

No. 628,077.

Patented July 4, 1899.

W. B. DEVEREUX.
CALCINING FURNACE.

(Application filed Oct. 15, 1897.)

(No Model.)

4 Sheets—Sheet 2.

Fig. 2,

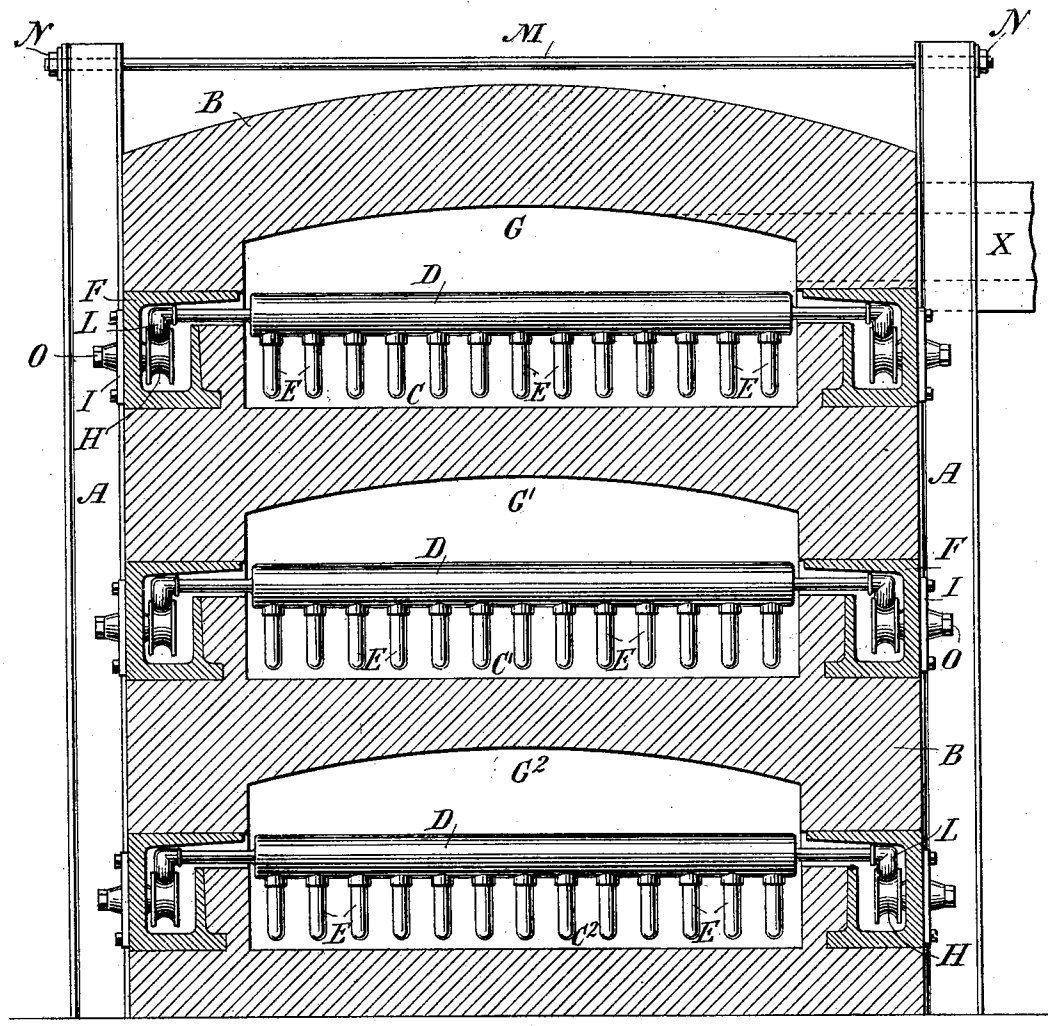
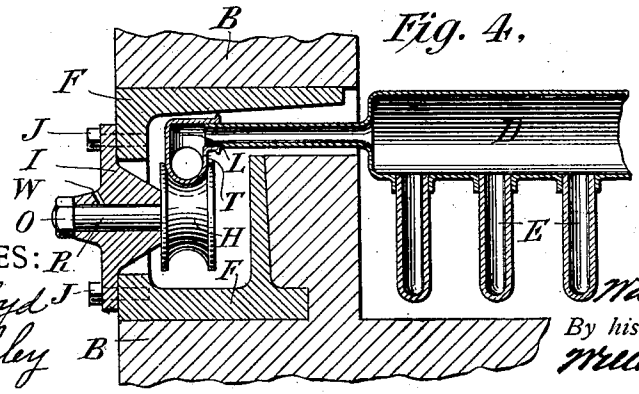


