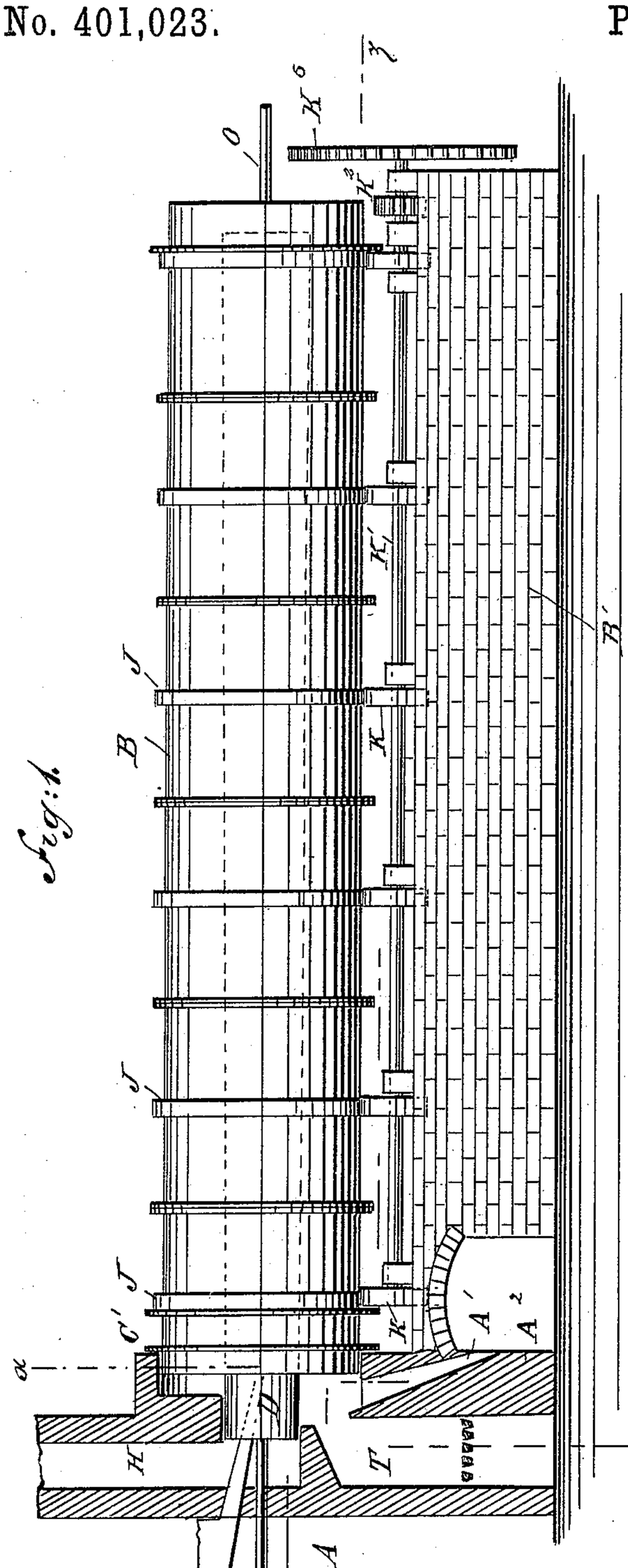
(No Model.) 3 Sheets—Sheet 1.

C. J. FENDEL.

ORE ROASTER.

No. 401,023. Patented Apr. 9, 1889.



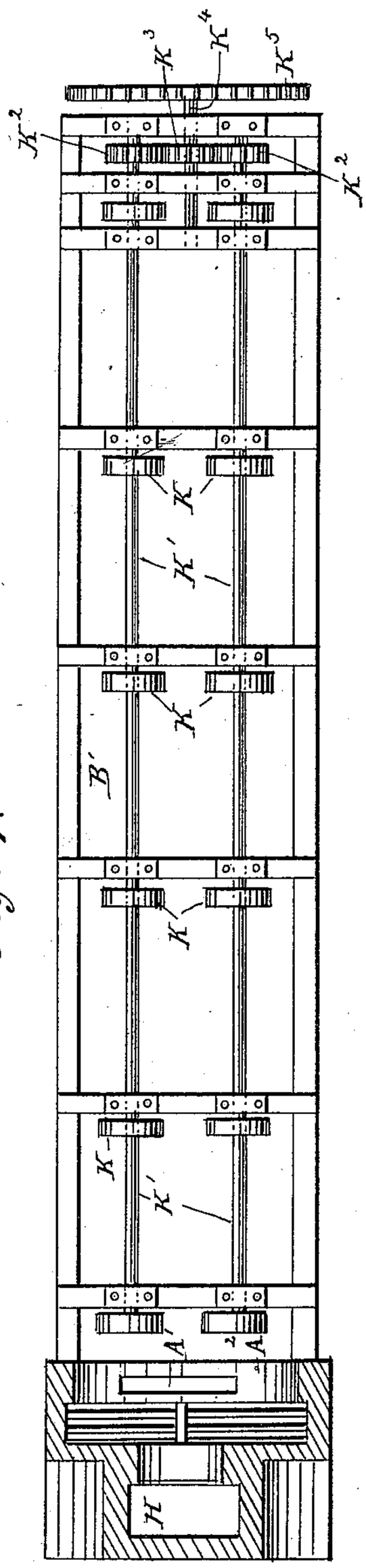
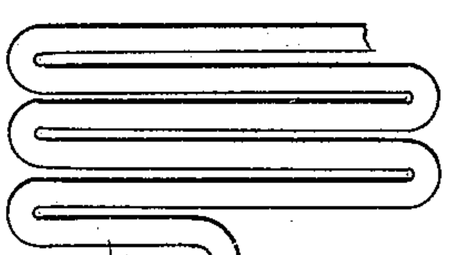


