No. 836,871. PATENTED NOV. 27, 1906.

T. EDWARDS.

MECHANICALLY RABBLED ORE ROASTING FURNACE.

APPLICATION FILED JAN. 27, 1905.

2 SHEETS—SHEET 1.

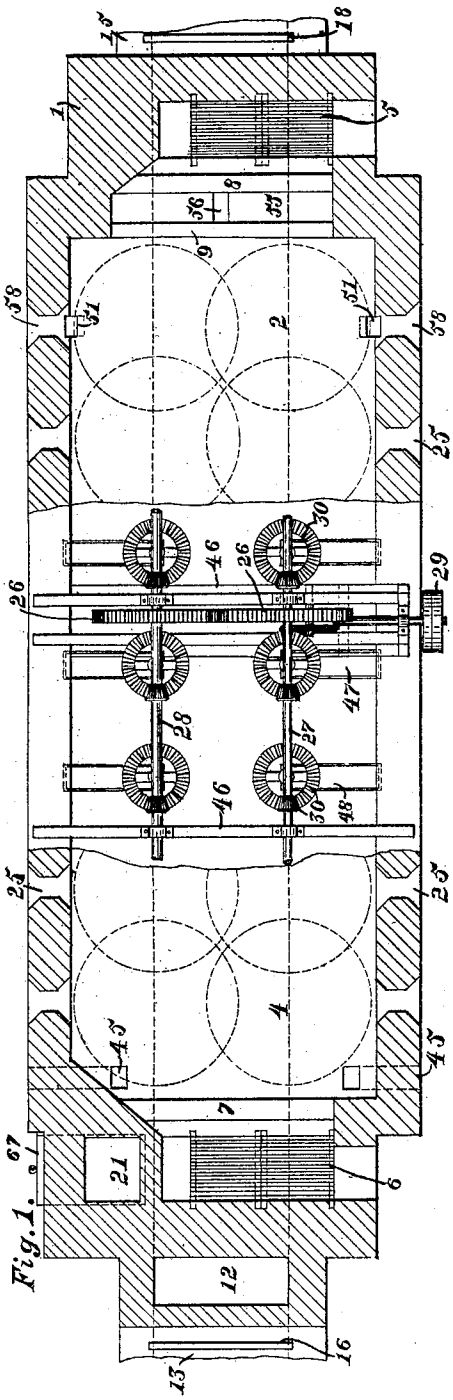

Fig. 1.

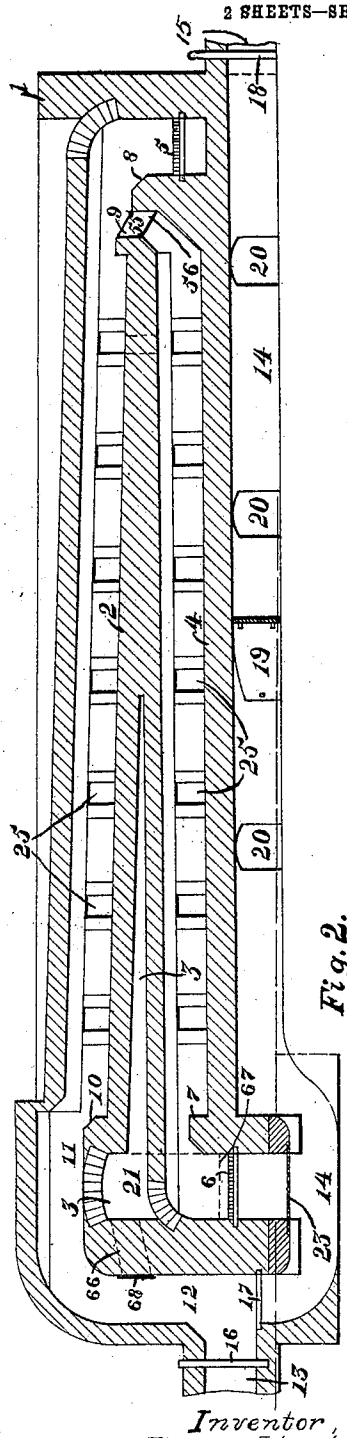

Fig. 2.