Fig. 4,



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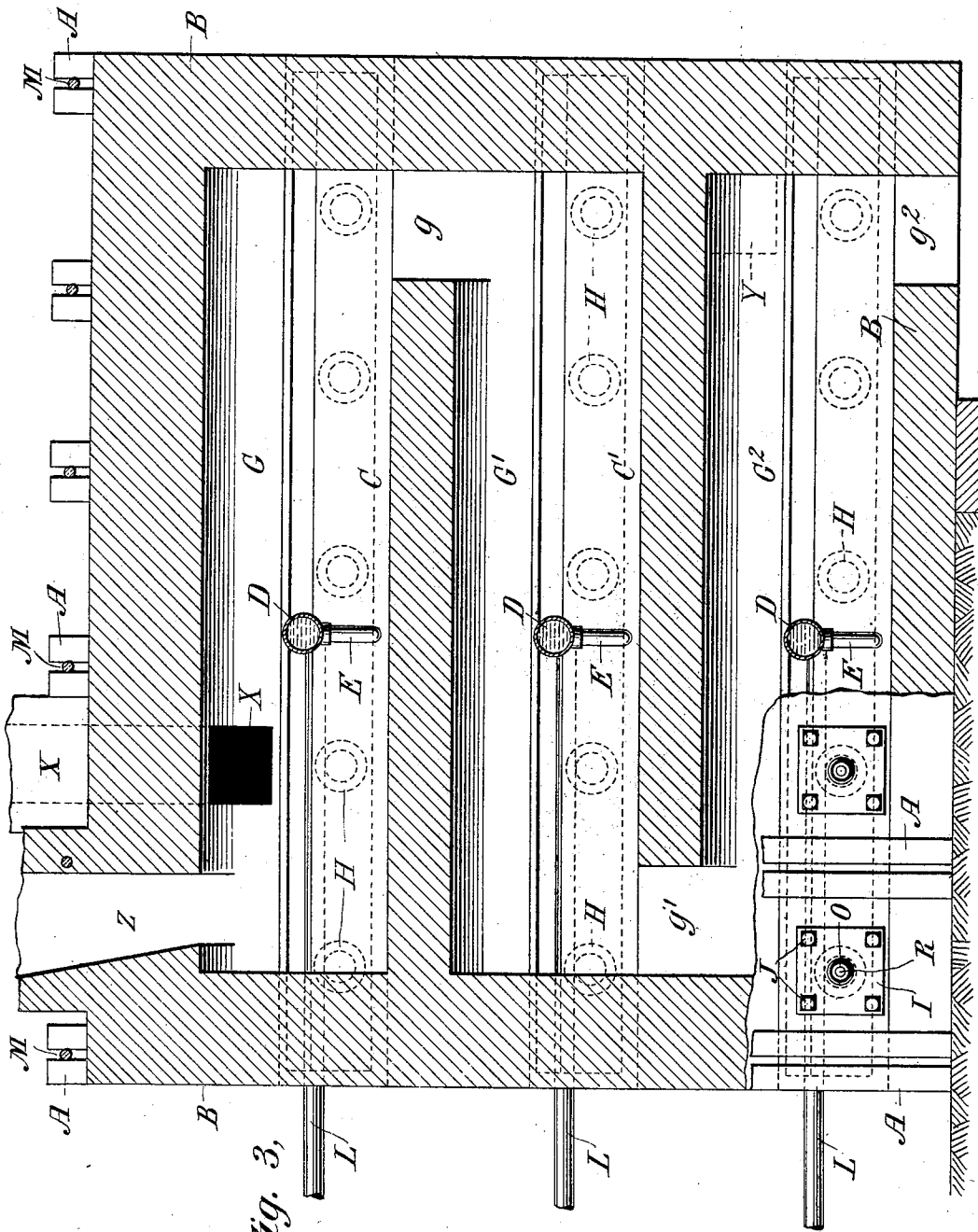


Fig. 3,

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4 Sheets—Sheet 4.

