No. 832,248. PATENTED OCT. 2, 1906.

T. EDWARDS.

ORE ROASTING FURNACE.

APPLICATION FILED DEC. 19, 1903

2 SHEETS—SHEET 1.

Fig. 1

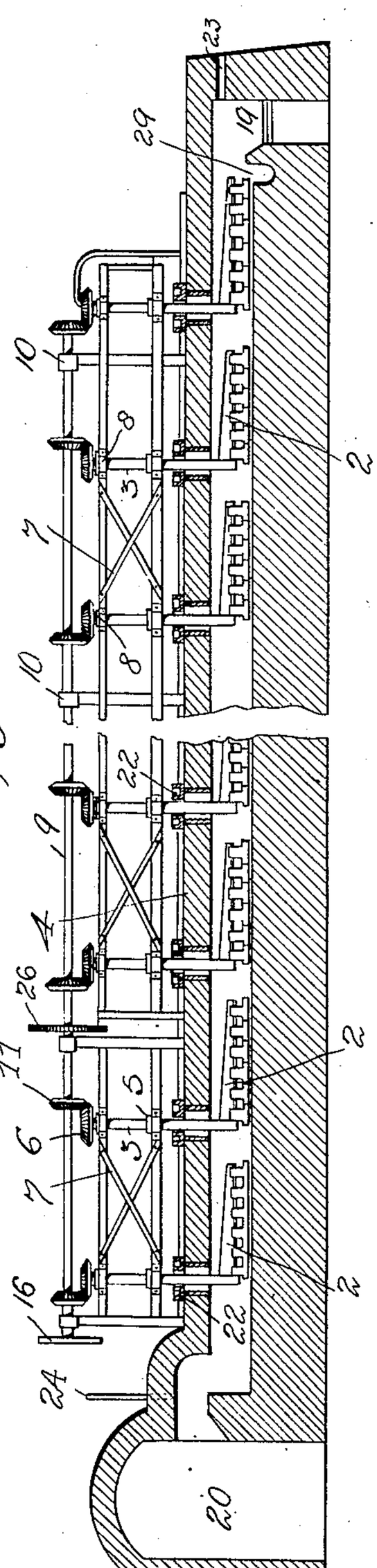
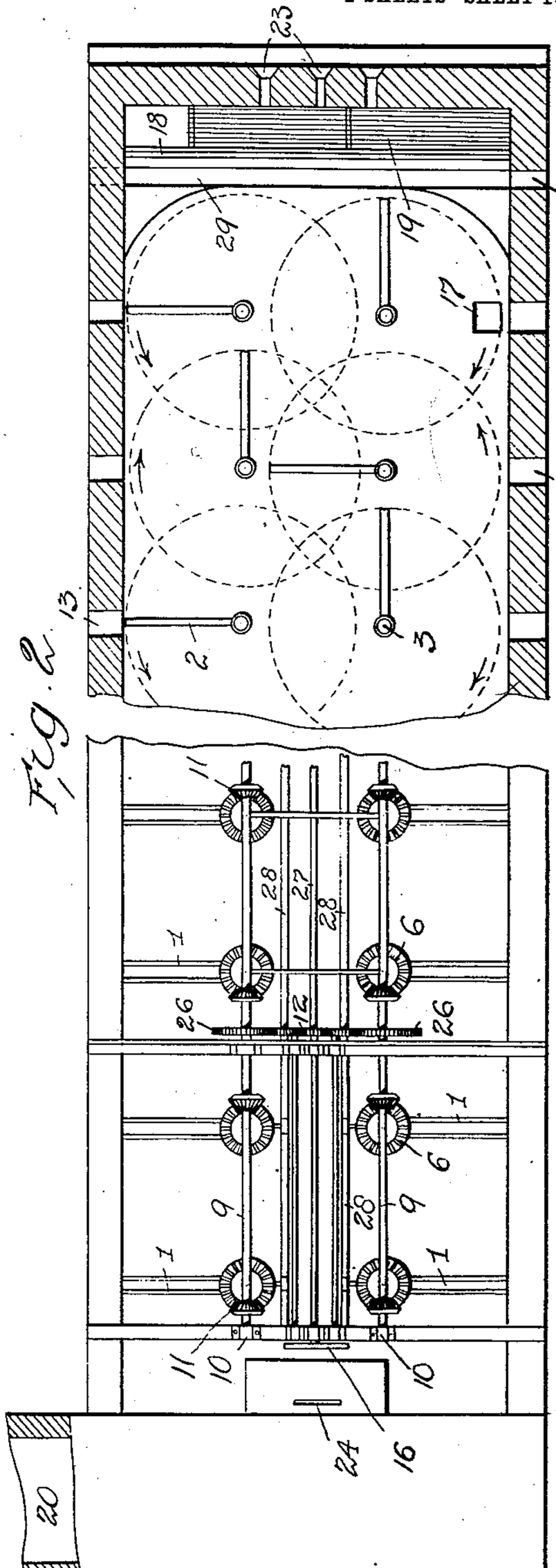


