No. 652,346. Patented June 26, 1900.

A. A. CHAINEY.

ORE ROASTING FURNACE.

(Application filed Sept. 8, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

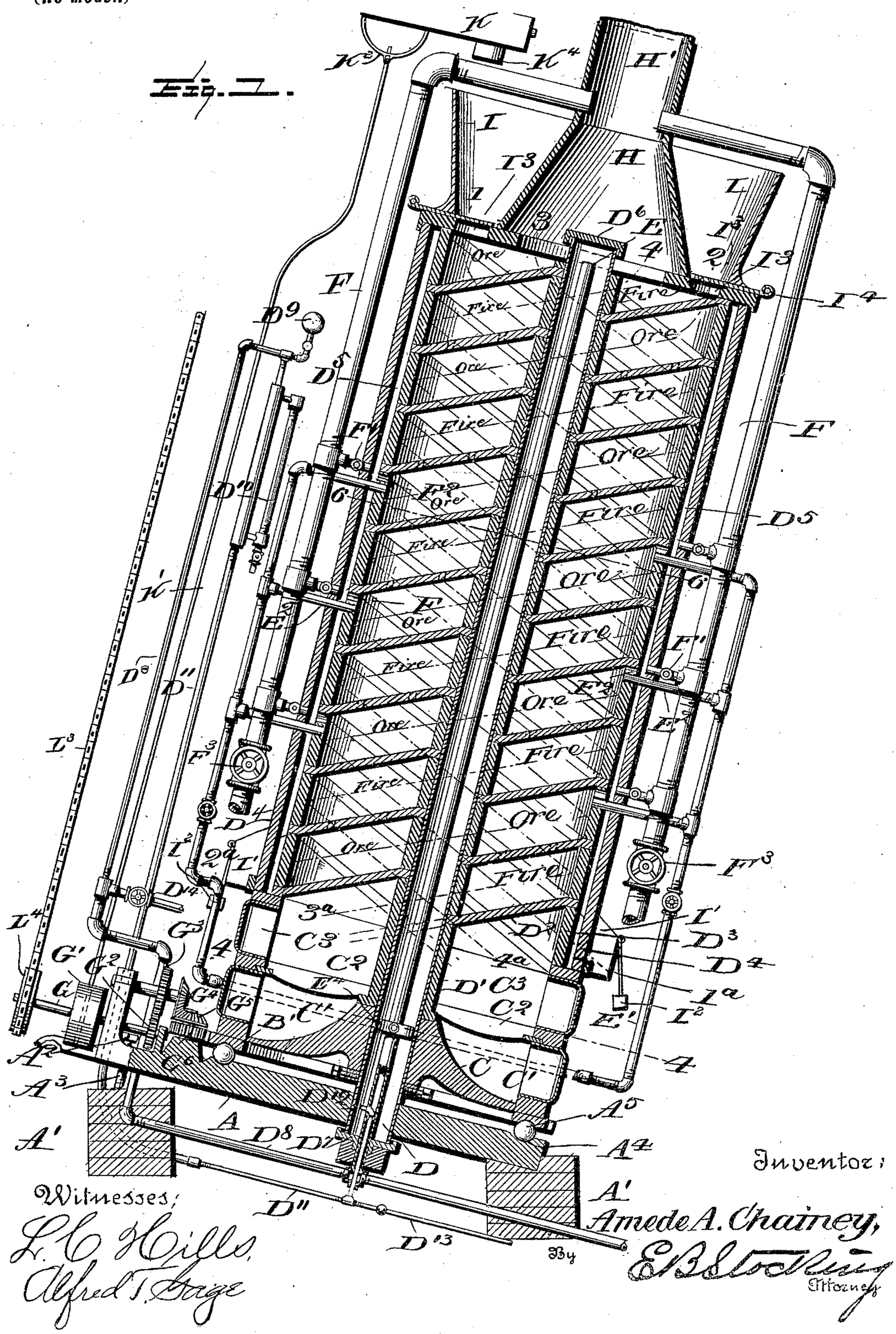

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Fig. 2.

