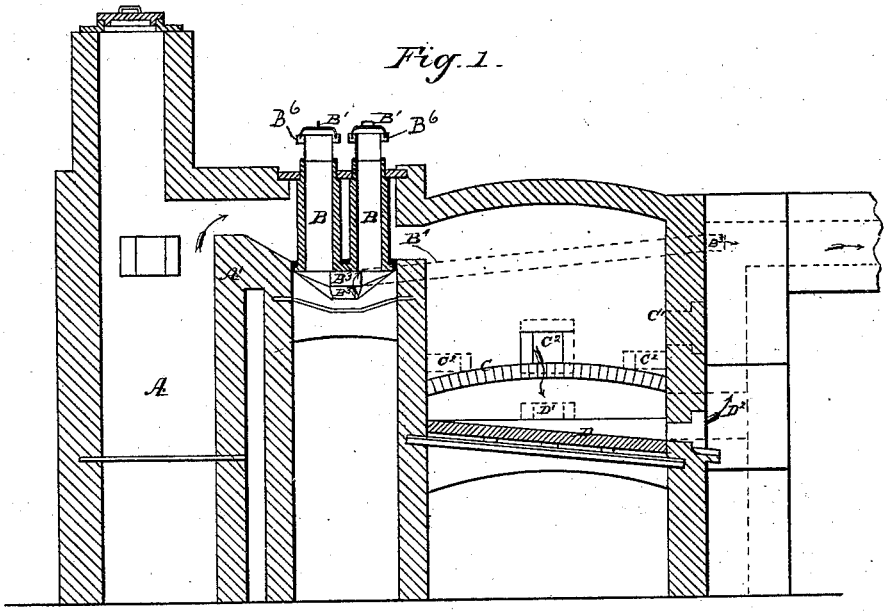

Fig. 2.

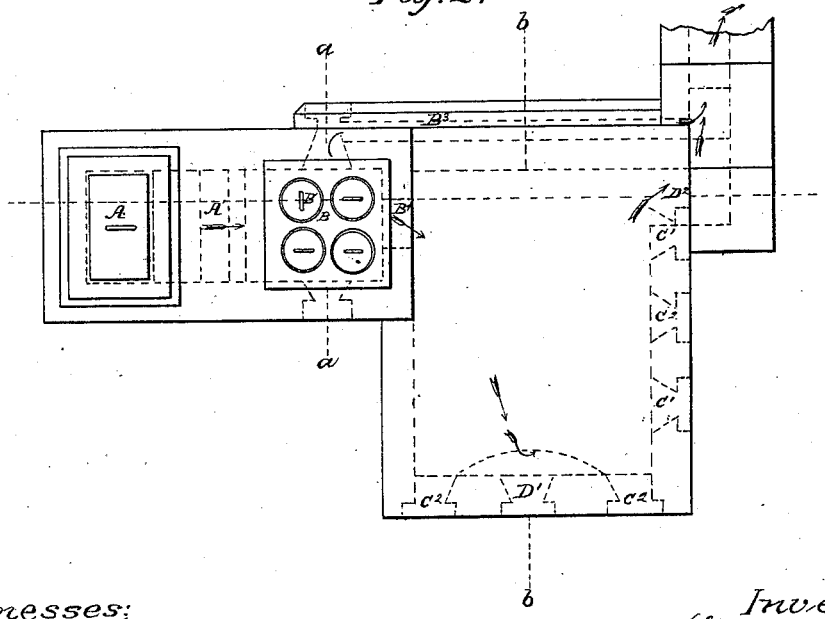

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Fig. 3.

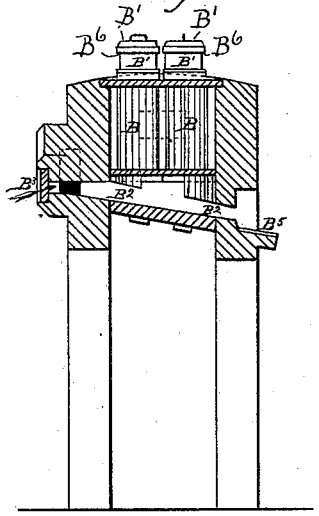
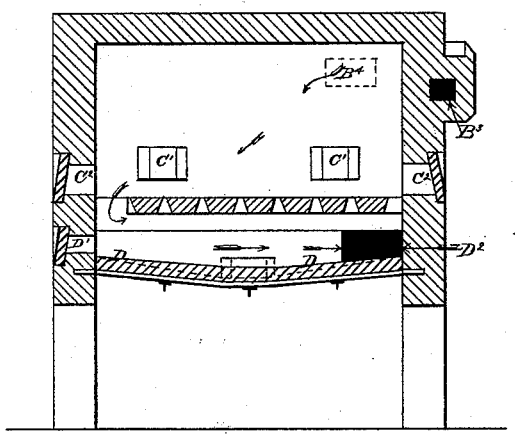


Fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES COSMO NEWBERY, JOHN LISTER MORLEY, AND BARRY CLEVELAND, OF MELBOURNE, VICTORIA.

FURNACE FOR REDUCING AND SMELTING ORES.

SPECIFICATION forming part of Letters Patent No. 303,586, dated August 12, 1884.

Application filed August 25, 1882. (No model.)

To all whom it may concern:

Be it known that we, JAMES COSMO NEWBERY, analytical chemist, JOHN LISTER MORLEY, gentleman, and BARRY CLEVELAND, gentleman, all subjects of the Queen of Great Britain, residing at Melbourne, in the British Colony of Victoria, have invented certain Improvements in Furnaces for Reducing and Smelting Ores, of which the following is a specification.

