(No Model.) 2 Sheets—Sheet 1.

J. DOUGLAS.

FURNACE FOR CALCINING ORES.

No. 458,102. Patented Aug. 18, 1891.

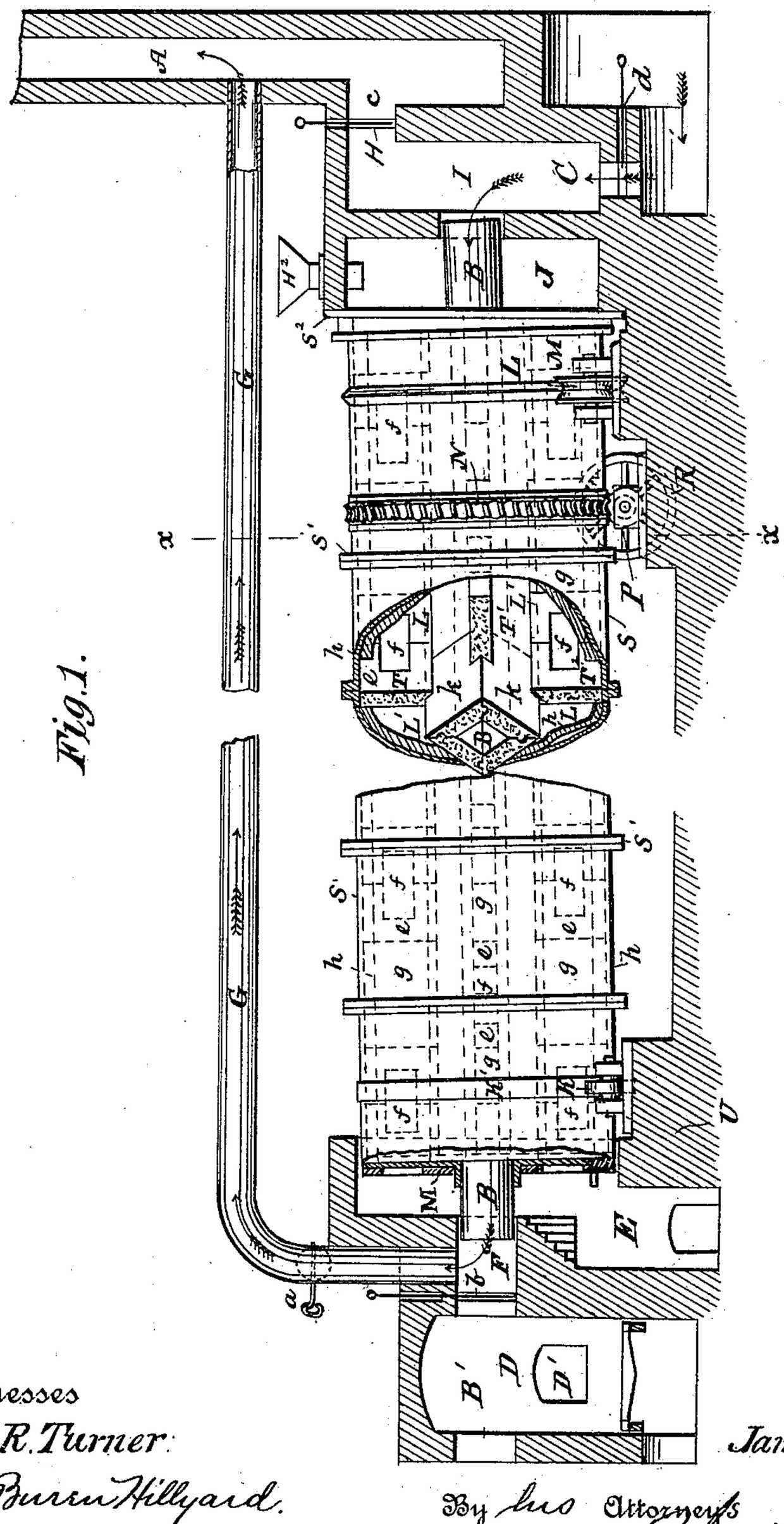

Fig. 1.

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Fig. 2.