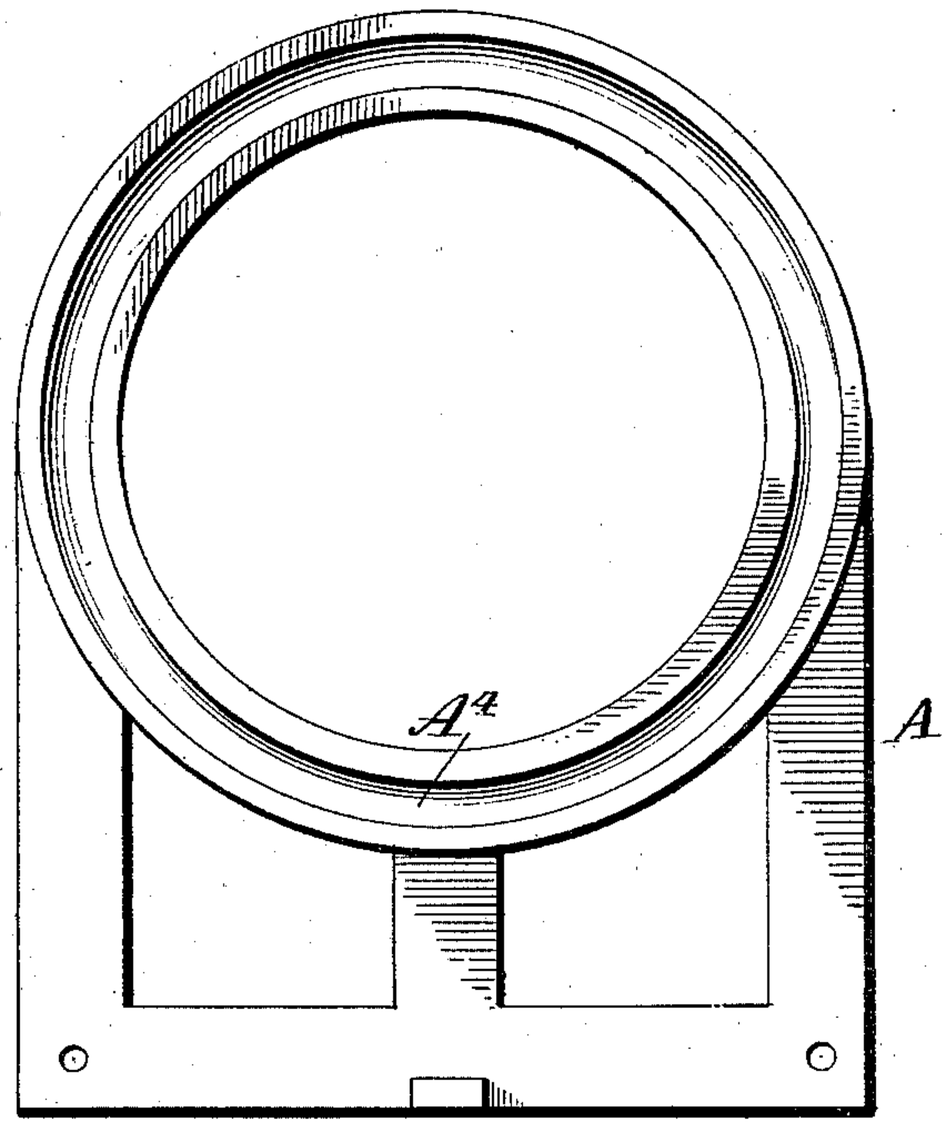

Fig. 3.

Fig. 4.

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Fig. 5.