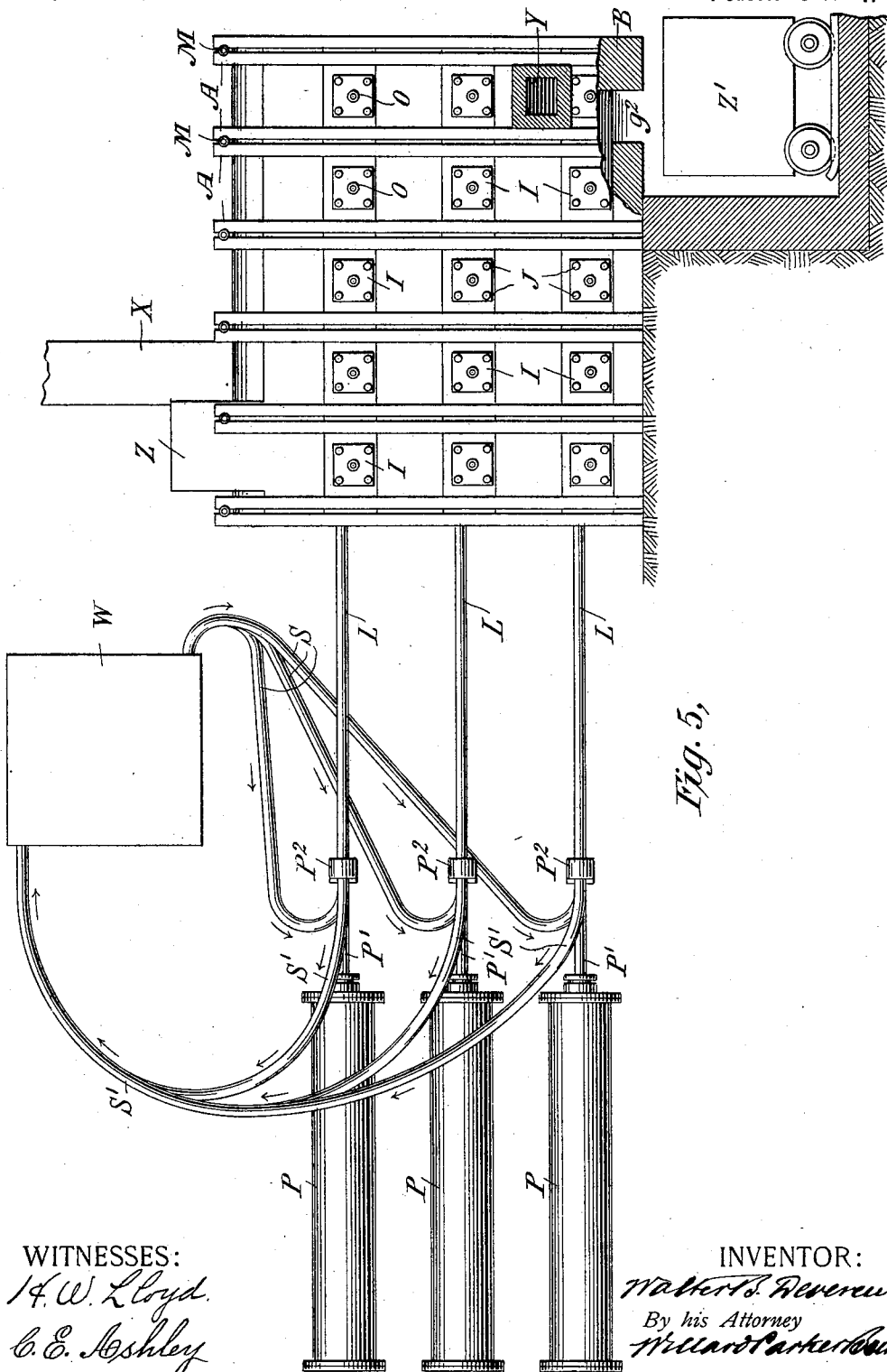


Fig. 5,

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UNITED STATES PATENT OFFICE.