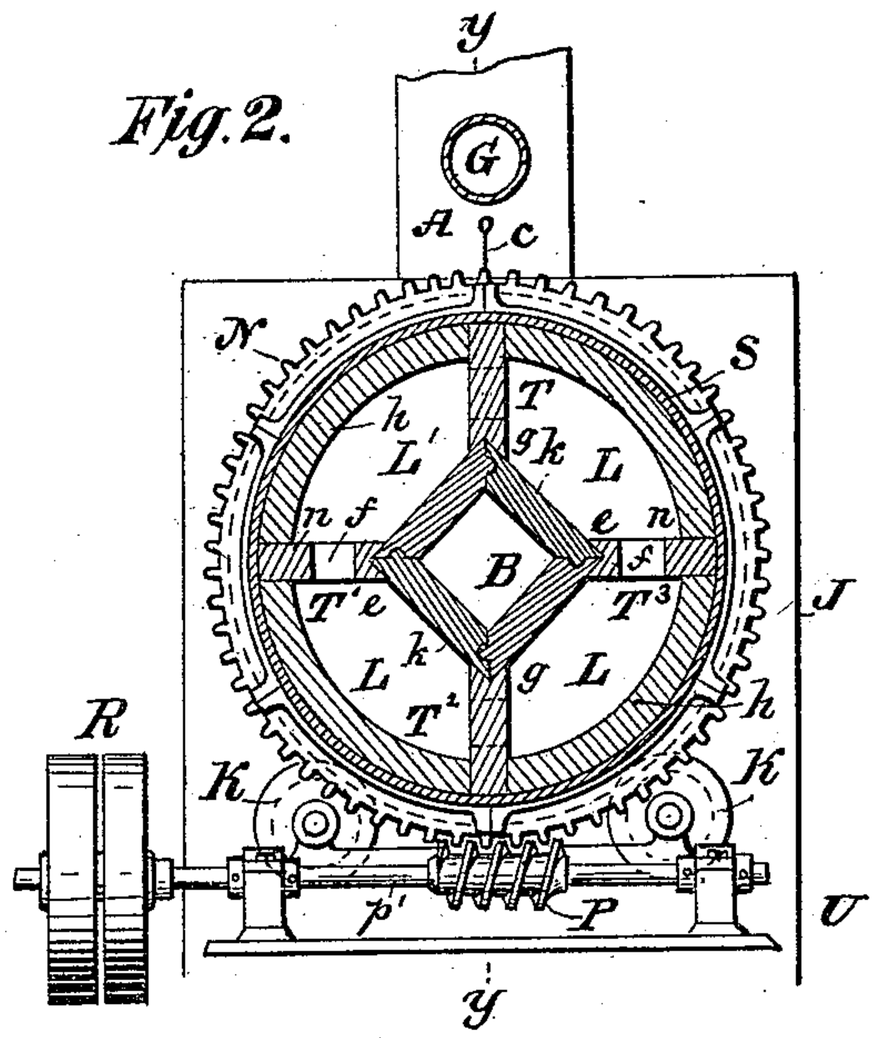
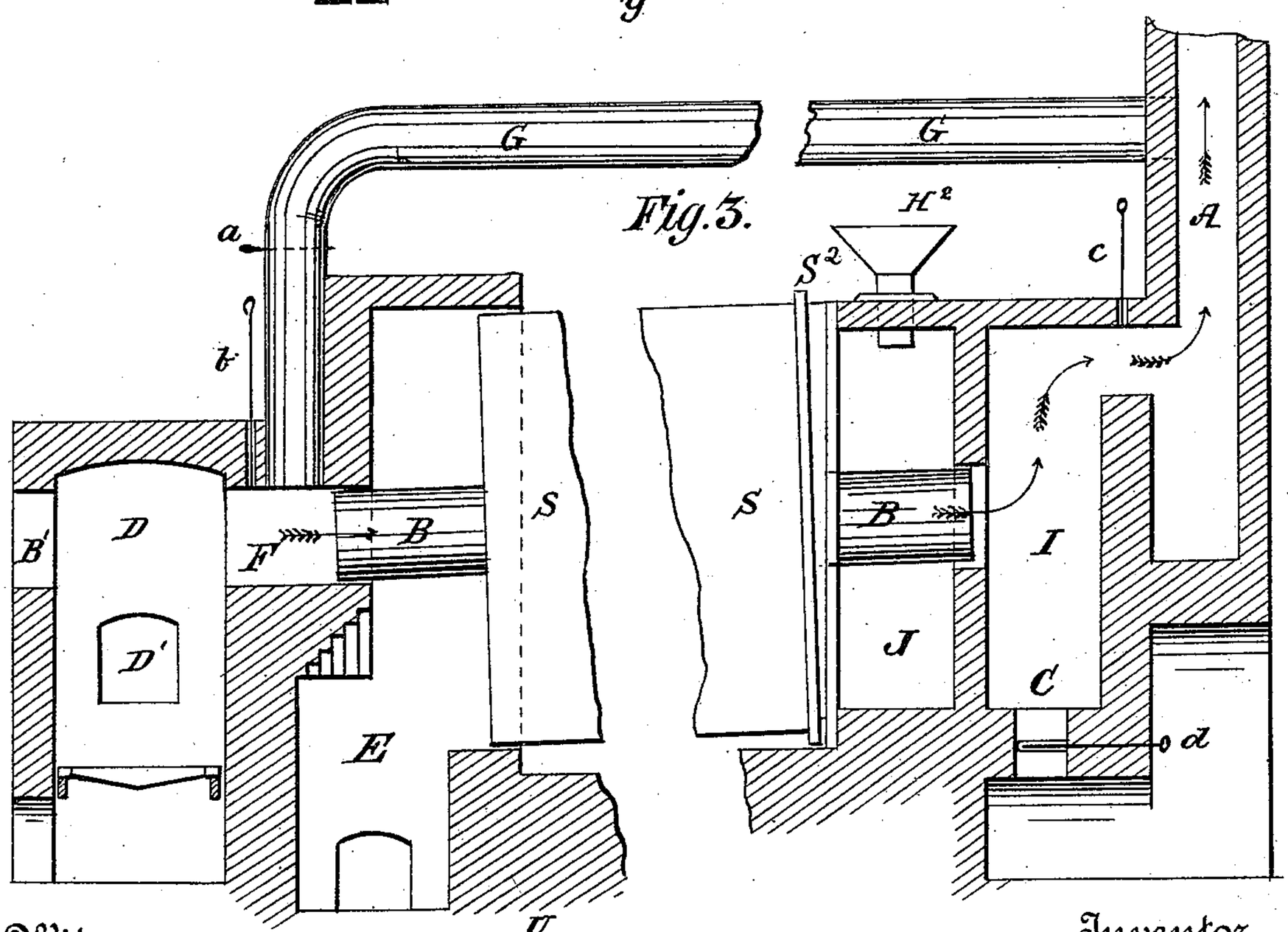