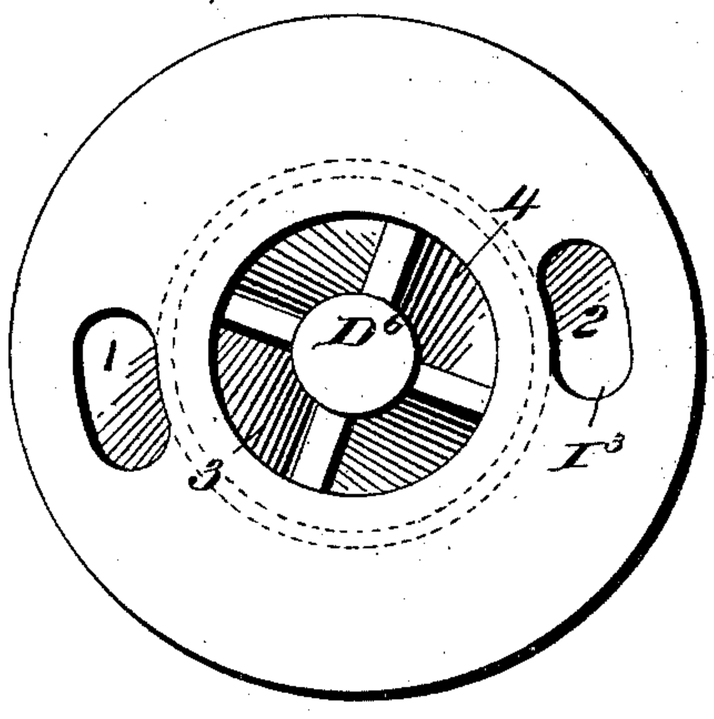


Fig. 6.

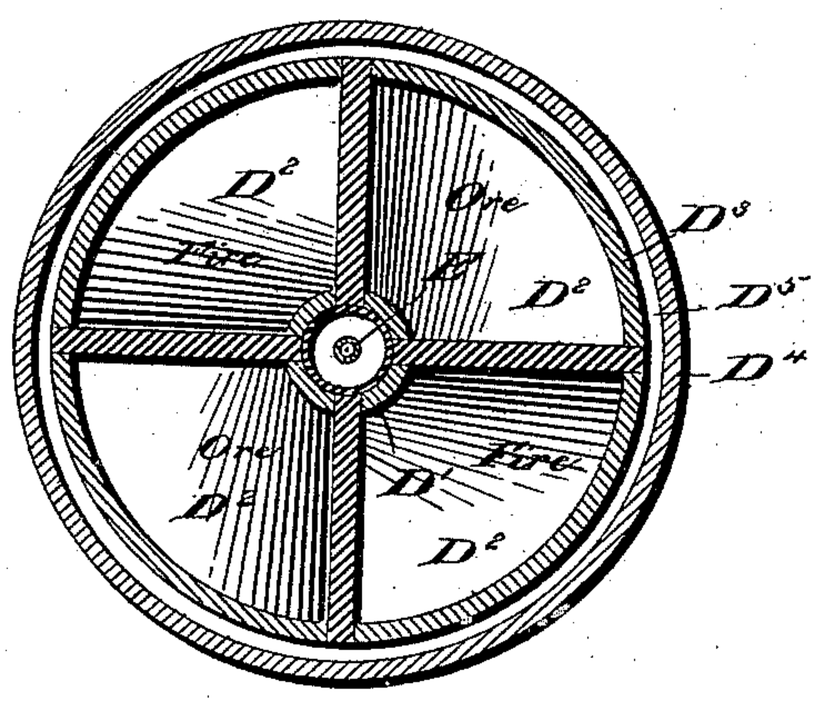


Fig. 7.