WALTER B. DEVEREUX, OF NEW YORK, N. Y.

CALCINING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 628,077, dated July 4, 1899.

Application filed October 15, 1897. Serial No. 655,359. (No model.)

To all whom it may concern:

Be it known that I, WALTER B. DEVEREUX, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Calcining-Furnaces, of which the following is a specification.

My invention relates to improvements in calcining-furnaces, and more particularly to that class of calcining-furnaces in which the ore is stirred by rakes and gradually pushed along the surfaces of the roasting-hearths until finally delivered at one end of the furnace in a calcined or desulfurized condition; and my purpose is to provide a simple and effective means of operating the rakes which stir and advance the ore along the hearths of such furnaces and to protect this mechanism from the action of the heat of the furnaces. The great difficulty experienced in these furnaces has arisen from the fact that any mechanism by which the rakes are operated must be exposed more or less to the great inner heat of the furnaces. In order to protect this mechanism as far as possible from this heat and at the same time provide a simple and effective mechanism for operating the rakes, I have devised the following plan; and my invention consists, essentially, in inclosing the mechanism by which the rakes are operated in hollow metallic channels, which channels are built into the walls of the furnace over the hearths on each side of the ovens and form integral parts of such walls. These metallic channels are cast of one piece in the shape of oblong boxes, capable of supporting masonry, and have narrow slits throughout their length on their inner side and preferably in the upper corner thereof opening into the interior of the furnace to admit of the free action of the operating mechanism; but in no part of their length do they come into direct contact with the interior of the ovens, but are separated therefrom by some portion of the brickwork which forms the furnace proper, while their entire outer surface on one side is in contact with the air. In these metallic channels are placed rollers, which support the rakes and by means of which they are operated. By this means and by keeping a constant flow of water through the various parts it is believed

a simple and effective means of operating the rakes is provided and that the mechanism is effectively protected from the injurious effect of the inner heat of the oven.

My invention will be best understood by reference to the accompanying four sheets of drawings, forming part of this specification, in which—

Figure 1 is a plan view, partly in section, of a calcining-furnace embodying my invention. Fig. 2 is a cross-sectional view on the lines 2 2 of Fig. 1. Fig. 3 is a longitudinal sectional view on the lines 3 3 of Fig. 1. Fig. 4 is an enlarged cross-sectional view of a detail, and Fig. 5 is a side view of the furnace complete.

Similar letters refer to similar parts throughout the several views.

In the drawings, B represents an ordinary calcining-furnace built of brick or other suitable material.

A are upright beams inclosing the furnace proper. These are placed at convenient intervals in pairs on both sides of the furnace and are connected by the rods M and nuts N.

G G' G² are the ovens, of which there can be any desired number. I have shown a furnace provided with three.

C C' C² are the hearths, and D the rakes by which the ore is stirred and advanced. These rakes D are hollow and extend across the ovens over the hearths and are provided with hollow teeth E. I prefer to construct these teeth of porcelain or similar material and have made them hollow in order that the water passing through the rakes may also circulate through these teeth. The rakes are attached at both ends to the rods L, by which they are operated. These rods extend beyond the furnace and are connected by cross-pieces P² and operated by any convenient power which can give them a reciprocating motion, as the cylinders P and the piston-rods P'. The rods L are hollow and constructed so as to allow a constant flow of water through them and the rakes D with the teeth E. The rods L are adjustably connected with rakes D by the elbows T, and at their opposite extremities the rods on one side of the oven are connected with the bottom of the water-tank W by means of the flexible

pipes S and the rods on the other side of the oven with top of the tank W by the return-pipes S'.