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES DOUGLAS, OF NEW YORK, N. Y.

FURNACE FOR CALCINING ORES.

SPECIFICATION forming part of Letters Patent No. 458,102, dated August 18, 1891.

Application filed February 5, 1890. Serial No. 339,257. (No model.)

To all whom it may concern:

Be it known that I, JAMES DOUGLAS, a citizen of Great Britain, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Furnaces for Calcining Ores; 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 roasting-furnaces which revolve and are provided at the discharge end with a rotating register, by means of which admission of air can be controlled and which receive the ore at one end, the ore traveling through an intensely-heated chamber. The size, formation, and relative arrangement of the roasting-cylinder are immaterial, as it may be conical in shape, in which case the axis is horizontal, and the ore when the cylinder revolves travels from the narrower end to the wider end, or it may consist of a tube with parallel sides and be tilted so as to be higher at the feed than at the discharge end, as shown in the accompanying drawings.

The prime object of this invention is to prevent an excessive heat at the receiving end of the roasting-cylinder and moderate the temperature at such end, the surplus heat being driven to the discharge end of said roasting-cylinder, where it will be of advantage in effecting an oxidation of the last traces of sulphur in the ore. This result is effected by causing a current of cool air to travel through the roasting-cylinder with the ore and in a reverse direction to the current of heated air. The cylinder may be revolved by any well-known mechanism. However, I prefer to revolve it by worm-gearing and to support it on friction-rolls, that nearest the feed end being V-shaped, so that the thrust will be toward the fire-chamber when the furnace expands under the action of the heat.