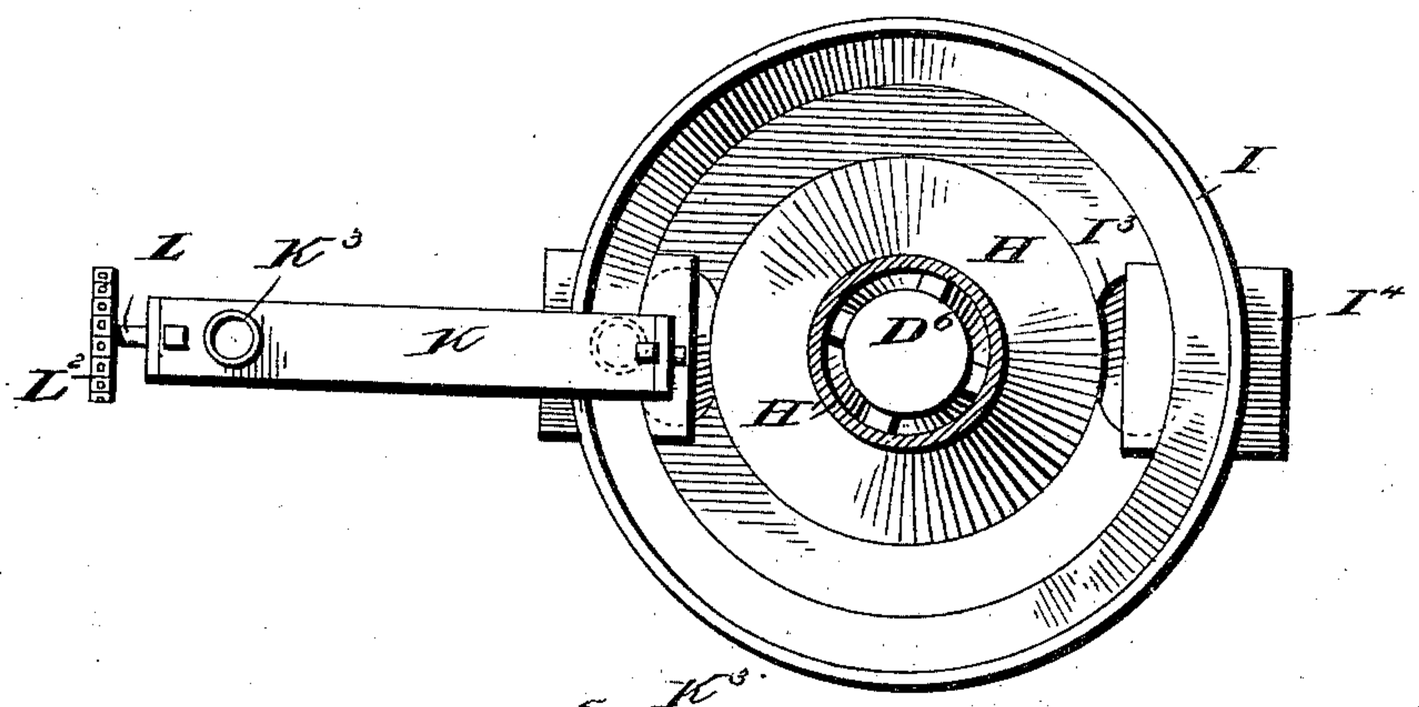
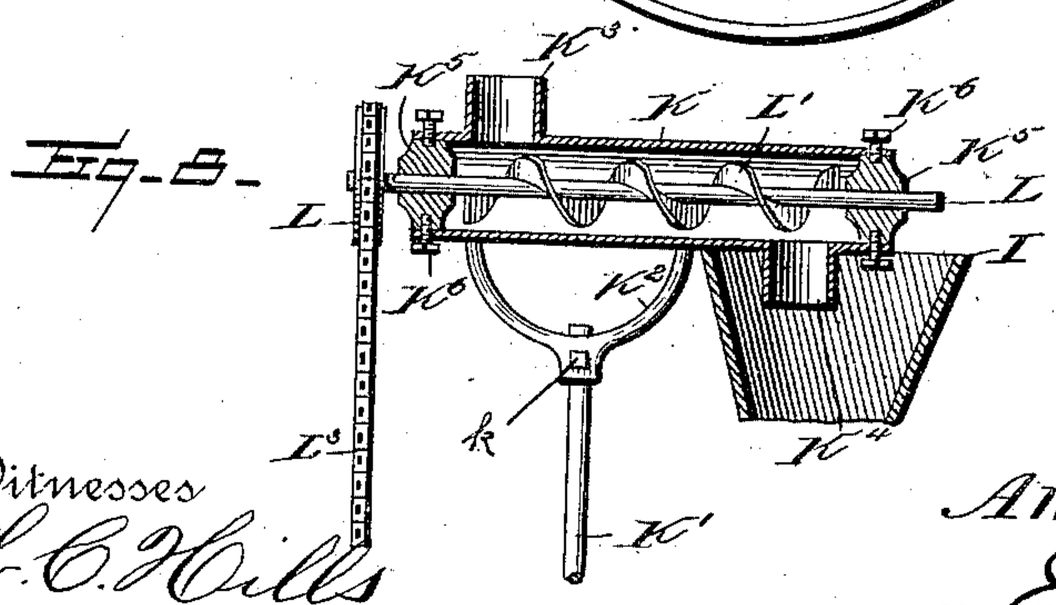


Fig. 8.