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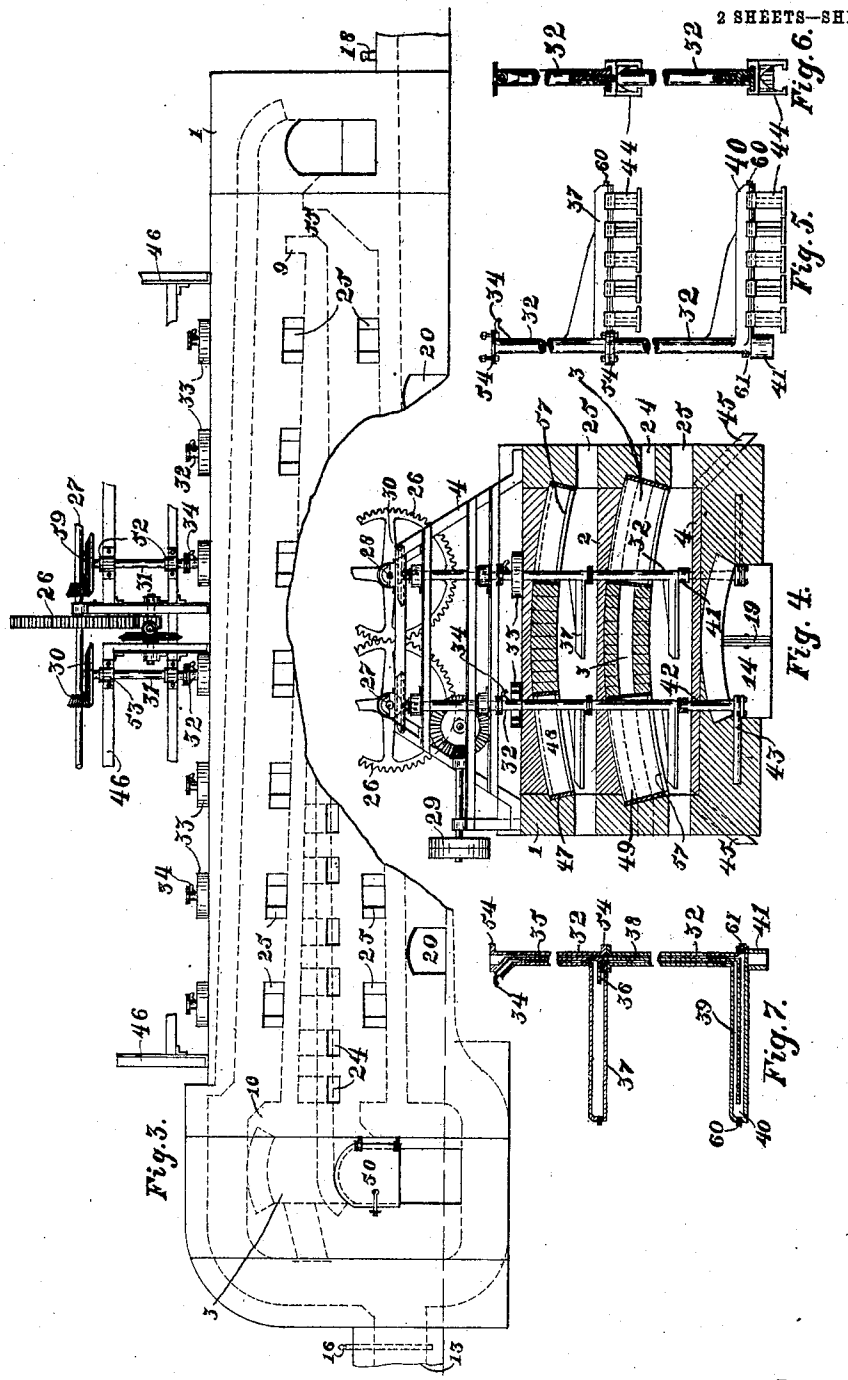

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE.

THOMAS EDWARDS, OF SEBASTOPOL, BALLARAT, VICTORIA, AUSTRALIA.

MECHANICALLY-RABBLED ORE-ROASTING FURNACE.

No. 836,871. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed January 27, 1905. Serial No. 242,951.

To all whom it may concern:

Be it known that I, THOMAS EDWARDS, a subject of the King of Great Britain and Ireland, residing at Sebastopol, Ballarat, in the State of Victoria, Commonwealth of Australia, have invented certain new and useful Improvements in Mechanically-Rabbled Ore-Roasting Furnaces; 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.