Fig. 2



Attest:
C. Middleton.
Edward Sexton

Inventor
Thomas Edwards.
by Ellis Spear & Company
Attys.

No. 832,248. PATENTED OCT. 2, 1906.

T. EDWARDS.

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2 SHEETS—SHEET 2.

Fig. 3.

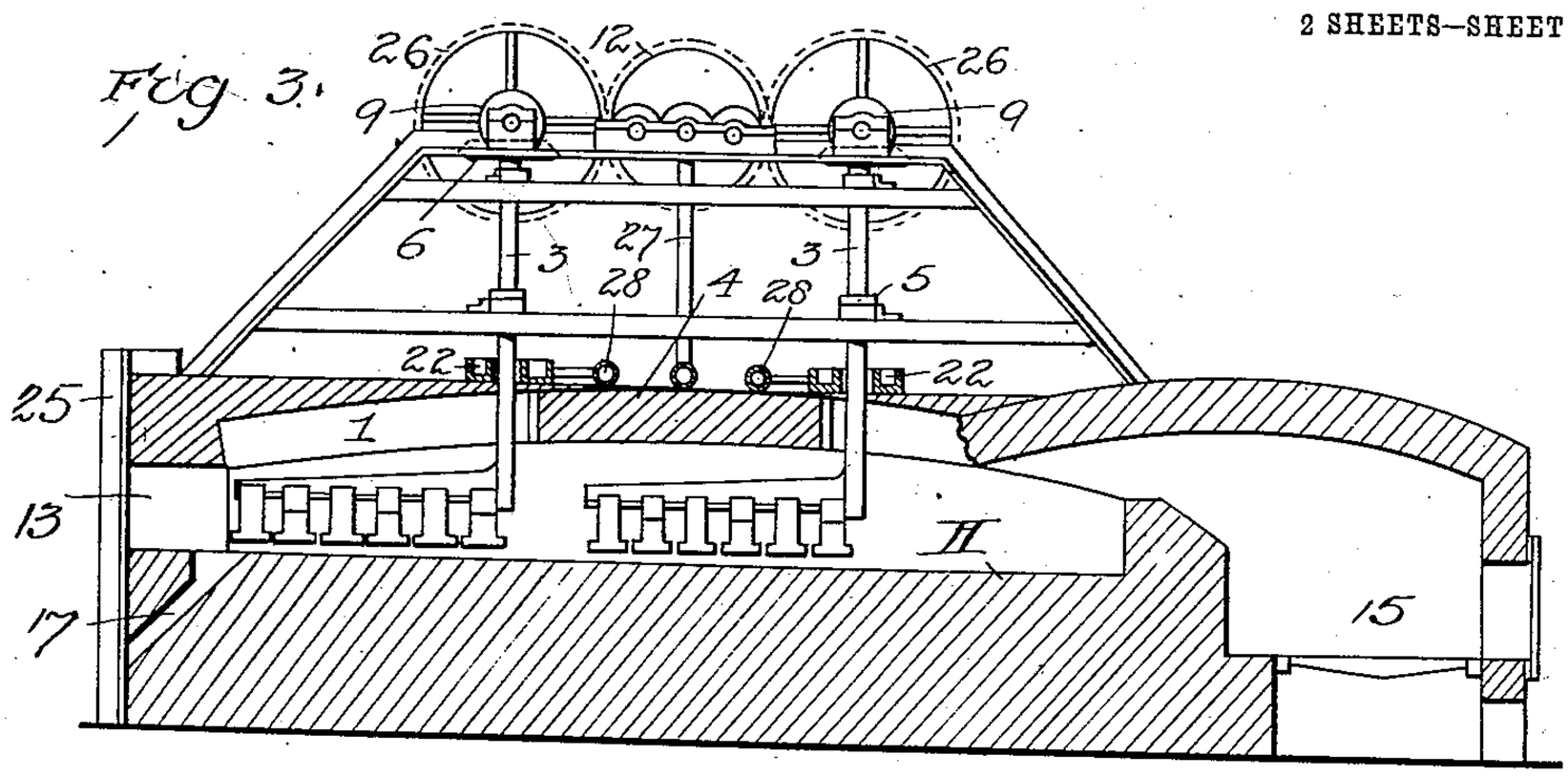


Fig. 5.

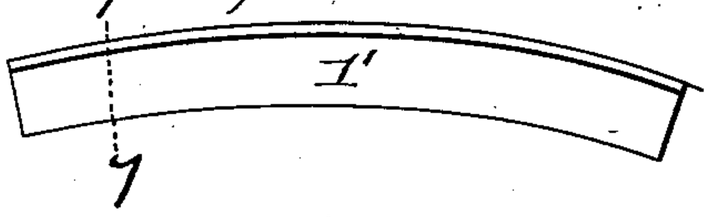


Fig. 6

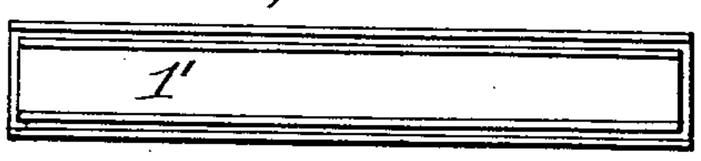
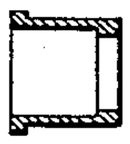


Fig. 7.



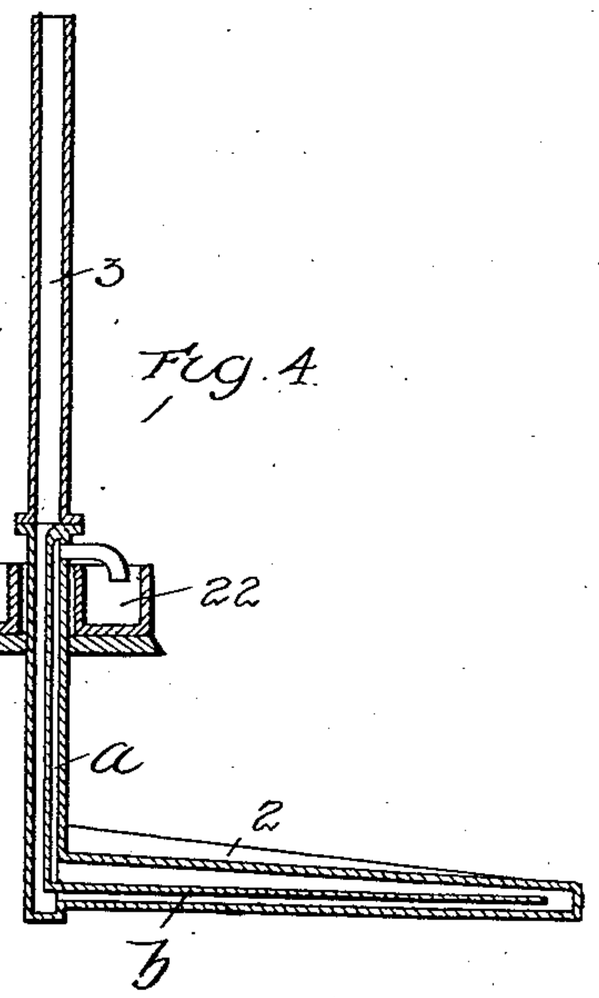


Fig. 4.