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UNITED STATES PATENT OFFICE.

AMEDE A. CHAINEY, OF SANFORD, MAINE, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO HENRY H. GREEN, OF SAME PLACE, ANDREW D. ROSS, OF SUNSHINE, COLORADO, AND CLINTON D. BOUTON, OF ITHACA, AND WILLIAM H. MARLAND, OF BINGHAMTON, NEW YORK.

ORE-ROASTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 652,346, dated June 26, 1900.

Application filed September 8, 1899. Serial No. 729,851. (No model.)

To all whom it may concern:

Be it known that I, AMEDE A. CHAINEY, a citizen of the United States, residing at Sanford, in the county of York, State of Maine, have invented certain new and useful Improvements in Ore-Roasting Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an ore-roasting furnace, and particularly to a device in which the ore traverses an inclined path and is subjected to the heat from the products of combustion during such travel.

The invention has for an object to provide a structure involving a vertically-disposed spiral way and a spiral heating-chamber extending parallel with said way.

A further object of the invention is to provide a steam-generating apparatus for operating a motor to rotate the furnace and for supplying steam or moisture to the ore during treatment.

Another object of the invention is to remove from the ore-chamber the liberated gases or fumes and to conduct them to a point of discharge.

The invention further consists in an improved construction, combination, and arrangement of parts by which the ore is continuously fed and removed from the furnace.

Other objects and advantages of the invention will hereinafter appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 represents a vertical section through the furnace. Fig. 2 is a plan of the base-block. Fig. 3 is a bottom view of the driving-gear. Fig. 4 is a cross-section on the line 4 4 of Fig. 1. Fig. 5 is a top view with the hopper removed. Fig. 6 is a section on the line 6 6 of Fig. 1 through the spiral paths. Fig. 7 is a top view of the furnace, and Fig. 8 is a vertical section through the feeding-conveyer.

Like letters and numerals of reference indicate like parts throughout the several figures of the drawings.

The letter A represents a base-plate, which is supported upon piers A' and may be adjusted in relation thereto by means of a set-screw A^2, passing through the base-plate and bearing upon a block A^3. This base is adapted to carry the driving apparatus and is also provided with a grooved way A^4, in which bearing-balls A^5 may operate. At the base of the cylindrical body B of the furnace a gear-plate B' is provided, with a circumferential way or groove B^2, in which the walls A^5 may travel. The periphery of this plate has thereon cog-teeth B^3, adapted to mesh with the driving-gear.

Above the driving-ring B' a casting C is provided, which forms the bottom of the ash-pit C', and resting upon suitable lugs are grate-bars C^2, forming fire-box C^3 at the base of the spiral ways. Extending centrally of the cylinder B is a pipe D, surrounded upon its outer face by a refractory casing D', which supports the spiral ways D^2, extending outwardly from the same to the outer refractory shell D^3. Beyond this shell is an outer casing D^4, spaced therefrom to form a chamber D^5 for a purpose to be hereinafter set forth. The pipe D may be secured to the ring B' by set-screws B^4, as shown in Fig. 3.

The upper end of the pipe D is provided with a suitable cap D^6, and into the upper portion of said pipe a steam-conducting pipe E is extended. This steam-pipe is not rotatable with the furnace and passes through a packing-box D^7 at the lower end of the pipe D, where it connects with a suitable conducting-pipe D^8, extending upward to a steam-gage D^9 and connected to a water column and gage D^{10}. A water-conducting pipe D^{11} extends from the lower end of this gage upward through the steam-pipe E into the lower portion of the pipe, as shown at D^{12}. By this means the water-level within the pipe will be indicated upon the column or gage D^{10}. For the purpose of supplying feed-water to the pipe a suitable pipe D^{13} extends to any source of supply, while valved branches D^{14} are applied to the steam-pipe for conveying the power to any suitable engine for rotating the furnace or supplying the steam to the ore-

chamber. For this latter purpose a feed-pipe E′ may be connected in any suitable way with the source of steam-supply—for instance, by a rotating collar E^4 on the pipe E and connected with the pipe E′—and the steam or moisture introduced into the ore-chamber through an inlet-pipe E^2, which may be provided with suitable valves to regulate the amount of steam entering the said chamber.