F are the metallic channels in which the mechanism which operates the rakes is inclosed. These channels are cast of one piece in the form shown and are hollow oblong boxes having slits throughout their length, in their upper inner corners opening into the furnace, and having openings on their outer sides at stated intervals of sufficient size to admit the placing therein of the rollers H. The upper parts of the channels over the slits project beyond the sides of the channels, thus forming shelves upon which the masonry rests. These channels form integral parts of the side walls of the furnace and are intended to displace the masonry of the ovens at the points where inserted and to support the masonry above them. The outer walls of the channels form the exterior walls of the furnace, and so are in direct contact with the outer air. There are two metallic channels in connection with each hearth, and they are placed on either side of the hearths and preferably slightly above them. The metallic channels in no place are in direct contact with the interior of the furnace, but at all points are separated therefrom by some portion of brickwork. As the tops of these channels form ledges which support the masonry, the space here between the interior of the oven and the metal is necessarily somewhat narrow; but this is more than compensated for by exposing the entire outer wall of the channel to the air. What I claim as my invention is the idea of providing such hollow metallic channels of such construction that they will protect the mechanism which operates the rakes from the heat of the furnace and at the same time form integral parts of the walls of the furnace and be exposed to the outer air. The mechanism for operating the rollers and giving them a continuous reciprocating movement is inclosed in these metallic channels and consists of rollers H and the rods L, sliding upon them. These rollers H are placed at whatever intervals may be found suitable and are provided on one side with axles R, by means of which they rotate. These axles are inclosed in the boxes I, in which they rotate, and are held in place by the nuts O. The boxes I are cast in the shape shown, being made sufficiently thick to exactly inclose the axles of the rollers H, which rotate in them. They are cut away on their outer edges and fit into the openings in the outer walls of the metallic channels, to which they are attached by the bolts J. This construction permits of the easy removal of the rollers whenever for any purpose it may become necessary.

For oiling the axles R of the rollers the wells W are provided.

Z is the feed-hopper; X, the chimney of the furnace; Y, the flue leading from the fire-chamber; g g' and g'' , the passages connecting

the various ovens, and Z² the car by which the ore in its final calcined state is removed.

The operation is as follows: The ovens are constructed as shown, with the metallic channels forming integral parts of the side walls. The rollers H are inserted in the openings in the side walls and bolted in place as described. The rakes D are then inserted and attached at both ends to the extremities of the rods L by the adjustable stuffing-box T. The ends of the rods L rotate loosely in the stuffing-boxes T, as shown in Fig. 4, as a result of which construction there is a partial rotation of the arms of the rake at the end of each stroke caused by the weight of the teeth when the latter cease to be in contact with the mass of ore on the bed. The outer extremities of the rods L are then connected with some source of power, and a reciprocating motion is imparted to the rods, and thus to the rakes, and the ore stirred and gradually advanced along the hearth. A continual flow of water is secured from the water-tank W through the pipes S, the rods L on the left of the furnace, the rakes D, and the teeth E, and as the water is heated in passing through the rakes it will return in the line of least resistance by the rods L on the right of the furnace and the return-pipes S' into the top of the water-tank W, where it will be again cooled and the operation continued. The ore is introduced through the chutes Z and stirred and raked over the first hearth C. It then falls through the passage g into the second hearth C', where a similar operation is undergone, and the process continues until the ore in its final calcined state is dumped into the car Z².

I claim as my invention—

1. The combination with the side walls and the roof of a calcining-furnace, of a hollow metallic girder having three sides closed and the fourth side divided by a continuous slot extending throughout its length, set longitudinally into the wall of the furnace, with its outer face set in the plane of the exterior wall of the furnace and forming the exclusive support for the side walls and roof above said channel, and with the slot opening into the interior of the furnace throughout the length of the bed.

2. The combination with the side walls and the roof of a calcining-furnace, of a hollow metallic girder, having three sides closed and the fourth side divided by a continuous slot extending throughout its length, set longitudinally into the wall of the furnace, with its outer face set in the plane of the exterior wall of the furnace and forming the exclusive support for the side walls and roof above said channel and exposed to the outer air throughout its length, and with the inner wall not in direct contact with the interior of the furnace, and the slot opening into the interior throughout the length of the bed, and arranged to replace the masonry for which it is substituted.

3. In a calcining-furnace the combination of a hollow metallic channel, constructed in and forming an integral part of the wall of a calcining-furnace, with its outer face set in the plane of the exterior wall of the furnace and forming the exclusive support for the side walls and roof above said channel, and opening into the interior of the furnace through the length of the bed; mechanism for stirring the material on the furnace-bed, and means substantially as described, within the channel, for supporting and moving the stirring mechanism over the furnace-bed.