This invention relates to several improvements in ore-roasting furnaces, one of its principal objects being to secure a furnace easy to work, economical of fuel, and capable of yielding an exceptionally large daily tonnage of properly-roasted crushed ore.

The construction may vary considerably within the scope of the invention; but for purposes of explanation and description diagrams or illustrations accompany this specification. In these various portions of a furnace are indicated.

Figure 1 represents a plan view, partly in horizontal section, so as to show at one end an upper hearth and at the other end a lower one. Fig. 2 exhibits a longitudinal vertical section. Fig. 3 is a side elevation; Fig. 4, a transverse section; and Figs. 5, 6, and 7 show details of rabbles, the furnace being of that class in which the ore is mechanically rabbled and transferred from the feed area to the point or points of discharge.

The circles described by the rabble-arms may cover areas, as dotted in Fig. 1, with lateral and longitudinal overlap, or the amount of overlap may be greater or less than that shown. I use superimposed hearths with apertured roofs or arches over them and a plurality of series of rabbles to stir the ore on said hearths, each rabble having (at different heights) arms or means to rabble such successive hearths, such a rabble being termed in the claims a "multiple" rabble for brevity. Means are adopted to regulate the heat at different parts of the furnace and to economize or utilize the heat of the hot gases which are discharged from the said hearths; but the invention is not limited to the number or design of long hearths shown nor to the number of lines of multiple rabbles nor to any feature similarly variable in position, size, or form.

The details of the furnace may embody additions of well-known parts not herein claimed.

In the illustrations some parts are in accordance with present practice. The furnace has a plurality of lines of rabble-spindle-rotating overhead shafting 27 and 28, which are revolved simultaneously at the same speed, and a corresponding plurality of lines of multiple rabbles which are revolved, their upper stems or spindles being marked 31 and the remainder of the stems 32, there being driving means, as gear-wheels 30, connected to the shafting and the spindles, respectively.

26 represents driving means, as gear-wheels, mounted on shafting 27 and 28, the said wheels being driven by suitable means, as pulley 29, with connecting mechanism.

The superimposed hearths are elongated or reverberatory, the multiple rabbles having stems passing through superimposed openings 47 in the arches or roofs of the said hearths 2 and 4.

48 shows a metal lining or box (as of cast-iron) set or fitted in each aperture 47, 49 showing a lining or box (used in some cases) deep enough to extend through the additional height of the air-chambering 3. Instead of one deep lining 49, however, there are two like 48 used generally, one above and one below the said air-chambering.

The apertures 47 comprise a plurality of longitudinal series so superimposed that the rabble-stems, with their arms attached, may be lifted upward and out of the furnace or be inserted with ease. The rabbles are suitably supported, as by collars 52, on their spindles, working on bearing-blocks 53, secured to any suitable framing, as 46, over the furnace. The base of each rabble-stem has an alinement device or hollow socket 41 located on or just above the hearth, adapted to inclose the top of an alinement-post 42, which projects a short distance above the hearth, where the alinement is effected. Post 42 is suitably and in some cases removably supported, as by bar 43. This arrangement has several advantages. The furnace has suitable side air and sight holes, as 25, along each side of each hearth, with means for closing the same partly or completely, as required for efficient working, and the rabbles (or some of them) have stems and arms which are hollow and partitioned. Partitioning is shown

(marked 36 and 39) in the arms 37 40 of the rabbles, extending for a minor or major part of the arm length, as illustrated in Fig. 7, and 35 and 38 show superimposed parts of a vertical partition. The part of the hollow rabble-stem above its water-outlet needs no partition. The rabbles have, where desired, any suitable teeth 44, and their stems are jointed or in sections bolted or secured together—as, for example, at 54—the course or circulation of water admitted (from any suitable piping, not shown) for cooling purposes to the rabble-stem top 59 being first downward to reach and pass along the various arms of the rabble, then upward, the water emerging by its own pressure at the stem-outlet 34 into a pan 33, (shown in Fig. 4,) both inlet and outlet being above the furnace. The discharge from pans 33 is by any desired means, as pipes. (Not shown.) The partition 35 at its top is joined to one side of the rabble-stem. (See Fig. 7.)