Fig. 4a

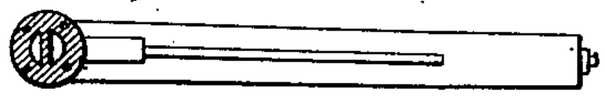


Fig. 4b

Witnesses
C. Middleton
Edward Sartori

Inventor
Thomas Edwards.
by Ellis Spear & Campbell
Attorneys

UNITED STATES PATENT OFFICE.

THOMAS EDWARDS, OF BALLARAT, VICTORIA, AUSTRALIA.

ORE-ROASTING FURNACE.

No. 832,248. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed December 19, 1903. Serial No. 185,883.

To all whom it may concern:

Be it known that I, THOMAS EDWARDS, a subject of the King of Great Britain, residing at Ballarat, Victoria, Australia, have invented certain new and useful Improvements in Ore-Roasting Furnaces, of which the following is a specification.

This invention relates to roasting-furnaces whereby copper ore, pyrites, matte, tin ore, antimony ore, quartz, and various other sulfid ores and other compounds may be efficiently and economically roasted, and, if desired, chloridized.

My improvements are made in and relate to reverberatory furnaces, so that coarse or finely-divided ores may be suitably roasted by mechanical rabbling.

The furnace may be made of brick, stone, or iron, lined with brick or other suitable material, and can be made of any suitable length or width.

In a long reverberatory furnace a single line of rotary rabbles restricts the width of the hearth or desired width of the furnace, but yet necessitates a long foot to the rabble. The great circle described by the point or extreme end of the foot of the rabble necessitates the application of great force to push the rabble through the ore on the hearth from its central spindle, which causes more or less breakages of the rabbles and consequent loss of time. At present the rabbles used are of great weight and unwieldly to remove from and to replace in the furnace and are costly in construction. In my present invention I do away with the objectionable feature of the long rabble-foot by replacing the single line of rabbles with two or more parallel lines of light and short-foot rabbles, which are easier to handle and cheap in construction, possessing great durability and immunity from breakages.

The invention consists in the features and combination and arrangement of parts hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of the furnace, taken along the line of one series of rabbles, parts being shown in elevation. Fig. 2 is a plan view with part of the furnace-wall broken away. Fig. 3 is a cross-sectional view through the furnace with parts in elevation. Figs. 4, 4^a, and 4^b show detail views of one of the rabbles. Figs. 5, 6, and 7 are detail views of the box through which the rabble-arms are placed in or removed from the furnace, Fig. 7 being a section on line 7 7 of Fig. 5.

In a long reverberatory roasting-furnace of various inside widths I provide, as shown in Figs. 2 and 3, two lines or more of a series of lateral oblong holes 1 through the arch or roof of the furnace, into each of which holes I insert an iron frame 1′, Figs. 5, 6, and 7, and after which the opening is closed by clay or other suitable material, which prevents air passing into the furnace when at work, and through which frames are inserted the feet 2 of the two separate lines or series of rabbles and from which they may be removed and replaced when warm.