4. In a calcining-furnace, the combination of a suitable hearth; two hollow metallic channels, constructed in and forming integral parts of each side wall of such furnace, on each side of the hearth, each with its outer face set in the plane of the exterior wall of the furnace and forming the exclusive support of the side walls above said channel, and each opening throughout its length into the interior of the furnace; mechanism for stirring the material on the furnace-bed, and means, substantially as described, within each channel, for supporting and moving the stirring mechanism over the furnace-bed.

5. In a calcining-furnace the combination of a suitable number of hearths; two hollow metallic channels, one of which is constructed in and forms a part of each side wall of the furnace above each hearth, each with its outer face set in the plane of the exterior wall of the furnace and forming the exclusive support for the side walls and roof above said channel; and each opening throughout its length into the interior of the furnace above each hearth; mechanism for stirring the material on the furnace-bed, means, substantially as described, within each channel for supporting and moving the stirring mechanism over each hearth of the furnace; and means for actuating the devices, substantially as described.

6. The combination of a hollow metallic channel, constructed in and forming an integral part of the wall of a calcining-furnace with its outer face forming the exclusive support for the side walls and roof of the furnace and opening into the bed of the furnace throughout its length; a rake, provided with suitable teeth, moving over the furnace-bed having arms extending through the opening in the metallic channel; rollers in the channel, upon which the arms of the rake slide; and means, substantially as described, for giving a reciprocating motion to the rake.

7. The combination of a hollow metallic channel, constructed in and forming an integral part of the wall of a calcining-furnace, with its outer face forming the exclusive support for the side walls and roof of the furnace and opening into the bed of the furnace throughout its length; a hollow rake, provided with suitable hollow teeth, moving over the furnace-bed, having arms extending through the opening in the metallic channel;

flexible water connections whereby water may be supplied to the interior of the rake continuously, for the purpose of cooling the same; and means, substantially as described, for giving a reciprocating motion to the rake.

8. The combination of a hollow metallic channel, constructed in and forming an integral part of the wall of a calcining-furnace, with its outer face forming the exclusive support for the walls and roof of the furnace, and opening into the bed of the furnace throughout its length; a hollow rake, provided with suitable hollow teeth, moving over the furnace-hearth, having arms extending through the opening in the metallic channel; rollers in the channel upon which the arms of the rake slide; flexible connections whereby water is admitted to the interior of the rake for the purpose of cooling the same; a circulating-tank to which said connections are attached, whereby a constant circulation of water is effected through the rake; and means, substantially as described, for giving a reciprocating motion to the rake.

9. The combination with each hearth of a calcining-furnace, of two hollow metallic channels, one of which is constructed in and forms a part of each side wall of the furnace above each hearth, each with its outer face forming the exclusive support of the walls and roof of the furnace, and each opening throughout its length into the interior of the furnace, above each hearth; a hollow rake, arranged to slide horizontally over each hearth, and provided with suitable hollow teeth, having arms extending through the opening in the metallic channel; rollers in each channel upon which the arms of the rake, moving over the particular hearth with which said channel is connected, slide; flexible connections attached to each rake whereby water is admitted to its interior for the purpose of cooling the same; a circulating-tank to which the connections of each rake are attached, whereby a constant circulation of water is effected through each rake; and means, substantially as described, for giving a simultaneous reciprocating motion to each of the rakes.

10. In a calcining-furnace the combination of a suitable number of hearths two hollow metallic channels for each hearth, constructed in and forming integral parts of the walls of the furnace, each opening throughout its length into the interior of the furnace above each hearth and each exposed upon one of its sides to the outer air throughout its length; rollers contained in the metallic channels, capable of supporting the rakes and on which hollow rods, connected with the rakes, slide; hollow rakes, arranged to slide horizontally over each hearth and be supported by the rollers contained in the metallic channels, and provided with hollow teeth; hollow rods, sliding on the rollers contained in the channels, connected with the rakes at one end and with a source of power at the other end; means for

giving the hollow rods a reciprocating motion; and water connections substantially as described, by which a constant circulation of water is secured through the hollow rods, the
5 rakes and teeth.

In testimony that I claim the foregoing as my invention I have signed my name, in pres-

ence of two witnesses, this 15th day of June, 1897.

WALTER B. DEVEREUX.

Witnesses:

WILLARD PARKER BUTLER,
JOHN FRENCH.