The upper hearth 2 is sloped from its feed end to its discharge, and the lower hearth 4 is also so sloped. Thus the fall of hearth 4 is (or may be) opposite to the fall of hearth 2. Between the two hearths a chamber 3 or chambers is or are provided as an insulation, but when required usable as a feeder of heated air to an ash-pit or fireplace of the furnace or as conducted by flue. This chambering, which may be tapering, is formed in the tapered partition, extending between the two hearths and extends the whole or part of the hearth length and has means, as by openings 24, at (one or) both sides, through which air may be admitted or passed through to cool the said chambering or to utilize the air therein, the inlets being closed when desired with suitable doors or means. (Not shown.) The heated gases of combustion from the upper hearth are enabled to pass downward and then longitudinally for the utilization of their heat, as through flues 11 12, into a subflue or passage 14 and out at some suitable discharge, as 15. The lower-hearth heat is economized by this arrangement.

One of the most serious drawbacks of old types of multiple-hearth ore-roasting furnace is the difficulty and in some cases the impossibility of maintaining on each hearth a temperature to suit the ore. When some of these hearths are working at the right temperature, others are so overheated that the roasting is unsatisfactory, the extraction value of the product being deteriorated. Interhearth-chambering, however, permits of such control of the heat as to prevent even ores which contain a large percentage of sulfur from becoming overheated on the upper hearth or hearths. If the temperature of the hearth 2 is becoming higher than is desired, the furnace man will admit fresh cool air to the interhearth-chambering and in any suitable way promote ventilation therethrough, so modifying the heat of the hearth above it. When the more or less heated interhearth-air is passed downward, a passage or communication 21 from chamber 3 being provided therefor, Fig. 1, it is delivered as into the ash-pit 22, (fitted with under damper 23 and closable air-tight door 50,) and there is then an economy of fuel.

The communication or well 21 may pass along any suitable course from the chambering to the ash-pit or to the fire-chamber 6 or the like. On preventing or reducing sufficiently the influx of cold air to the interhearth-chambering the hearth 2 can be heated as highly as necessary to roast ore low in sulfur.

Bridges or walls across the hearths or fireplaces are shown at 7, 8, 9, and 10, the flue 55 leading gaseous products of combustion upward to hearth 2. 56 is a means or bridge provided when desired in flue 55 to further support hearth 2. The discharge from hearth 2 is through any suitable holes, as 51, and to any suitable receiver. The holes may have a slide or regulator at 58 (not shown) for closing the same as desired. Usually the discharge from hearth 4 is through holes, as 45, Fig. 1. There may be several hearth discharge-holes at different distances from the hearth lower ends, each fitted with means of closure or regulation, to allow discharge of ore where and as desired.

The main fireplace is marked 6, being at the lower end of the lower hearth, and there is auxiliary firing by fireplace 5 at the other end of the furnace. The use of fireplace 6 is in some cases sufficient, ores high in sulfur not needing so much fuel to roast them. Ordinarily the level of fireplace 5 is higher than that of fireplace 6. The end of chambering 3 is generally brought over the fire chamber or box 6. 16 indicates a damper or shutter, and when it is open flue 12 communicates with a chimney or outlet 13. Another damper is marked 67 and is fitted to the lower part of flue 21 above ash-pit 22, and when 67 is closed the air from chambering 3 is cut off, so that it cannot pass to the ash-pit 22. An air-exit 66, with damper 68, is also usually provided to communicate (when damper 67 is closed) from the chambering 3 to flue 12 and thence to subflue 14, if desired, or (as predetermined) chimney 13. The means for discharge of air into the subflue 14 are made when desired more direct.

There is a damper 17 to control or bar the passage of heated gases in respect of flue 14, (extending beneath the lower hearth,) and a damper, as 18, controls or bars their passage as to any outlet, as 15. Flue 14 has side openings or doorways, as 20, with means (not shown) of closing same, and may have suitably-located inner doors 19 to close the flue at

will. As the stoppings of the linings 48 and 49 fire-brick or like blocks are used of special form to fit, tamped, as with clay or clay and sand, the latter being brought to the hearth-height at all parts desired. The blocks are made convenient to insert or remove, means for gripping them being provided, and suitable inner flanges 57 in the linings 48 49 act as supports of the blocks during the ore-roasting. The hearths may be stepped or stepped in part instead of being inclined.