For the purpose of withdrawing or removing the gases or fumes liberated from the ore I have provided a discharge-pipe F, which is connected with the space between the refractory shell and the outer case by means of a lateral valved branch F′. This space D^5 permits the collection of the gases from the ore by reason of the openings F^2 through the refractory shell D^3, so that at all times the sulfur-gases may be removed and discharged at any suitable point. The lower ends of these pipes F are provided with air-inlet valves F^3, which regulate the draft or amount of air entering said pipes.

The furnace is mounted at an angle of about ten degrees from a vertical line, which disposes the spiral ways in such position that the ore lies flat thereon during one portion of the rotation of the cylinder and in the further movement is dropped at an angle to thoroughly agitate and expose all portions of the same to the heating influence. It will be obvious that the cylinder B may be rotated by any suitable means; but for the purpose of illustration I have shown a driving-shaft G, provided with a band-wheel G′ and carrying at its inner end a gear G^2, which meshes with a similar gear G^3, upon the shaft of which a pinion G^4 is secured. This pinion meshes in turn with a similar pinion or beveled gear G^5, upon the shaft of which a driving-pinion G^6 is carried and meshes with the periphery gear-teeth A^5 upon the driving-ring.

By reference to Figs. 1 and 6 it will be seen that there are four spiral ways, which extend parallel with each other, and two of which are for the reception of ore, while the remaining two communicate with the fire-box. This disposition of the spiral ways places a fire-flue upon each side of the ore-flue. For convenience in considering these flues the ore-flues have been numbered 1 and 2, and by following the dotted line leading downward from the entrance of flue 1 it will be seen that the same discharges at the side of the machine at 1^a, while the flue 2 discharges at 2^a. The fire-flues communicating with the annular fire-box and the stack H are numbered 3 and 4 and terminate within the fire-box at the points 3^a and 4^a after traversing the course shown by dotted lines. The discharge-chutes 1^a and 2^a are closed by doors I′, having weights I^2 to open and close the doors in the rotation of the cylinder. By this structure and arrangement of flues the ore is heated both from above and below and a more even temperature thereby maintained, which greatly facilitates the oxidation operation in the treatment of ores.

For the purpose of feeding the ore to the flue a hopper I is constructed around the base of the stack H and is carried with the cylinder, so that in the rotation of the cylinder the openings I^3 in the head thereof will be fed and the two ore-flues receive and discharge simultaneously. The amount of this charge may be suitably regulated by means of a suitable slide-valve I^4, disposed above the opening I^3 in the head of the cylinder. The stack H may be extended upward, as at H′, to any desired extent to carry the products of combustion to a desired elevation, and the steam and water pipes may be provided with any of the usual valves for the regulation of the fluids passing therethrough.

For the purpose of feeding ore to the hopper I have provided a conveyer K, which is adjusted at the upper end of the rod K′. This adjustment is effected by means of a yoke K^2, which may be rotated upon the rod or standard K′ and adjusted vertically thereon and held in any desired manner—for instance, by a set-screw *k*. The conveyer-casing K is provided with an inlet K^3 and an outlet K^4, discharging into the hopper I, and at each end of the casing bearing-blocks K^5 are adjustably secured by means of set-screws K^6. Journaled in these blocks is a shaft L, having thereon a spiral blade L′, adapted to feed the material from one end of the conveyer-casing to the other. This shaft is driven by means of a sprocket-gear L^2 upon its end and a driving-chain L^3, extending downward to a gear L^4, located upon the outer end of the main driving-shaft G of the machine. The speed of rotation imparted to the spiral L′ will determine the amount of material fed to the hopper within a predetermined time, and the action of the machine can thus be effectually controlled.