Our invention relates to certain improvements in furnaces for reducing and smelting metallic ores, especially those which form oxides or compounds that may be reduced by heated charcoal—such as ores of antimony, bismuth, copper, tin, and zinc; and it consists, essentially, in a furnace wherein there are a fire-chamber, a flue, and a reverberatory reducing-hearth, and interposed or extending through said flue, but not in internal communication therewith, a series of smelting pots, chambers, or crucibles, open at bottom over an independent hearth provided with a tap-hole and an independent flue-connection with the chimney, said crucibles being at top outside the furnace and provided with luting-cover.

One part of the device shown in the drawings (relating to the production of oxides from sulphides, arsenides, and other oxidizable ores) consists of a hearth on which the raw ore is treated. When the ore is easily fusible—such as sulphide of antimony—the method of treatment differs from that of ores not readily fused. In the case of sulphide of antimony the hearths in use usually consist of a solid surface with a tap-hole in some convenient position for drawing off the fused sulphide, which is then smelted in a crucible or a furnace. The hearth shown is not solid, but has holes or perforations through it, which allow the fused sulphide to pass onto a solid bed underneath, where the sulphide is converted into oxide; or, if required for any purpose, may be drawn off as sulphide. When the ores do not fuse readily, the oxide may be formed in any of the ordinary ways now in use.

Another part of the device shows means whereby the oxides may be converted into metal, whether natural or artificial. This is accomplished by smelting them in a furnace so constructed that the draft is downward through the oxides in process of smelting and through the carbonaceous material used in such process. The furnace is so constructed and arranged that the heat from one fire is utilized for roasting the ore, perfecting the oxidation, and producing the metal from the oxide.

In order, however, that the invention may be clearly understood, we will now refer to the drawings hereto attached, in which—

Figure 1 shows a longitudinal section of the furnace; Fig. 2, a plan view; Fig. 3, a cross-section of the reducing part of the furnace on the line *a a* in Fig. 2, and Fig. 4 a cross-section of the liquating or oxidizing part of the furnace on the line *b b* in Fig. 2.

A is the fire-place, and A′ the fire-bridge. B B are tubes or cylindrical chambers made of fire-clay and closed with caps B′ B′. B^6 are circumferential grooves on tubes B B, adapted to receive the caps B′ B′. When said caps are placed in said grooves and luted and a thick layer of solid carbon placed in the bottom of the tubes, a small per cent. of combustible liquids or gases may be used, which will be more fully hereinafter described. B^2 is the bed of this part of the furnace. B^3 is the flue from the bottom of reducing part of the furnace into the precipitating chambers or flues, and B^4 the entrance into the oxidizing-chamber. C is the perforated hearth of the roasting or liquating chamber, and D the solid bed underneath. C′ C′ are feeding-doors, and C^2 cleaning-out doors. D′ is also a cleaning-out door, and D^2 the escape-flue to the precipitating flues or chambers.

The mode of operation is as follows: The fire having been lighted in A, and the necessary heat having been attained, the hearth C is supplied through doors C′ C′ with the ore to be treated, and the doors are closed. The tubes or cylindrical chambers B are then charged with the oxide to be smelted and with the carbon necessary for the purpose, in substantially the following way: First, there must be a thick layer—say, one foot—of the carbonaceous material (such as wood charcoal) at the bottom, then a layer of, say, six

inches of oxide, and then another layer of, say, two inches of carbon, and so on, until the tube is filled, so as to provide sufficient carbon to reduce the oxide to metal, as is well understood. As the contents descend, they are replaced by fresh oxide and carbon in similar proportions, the caps of the tubes being left off until there is no more material to treat, when they are put on, so as to prevent the possible escape of injurious gases, and to prevent unnecessary waste of material. The heat from the fire A plays around said tubes, then passes through B^4 into the liquating-chamber, and when fusible sulphides are being treated it fuses them, and they run through the perforations of the hearth C onto the solid bed D. The heat then passes over such solid bed, and finally is conducted through escape-flue D^2 to the precipitating flues or chambers. (Not shown.) As the heated current passes over the solid bed D, it carries with it the oxide that has been formed thereon, and in order to facilitate the production of this oxide the door D′ is opened sufficiently and as often as may be required; or heated air may be supplied to the bed D through pipes. The oxide in the tubes B becomes heated to such an extent as to be reduced by the carbon present, and, passing through the carbon at the bottom, is discharged as metal onto solid bed B^2, from whence it runs through tap-hole B^5 into a proper receiver. Combustible gases or liquids—such as hydro-carbon, hydrogen, or carbonic oxide—may be used more or less as a substitute for the solid carbon in the tubes, so long as a thick layer of carbon remains in the bottom of each.

Having thus described the nature of our invention and the manner of performing same, we would have it understood that what we believe to be new, and therefore claim as our improvements in furnaces for reducing and smelting metallic ores, especially those which form oxides, or compounds that may be reduced by heated charcoal, is—

1. A reducing and smelting furnace comprising the furnace-chamber A, reducing-chamber C, and the smelting-retorts B, interposed between said chambers, and provided with a separate hearth and tap-hole, all arranged in the manner set forth.

2. A fire-box, A, flue B^4, and roasting-hearth C, combined with a hearth, B^2, open-bottom reducing-tubes B over said hearth B^2, provided with luting-grooves B^6, and covers B′, and flue B^3, substantially as described.

3. A reducing and smelting furnace comprising the fire-chamber A, the reducing-chamber C, and the open-bottom smelting tubes or retorts B, hearth B^2, and separate flues B^3, as shown and described.

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