Shoes, as 44, Figs. 5 and 6, adapted to slide on or off the rabble-arms, are used on all arms where desired. The rabble-arms at those parts of the furnace where the heat will be sufficiently low may dispense with water circulation. Thus upper hearth-arms at the end near the ore-feed to the upper hearth may be so made, while still retaining the means of water circulation in the rabble stems and lower arms. The speed of the rabbles is varied when desired by varying the gear-wheels 30, and the gears driving the rabbles near a hearth end or ends are in some cases arranged to move them at double the speed of the adjoining rabbles. The parts 41 to 43 are omitted where the stem alinement is secured at higher points. The apertures 47 may extend otherwise than transversely, as at an angle to the direction shown, and the rabble-stems are rested when desired upon the upper ends of pins 42 above hearth 4.

Each water-circulating rabble-arm is usually provided with a removable plug at one or both ends 60 61. The location of discharge from flue 14 is in some cases at the side or sides before reaching the end 15. Flue 14 is in some cases partitioned and the partition so apertured that the gases can be passed along one side of the partitioning and back at the other side thereof to an outlet or chimney.

The furnace-body construction may be of any suitable materials, adopting, for example, an iron casing lined with brick, or the body may be built of brick with straps or bar-iron, the whole strongly stayed and bolted togeth r.

To avoid in some cases repetition in the drawings, various features are omitted from some figures—as, for example, the passages 24 from Fig. 2, while customary devices, such as draft-apertures or flues to admit external air to fuel-chambers 5 6 or the like, are not shown.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. In an ore-roasting furnace, in combination with superimposed hearths, multiple rabbles, a plurality of lines of rabble-spindle-rotating overhead shafting, and a plurality of longitudinal series of superimposed closable apertures for insertion and removal of multiple rabbles as indicated.

2. In an ore-roasting furnace, in combination with superimposed hearths, a plurality of lines of rabble-spindle-rotating overhead shafting, and a corresponding plurality of lines of multiple rabbles as indicated.

3. In an ore-roasting furnace, in combination with superimposed hearths, a plurality of lines of multiple rabbles having means for their simultaneous rotation at the upper parts of their stems.

4. In an ore-roasting furnace, in combination with superimposed hearths, a plurality of lines of multiple rabbles having means for their simultaneous rotation at the upper parts of their stems, the location of the rabble-arms being such that they will describe circles intersecting one another longitudinally and laterally on each hearth.

5. In an ore-roasting furnace and in combination with superimposed hearths, multiple rabbles having each a stem constructed in sections, each section having an arm formed integrally therewith and each having an integral partition extending vertically of its stem portion and alining with the vertical partition in the adjacent section or sections and the horizontal arms having partitions integral therewith and with the vertical stem-partitions, substantially as described.

6. In an ore-roasting furnace, in combination with superimposed hearths, multiple rabbles having each a stem constructed in sections, and supports, and means of rotation, and a water-inlet to and a water-outlet from the rabble-stem, each above the furnace, and partitioning within the rabble below the said outlet, and extending along the stem and along a rabble arm or arms, each section of the stem having its partition arranged to register with the partition in the adjacent section.

7. In an ore-roasting furnace, the combination with superimposed hearths, a rabble comprising a stem and a plurality of arms thereon, an inlet and an outlet for water both at the upper part of the rabble-stem and partitions in the stem and arms, that in the stem extending from side to side of the same transversely to the axes of the arms, the partitions in the arms joining the side face of the said stem-partition, substantially as described.

8. In an ore-roasting furnace, in combination with superimposed hearths, multiple rabbles having at different heights, arms, the lower one of which is partitioned, a stem with water-outlet partitioned below said outlet, and an upper non-water-circulating foot.

9. In an ore-roasting furnace, a water-cooled rabble, the stem of which is supported and has means of rotation at its upper end, and the base of which has an alinement-socket slightly above the hearth.

10. In an ore-roasting furnace, in combination with superimposed hearths, inter-hearth-chambering adapted to serve as insu-

lation, and having closable superimposed (or top and bottom) apertures for the introduction and removal of rotatable rabbles.

11. In an ore-roasting furnace, in combination with superimposed hearths, one or more longitudinal series of closable apertures of elongated narrow form, over one—but under another—hearth, for the introduction and removal of rotatable rabbles.

12. In an ore-roasting furnace, in combination with superimposed hearths, interhearth-chambering having means for the admission of air thereto and means of discharge of air therefrom, for modifying the temperature of the hearth above said chambering.