In the operation of the furnace it will be seen that the ore resting in the hopper will be partially dried by the heat from the base of the stack H and passes thence into the flues 1 and 2, where it is suitably heated or roasted to liberate therefrom the desired chemical gases or bodies, after which it may be discharged at the points 1^a and 2^a in a proper roasted condition. The structure of the pipe within the cylinder provides an economical method of generating the necessary steam to operate or rotate the furnace and to supply moisture or oxygen to the ore when desired. The angular disposition of the furnace causes the ore to be shifted constantly, and thus all portions thereof are exposed to the heat, and the automatic action of the machine is such that the same can be run by a less number of men than is ordinarily necessary to operate a roaster. The gases liberated from the ore are drawn off at once, and thus all danger of a recombination with the ore prevented.

If found desirable in the operation of the furnace, the floor of the fire-flue or spiral

forming the top of the ore-flue may be provided with apertures, as shown by dotted lines in Fig. 1, which permit the gas or sulfur fumes liberated from the ore to pass into the fire-flue and be conveyed to the stack by the products of combustion. It will be seen that this structure may be used in connection with the discharge-pipes F or independent thereof, as found desirable or necessary in connection with the character of ore treated by the furnace—that is, if the ore should contain a very large amount of substances to be driven off by heat the apertures can be used in connection with the discharge-pipes.

It will be obvious that changes may be made in the various details of construction and attachments to the furnace and that the pipe and other auxiliary devices might be omitted without departing from the spirit of the invention as defined by the appended claims.

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

1. In a roasting-furnace, the combination with a cylinder provided with ore feeding and discharging means and heat-producing means, of a spirally-disposed ore-flue within said cylinder, a fire-flue parallel with said ore-flue, and means for rotating said cylinder; substantially as specified.

2. In a roasting-furnace, the combination of a cylinder provided with ore-feeding means, a spirally-disposed ore-flue within said cylinder, a fire-flue parallel to said ore-flue, means for rotating said cylinder, a fire-box communicating with said fire-flue, and a discharge-outlet communicating with the ore-flue; substantially as specified.

3. In a roasting-furnace, the combination of a cylinder provided with ore-feeding means, a spirally-disposed ore-flue within said cylinder, a fire-flue parallel to said ore-flue, means for rotating said cylinder, a fire-box communicating with said fire-flue, a discharge-outlet communicating with the ore-flue, and means for conducting the liberated gases from the ore within the ore-flue; substantially as specified.

4. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, a spirally-disposed ore-flue within said cylinder, fire-flues parallel with said ore-flue upon opposite sides thereof, and means for rotating said cylinder; substantially as specified.

5. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, a pipe centrally disposed within the cylinder, inclined partitions parallel with each other constituting ore and fire flues extending between said pipe and cylinder, and means for rotating said cylinder; substantially as specified.

6. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, a pipe centrally disposed within the cylinder, inclined partitions parallel with each other constituting ore and fire flues extending between said pipe and cylinder, means for rotating said cylinder, a steam-discharge pipe extending to the upper portion of said pipe, and means for feeding water to said pipe; substantially as specified.

7. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, a pipe centrally disposed within the cylinder, inclined partitions parallel with each other constituting an ore and a fire flue extending between said pipe and cylinder, means for rotating said cylinder, a steam-discharge pipe extending to the upper portion of said pipe, means for feeding water to said pipe, and means for introducing steam into said ore-flue; substantially as specified.

8. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, a pipe centrally disposed within the cylinder, inclined partitions parallel with each other constituting an ore and a fire flue extending between said pipe and cylinder, means for rotating said cylinder, a steam-discharge pipe extending to the upper portion of said pipe, means for feeding water to said pipe, means for introducing steam into said ore-flue, and means for conducting liberated gases from said ore-flue; substantially as specified.

9. In a roasting-furnace, the combination of a cylinder provided with ore-discharging means, heat-producing means, a pipe centrally disposed within the cylinder, inclined partitions parallel with each other constituting an ore and a fire flue extending between said pipe and cylinder, means for rotating said cylinder, a steam-discharge pipe extending to the upper portion of said pipe, means for feeding water to said pipe, means for introducing steam into said ore-flue, means for conducting liberated gases from said ore-flue, and a feed-hopper arranged to discharge into said ore-flue; substantially as specified.

10. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, a base-plate provided with an annular groove, a driving-ring provided with an annular groove, bearing-balls between said base and ring, a stack at the central portion of said cylinder, inclined ways parallel with each other extending from the upper to the lower portion of said cylinder, one of which communicates with said fire-box and stack and another with said feed and discharge means for the ore, and means for rotating said ring; substantially as specified.

11. In a roasting-furnace, the combination of a cylinder provided with ore feeding and discharging means, heat-producing means, parallel ore and fire flues spirally disposed within said cylinder and having openings extending through the walls of said flues, an

outer closed shell spaced from the walls of said cylinder, and a conducting-pipe communicating with the space between said shell and cylinder for conducting gases therefrom; substantially as specified.

12. In an ore-roasting furnace, the combination of a cylinder mounted in a substantially-vertical position and provided with ore feeding and discharging means, heat-producing means, parallel ore and fire flues spirally disposed within said cylinder, and means for rotating said cylinder; substantially as specified.

13. In a roasting-furnace, a substantially-vertical cylinder provided with parallel spirally-inclined ore and fire flues, means for rotating said cylinder, a hopper at the upper portion of said cylinder communicating with said ore-flue, a feeding-conveyer adapted to discharge into said hopper, discharging means for said ore, and heat-producing means; substantially as specified.

14. In a roasting-furnace, a substantially-vertical cylinder provided with spirally-disposed ore and fire flues, means for rotating said cylinder, an annular hopper at the upper portion thereof communicating with said ore-flue, heat-producing means, discharging means for said ore and fire flues, and an adjustable feeding-conveyer arranged to discharge into said hopper; substantially as specified.

15. In a roasting-furnace, a cylinder provided with a central pipe, a refractory casing around said pipe an outer refractory shell, a series of parallel ore and fire flues supported by said casing and shell, a hopper communicating with said ore-flues, a centrally-disposed stack communicating with said fire-flues, means for rotating said cylinder, and means for discharging ore from said flues; substantially as specified.

16. In a roasting-furnace, a cylinder provided with a central pipe, a refractory casing around said pipe, an outer refractory shell, a series of parallel ore and fire flues supported by said casing and shell, a hopper communicating with said ore-flues, a centrally-disposed stack communicating with said fire-flues, means for rotating said cylinder, valves for controlling the feed from said hopper, and an outlet adapted to discharge the ore from said ore-flues during a portion of the rotation thereof; substantially as specified.

17. In a roasting-furnace, the combination of a substantially-vertical rotating cylinder having a feed-hopper thereon, parallel spiral ore and fire flues within said cylinder, a feed-conveyer supported above said hopper, means for adjusting said conveyer, means for driving the same, discharging means for ore and fire flues, and means for rotating said cylinder; substantially as specified.

18. In a roasting-furnace, the combination of a cylinder, a central support therein, parallel spiral ore and fire flues extending from said support to a wall of the cylinder, an annular fire-box at the base of said fire-flues and communicating therewith, a peripheral discharge communicating with said ore-flues, means for feeding ore and means for rotating said cylinder; substantially as specified.

19. In an ore-roasting furnace, the combination of a substantially-vertical cylinder, a driving-ring supporting said cylinder and provided with peripheral gear-teeth, a centrally-disposed pipe extending upwardly through said cylinder, clamping-screws carried by the hub of said ring to engage said pipe, driving mechanism engaging the peripheral teeth of said ring, parallel ore and fire flues within said cylinder, feed and discharge means for said ore, and heat-producing means; substantially as specified.

20. In an ore-roasting furnace, the combination of a rotating cylinder provided with a series of parallel spiral ore and fire flues, a top plate for said cylinder having a central aperture above and communicating with said fire-flue and an ore-feeding aperture above and communicating with said ore-flues, a stack inclosing said central aperture, an annular hopper surrounding said stack, discharge means for said ore and fire flues, and heat-producing means; substantially as specified.

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

AMEDE A. CHAINEY.

Witnesses:

WILLIAM H. MARLAND,

JAMES E. DEWEY.