The rabbles may be made of iron or any suitable material, the spindles 3 of which will protrude above the arch 4. On each spindle of the rabbles will be fitted a collar 5 and a cog-wheel 6. I also provide framework 7, securely fixed above the arch of the furnace, which may be made of iron or other suitable material. To this frame are fitted the bearings 8, into which the spindles of the rabbles are placed, and thus the two series of rabbles with their cog-wheels are held in proper position to be rotated. On the top of this framework 7 I place two or more lines of shafting 9, fitted with cog-wheels 11, which shafting rests on bearings 10, secured to the framework 7. The pinions 11 on the shaft are now geared into their respective crown-wheels 6 on the various rabble-spindles. These shafts are connected by gearing 12 26 to make the shafts run at a uniform speed, so that the feet of one series of rabbles cuts the circle or path of the other series, while each series cuts its own circles or paths of the rabbles, thus preventing the various rabbles from coming into contact or fouling each other.

I provide air-holes 13 along each side of the furnace, a little above the hearth H, through which air may be admitted in proper quantities to oxidize the roasting ore. The circles and arrows, Fig. 2, show the various paths of travel. This figure also shows the air-holes 13 along the sides and the roasted-ore-discharge hole 17, the fire-bridge 18, and fire-place 19, also the flue 20. End air-holes are shown at 23. A damper is shown at 24, side stays at 25, and a drive-pulley at 16. A side furnace may be used, as at 15, Fig. 3, and this may be multiplied according to size and conditions.

My improved rabbles are hollow and comprise a vertical partition *a* within the stem or spindle and a horizontal continuation thereof, as at *b*, within the foot, both parts *a b* being preferably integral with said foot. The adjoining parts of the stem or spindle of the rabbles are cooled by a constant stream of water flowing through the same, the water being conducted to the rabbles by the pipe 27, while the water is discharged from them into the annular pan 22 and is carried away by the pipe 28. Thus the passage for the water is formed in the solid iron through the stem and foot of the rabble, doing away with the introduction of a pipe into the foot of the rabble, which is always unsatisfactory. The water is introduced through the top of the spindle and passes down through the stem *a* and returns by way of the passage *b* through the foot and escapes through the outlet-pipe in the stem of the rabble just under the flange into the annular waste-water pan. There are but two longitudinal lines or series of rabbles shown in the drawings as an example; but this does not limit the application of this principle of applying any number of lines or series of rabbles to long reverberatory furnaces, as the width of the furnace must be accommodated with the necessary longitudinal lines or series of rabbles.

The rabbles are arranged so that the middle of the furnace is stirred twice, each line of rabbles sweeping the ore in the middle toward the fire end, while the sides of the furnace are only stirred once, so that the ore is drawn from the feed end without having an inclined hearth; but this can also be arranged to work equally well on the inclined hearth.

29 is a recess formed in the hearth of the furnace close to the fire-bridge, into which the rabble discharges the roasted ore from the hearth. This is used when roasting fine ore for the smelting-furnaces. The object of the recess is to store up sufficient ore while being kept very hot to be drawn off at intervals into a mechanical press or iron pots and pressed therein while hot. This when cooled becomes a concrete mass. Thus little or no fine ore can be blown into the flues of the smelting-furnaces as dust.

In smelting operations ore containing more than five per cent. of sulfur must be roasted, and to do this expeditiously and well the ore must be crushed fine, so that it will pass through a sieve the mesh of which varies from four holes to sixteen holes to the inch. This fine roasted ore if put into the cupola smelting-furnace would be blown, by means of the necessarily strong blast of air, into the flues, and little or none of the ore would be smelted. To obviate this difficulty, it has been found necessary to leave from two per cent. to three per cent. of sulfur in the ore and while it is very hot to draw the ore from the furnace into iron pots or molds, into which the hot ore is pressed or hammered, so that with the small amount of sulfur contained in the ore it becomes coagulated. Hence, being in lumps, it resists the action of the air-blast and is not blown out of the smelter.

The recess is, as shown, close to the bridge or hottest place of the furnace, in which the ore is discharged from the hearth, which remains in the heat until there is sufficient ore to fill an iron pot or mold, when it is drawn by manual labor or mechanical force from the furnace into the molds, and the desired object is obtained. This same object could not be assured without the recess, as the ore would be drawn out little by little, when the ore would become too cold before it could be pressed. The recess is used only when roasting for smelters, and the ore will be drawn out through the side of the furnace at 29ª.