13. In an ore-roasting furnace, an air-chamber, a hearth above the same, a hearth beneath the chamber, means whereby air may be admitted to the chamber and a passage for conveying the air from the said chamber to the ash-pit or fire-box, substantially as described.

14. In combination in an ore-roasting furnace, an air-chamber, a hearth above the same, a hearth beneath the chamber, a subflue below the lower hearth, means whereby air may be admitted to the chamber and means for discharging the air from said chamber to the subflue, substantially as described.

15. In an ore-roasting furnace, in combination with superimposed hearths, interhearth-chambering having closable top and bottom rabble-apertures, means for the admission of air, and a well for the discharge of air as predetermined.

16. In an ore-roasting furnace, in combination with superimposed hearths, interhearth-chambering, means of admitting air thereto, and discharging it therefrom at the sides, a flue or flues therefrom, and a damper or dampers to give, or to cut off, communication with an ash-pit, fire-chamber or the like through a flue.

17. In an ore-roasting furnace, in combination with superimposed hearths, a longitudinal partition of tapering form, and interhearth-chambering also of tapering form having air inlet and exit apertures, and means for closing or regulating the same.

18. In an ore-roasting furnace, in combination with superimposed longitudinal hearths, with an intermediate partition which is thicker at one end than at the other, the provision of air-chambering along the thicker part of the roof.

19. In combination in an ore-roasting furnace, a plurality of hearths, a fire-box at the end of the lower hearth, an air-chamber extending between the hearths and extending over the said fire-box, and means for allowing air to enter and discharge from said chamber, substantially as described.

20. In an ore-roasting furnace, superimposed hearths with an air-chamber between them for heating fresh air, a fire-box over which a part of the air-chamber is located, the ash-pit, a subflue under the furnace-hearth and means for conducting the heated air to the ash-pit or subflue, substantially as described.

21. In an ore-roasting furnace the combination of a hearth and a flue beneath the said hearth, a pin projecting through the hearth from the flue beneath the same, means consisting of a bracket or bar in the flue for supporting the pin, and a rabble-stem having its lower end resting on the pin, substantially as described.

22. In an ore-roasting furnace having superimposed hearths and interhearth-chambering, a narrow, long, and deep closable lining or box to extend from the arch or roof over one hearth, beyond the chambering, and into the hearth above, and adapted to allow of the passage of a rabble-stem and foot therethrough.

23. In an ore-roasting furnace, in combination with superimposed longitudinal hearths a fire-chamber at the lower end of the lower hearth, and another fire-chamber at a higher level at the other end of the furnace at the lower end of a higher hearth, and fire-bridges across each of the said hearths, and interhearth-chambering between the hearths with means for regulating the temperature thereby said hearths communicating with each other adjacent the higher fire-chamber.

24. In an ore-roasting furnace, the combination of superimposed hearths, closable superimposed roof-apertures for rabbles, interhearth-chambering having means for admission and discharge of air, a plurality of lines of overhead shafting, and of multiple rabbles, a plurality of fireplaces, driving-gear for said shafting and rabbles, a subflue, means for introducing the heated gases of combustion into the subflue, and means for discharging the ore from the respective hearths.

25. In an ore-roasting furnace, and in combination, a hearth, a rabble, means at the upper end of the rabble for rotating the same, alining means projecting up through the hearth and on which the lower end of the rabble turns and a bar or bracket arranged below the hearth for supporting the alining means, said alining means being stationary and the hearth being practically solid, substantially as described.

26. In combination, in an ore-roasting furnace, superimposed hearths, a rabble having an arm working in each hearth, an opening leading from one hearth to the other for the passage of the rabble-arm from the lowermost hearth and a filling for said opening to form practically a solid upper hearth, substantially as described.

27. In combination in an ore-roasting furnace, superimposed hearths, an air-chamber between said hearths, two lines of rabbles,

each rabble having a plurality of arms, one for each hearth, the arms on each rabble being in the same vertical plane and openings arranged laterally and at each side of the air-chamber to permit the removal of the rabbles, substantially as described.

28. In combination in an ore-roasting furnace, superimposed hearths with an intermediate partition which is thicker at one end than at the other, an air-chamber within the thickened partition, a fire-box at the thickened end of the partition, but separated therefrom by the lower part of said partition extended over the said fire-box, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

THOMAS EDWARDS.

Witnesses:
G. G. TURRI,
B. M. LOWE.