Another object of the invention is to divide the space between the sides of the cylinder and the sides of the central flue into a series of compartments or muffles by longitudinal partitions, which have openings to permit the ore to pass from one compartment to another, thereby effecting a thorough agitation of the same. The openings in one partition come opposite the solid part between the openings of the adjacent partition, causing the ore to spread and subjecting it to the influence of the heat.

The improvement consists of the novel features which will be hereinafter more fully described and claimed, and which are shown in the accompanying drawings, in which—

Figure 1 is a side view, partly in section and parts being broken away, of a furnace embodying my invention. Fig. 2 is a cross-section on the line X X of Fig. 1, looking to the right. Fig. 3 is a longitudinal section on the line Y Y of Fig. 1, the middle part of the furnace being broken away.

U represents the masonry or brick-work of the furnace, which supports the roasting-cylinder S, which is mounted on rollers K K and M M, the latter being placed at the receiving end of the cylinder and grooved to receive the V-track L.

N is a worm-gear encircling the cylinder, and P is a worm pinion or thread on shaft P′, meshing with gear N; R, a band-pulley on shaft P′, to receive belt, (not shown,) by which shaft P′ and cylinder S are rotated.

It is preferred to line the cylinder with brick. The central flue, which carries the heat from the fire-chamber to the stack and heats the space between it and the cylinder, may be of iron and be supported by cast-iron spiders; but I have found that the best material out of which to construct the central flue is fire-clay tiles, and that the central flue thus built is most conveniently supported and held in position by four partitions, likewise built of tile, if the flue be built square, or by three partitions if the flue be prismatic. One end of the supporting-tiles constituting the partitions is secured by the brick lining *h* of the cylinder, while a V-shaped depression in the other end of the tiles receives the angles of the central flue. A furnace thus constructed would consist of a central flue surrounded by four separate compartments, which, being heated by radiation from the central flue, constitute four muffles. I have found in practice, however, that ore roasts very imperfectly in a furnace thus constructed, as it rolls around the compartments protected by a stratum of dense gas from the action of the air. I therefore

provide the supporting-tiles constituting the partitions with openings of any sufficient size, and I prefer slots, and I so arrange these slots that the ore falling through a slot in one of the tiles of the supporting-partitions shall fall on solid tiles of the partition below or on the lining of the cylinder. I prefer to make the slots longitudinal openings in the center of the tiles, by which means the remaining portions of the tile adjacent to the central flue and that adjacent to the cylinder form lifters and carry around the ore and cause it to fall twice during each revolution of the cylinder.

The method I propose for supporting the central flue and arranging the slots will be better understood from Figs. 1 and 2.

B is a central flue constructed of the tiles *k k k k*. The slots *f f* are so arranged that those in the partitions T′ and T³ will discharge the ore in a sheet on the solid tiles *g* of the partitions T and T². The slots in the partitions T and T² are intermediate in position to those in the partitions T′ and T³. The portion of the tile *n* between the slot and the cylinder and the portion *e* between the slot and the central flue form lifters, from which a shower of ore is discharged twice every revolution of the cylinder. This thorough agitation of the ore in its passage from one compartment to another not only brings it into most intimate contact with the air, but agitates the air itself and prevents gaseous stratification.