I would point out that the two or more separate lines or series of rabbles may be rotated by other means than by a longitudinal line-shaft to each line or series of rabbles.

It will be noticed that the rows of elongated openings are arranged out beyond the plane of the line-shafts and that the discharge-pipes 28 occupy positions between the lines of rabble-stems. It will be understood that the arrangement of the elongated openings to extend transversely of the furnace is of advantage in that the strength of the arch is not lessened, as would be the case were these openings extended longitudinally of the furnace.

I claim as my invention—

1. A water-cooled stirring-shaft provided with a partition dividing the shaft into two compartments, said partition forming the end of one compartment, a stirrer-arm, and means connected to the stirrer-arm for providing circulation through the arm and shaft.

2. A water-cooled stirring-shaft provided with a partition dividing the shaft into two parts, one part being closed on the top and provided with a pipe for the passage of water.

3. A water-cooled stirring-shaft divided by a partition, a stirrer-arm attached to said shaft, a partition in the stirrer-arm, an opening at the end of said latter partition, means for admitting water into one part of the shaft and means for permitting the outlet of the water from the other part of the shaft.

4. An ore-roasting furnace of elongated form comprising a hearth and a plurality of lines of rabbles rotating over the said hearth, the two lines of rabbles rotating in opposite directions and sweeping the ore between them toward the fire end of the furnace, substantially as described.

5. An ore-roasting furnace comprising a hearth, and two lines of rabbles extending longitudinally of the furnace and rotating

over the hearth, the circular paths of the rabbles intersecting each other laterally of the furnace, substantially as described.

6. An ore-roasting furnace comprising an elongated hearth and a plurality of lines of rabbles rotating over the said hearth, the paths of movement of said rabbles intersecting each other both longitudinally and laterally of the hearth, substantially as described.

7. An ore-roasting furnace comprising an elongated hearth and a plurality of lines of rabbles rotating over the said hearth, the paths of movement of said rabbles intersecting each other both longitudinally and laterally of the hearth, two lines of shafting extending longitudinally of the furnace, gearing between the said shafting whereby they move in unison and gearing from the said line-shafts to the rabbles, substantially as described.

8. In combination in an ore-roasting furnace, an elongated hearth, a plurality of lines of rabbles rotating over the hearth, and elongated openings extending from the rabble-stems laterally toward the edge of the furnace-arch through which the rabble-feet may be introduced or removed.

9. In combination in an ore-roasting furnace, an elongated hearth, a plurality of lines of rabbles rotating over the hearth, and having their stems extending up through the arch of the furnace, a plurality of line-shafts extending longitudinally of the furnace above the arch, gearing between said line-shafts and the upwardly-extending stems, water-pans surrounding the stems, discharge-pipes for the water extending longitudinally over the arch between the rabble-stems and openings for the placing or removing of the rabbles, said openings being located out beyond the longitudinal plane of the line-shafts and extending from the rabble-stems toward the side edges of the furnace, substantially as described.

10. In combination in an ore-roasting furnace rabbles and means for driving the same, said furnace having elongated openings in its arch with their long dimension extending laterally of the furnace for the introduction of the rabble, substantially as described.

11. A water-cooled stirring-shaft having a stirrer-arm, a partition extending longitudinally of the said shaft, a partition extending longitudinally of the said arm, said arm and shaft being integral and the partitions being integral with each other and with the shaft and arm respectively, the said integral partition forming one end of one compartment in the shaft, the inlet and outlet for the water being at the upper part of the shaft.

12. A water-cooled stirring-shaft having a stirring-arm and a partition extending from side to side and along said shaft and arm, said shaft having the inlet and outlet for the water at the upper portion thereof, whereby a circulation is secured down one side of the shaft, along one side of the arm, returning along the other side of the arm and up the other side of the shaft.

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

THOMAS EDWARDS.

Witnesses:
EDWARD W. KENT,
RALPH R. WRIGHT.