A further improvement in my calcining-furnace is the use of a central flue for the purpose of cooling the furnace when calcining an ore very rich in sulphur or other combustible. When roasting such an ore, the combustion is liable to be very intense and the heat too great near the end of the furnace into which the ore is fed, and it is always desirable to increase the heat near the discharge end of the furnace, where, nearly all the sulphur or other oxidizable material having been burned out of the ore, extraneous heat is necessary to oxidize the last traces. Both these desirable objects may be attained by drawing cold air through the air-vent C into the central flue B and through the central flue in a direction opposite to that in which hot air travels from the fire-chamber D through the same flue when ores low in sulphur are being oxidized. The excessive heat at the feed end of the cylinder is lowered by heating the cold air passing through the central flue, and the air thus heated is conveyed to the discharge end of the furnace, where it is required. To reverse the draft and thus draw cold air through the central flue, I connect one end of the central flue B, Figs. 1 and 3, with the outer air by the air-vent C, and connect the other end of the central flue at F with the smoke-stack A by a flue G, which may be buried in the ground or be suspended above ground, as shown in the drawings. It may be of brick, tile, or of wrought or cast iron. The damper *a* controls the draft through the flue G. The damper *b* cuts off the central flue from the fire-chamber D. The damper *d*, when opened, admits cold air through the cold-air vent C, and the damper *c* shuts off all direct draft between the central flue B and the smoke-stack A.

When extraneous heat is required to roast an ore, a fire is maintained in the fire-chamber D, fuel and air being supplied to said chamber by means of the doors B′ and D′. Dampers *b* and *c* are opened and dampers *a* and *d* are closed, by which means heat travels from F to I and thence through the vent C into the smoke-stack A; but when an ore is being roasted, which requires for its calcination no extraneous heat, but, on the contrary, creates by its combustion too great a heat near the feed end of the furnace, I close dampers *b* and *c* and open dampers *d* and *a*. Immediately the draft of the stack A draws cold air through the vent C from I to F through the central flue B and then into the stack A through the flue G.

The discharge end of the cylinder will be provided with a rotating register M, of ordinary construction, which completely controls the rapidity of combustion by regulating the draft, thus aiding the central flue in moderating the heat. The openings in the register may be formed in the most convenient manner.

The ore is supplied to the chamber J by means of the hopper H². The receiving end of the roasting-cylinder is fitted to the flanged ring S², which is secured to the end of the furnace adjacent the receiving end of the said cylinder. The roasted ore is discharged into the receiving-chamber E, which is disposed between the fire-chamber D and the discharge end of the furnace.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A roasting-furnace comprising a fire-chamber and smoke-stack arranged a proper distance apart, a roasting-cylinder between the said fire-chamber and the smoke-stack and having communication at its ends with the said fire-chamber and smoke-stack, respectively, and having a register to control the admission of air to the receiving end of the said cylinder, the flue B, extending through the roasting-cylinder and having communication at its ends, respectively, with the fire-chamber and the smoke-stack, the flue G, connecting the end of the flue B near the fire-chamber with the smoke-stack, the damper *b* for cutting off communication between the fire-chamber and the flue B, the damper *a* in the flue G, the damper *d* for admitting air to the flue B, and the damper *c* for cutting off communication between the roasting-cylinder and the smoke-stack, substantially as described.

2. The herein-described roasting-cylinder, having a series of longitudinal compartments, the partitions forming said compartments

having openings, the openings in one partition being opposite the solid portion between the openings in the adjacent partition, substantially as and for the purpose described.

3. The combination, with the cylinder and the angular draft-flue therethrough, of the longitudinal partitions having V-grooves at their inner edges to receive the corners of the said draft-flue and having their outer edges secured to the cylinder, substantially as described.

4. The combination, with the cylinder lined with tiles and the angular draft-flue of tiling, of the longitudinal partitions having V-grooves at their inner edges to recieve the corners of the said draft-flue and having their outer edges fitted in between the tiles lining the said cylinder, substantially as set forth.

5. The hereinbefore-specified calcining-furnace, comprising a revolving cylinder, a central draft-flue through said cylinder communicating at the receiving end of the cylinder with the stack and cold-air pipe and at the discharge end of the cylinder with the fire-chamber and with the said stack, the dampers *b* and *c* for shutting off communication between the fire-chamber, stack, and said draft-flue, and the dampers *a* and *d* for effecting communication between the draft-flue, stack, and cold-air pipe, substantially as and for the purpose described.

6. The combination, with the roasting-cylinder and the draft-flue passing through the said cylinder and having communication at the receiving end of the cylinder with a cold-air pipe, of a rotating register at the discharge end of the cylinder, substantially as and for the purpose described.

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

JAMES DOUGLAS.

Witnesses:

WALTER CHANDLER,

JOHN B. KING.