Fig. 4.



WITNESSES:

Chas. Nida

C. Sedgwick

INVENTOR:

C. J. Fendel

BY Munn & Co

ATTORNEYS.

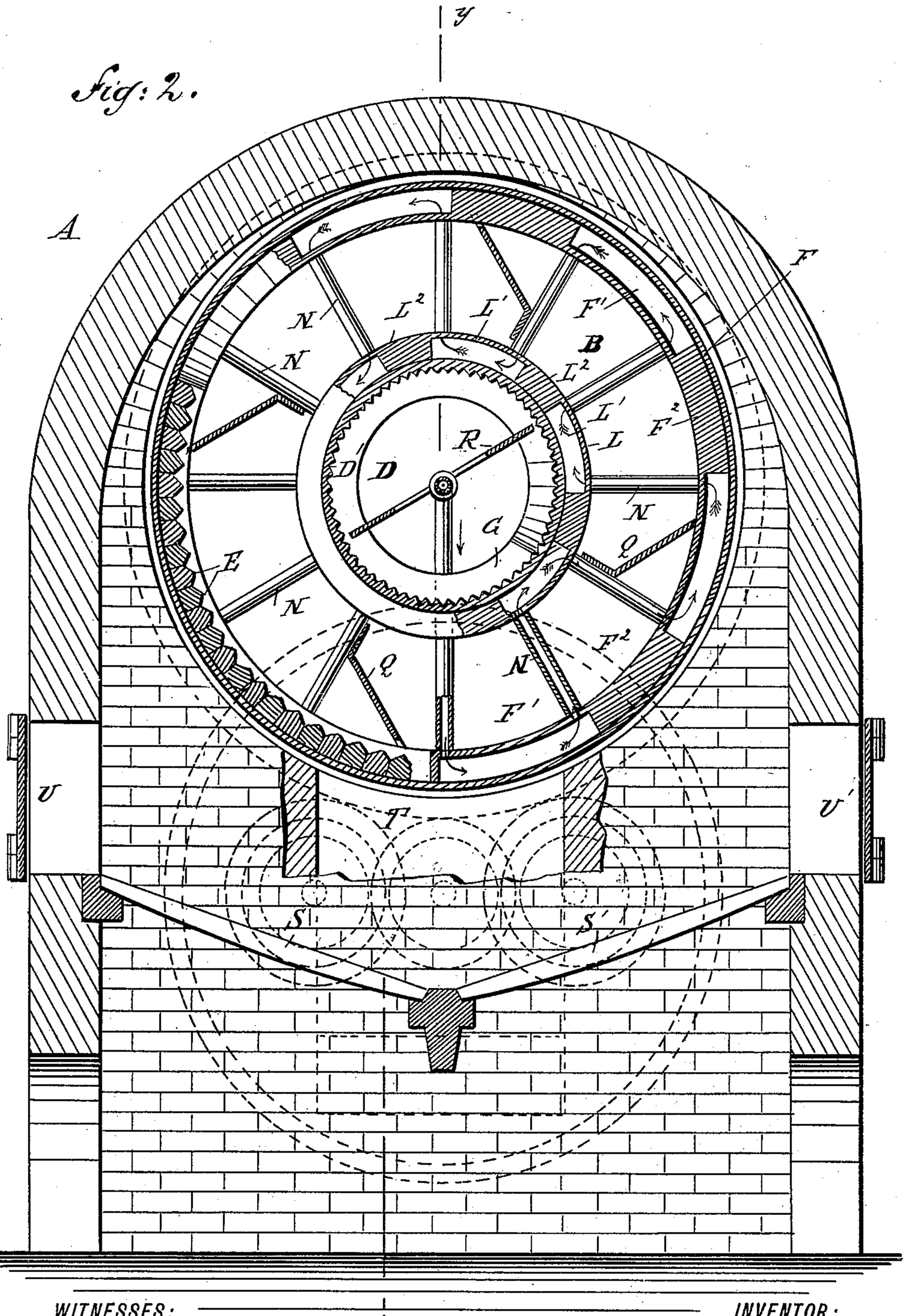
(No Model.) 3 Sheets—Sheet 2.

C. J. FENDEL.

ORE ROASTER.

No. 401,023. Patented Apr. 9, 1889.

Fig: 2.



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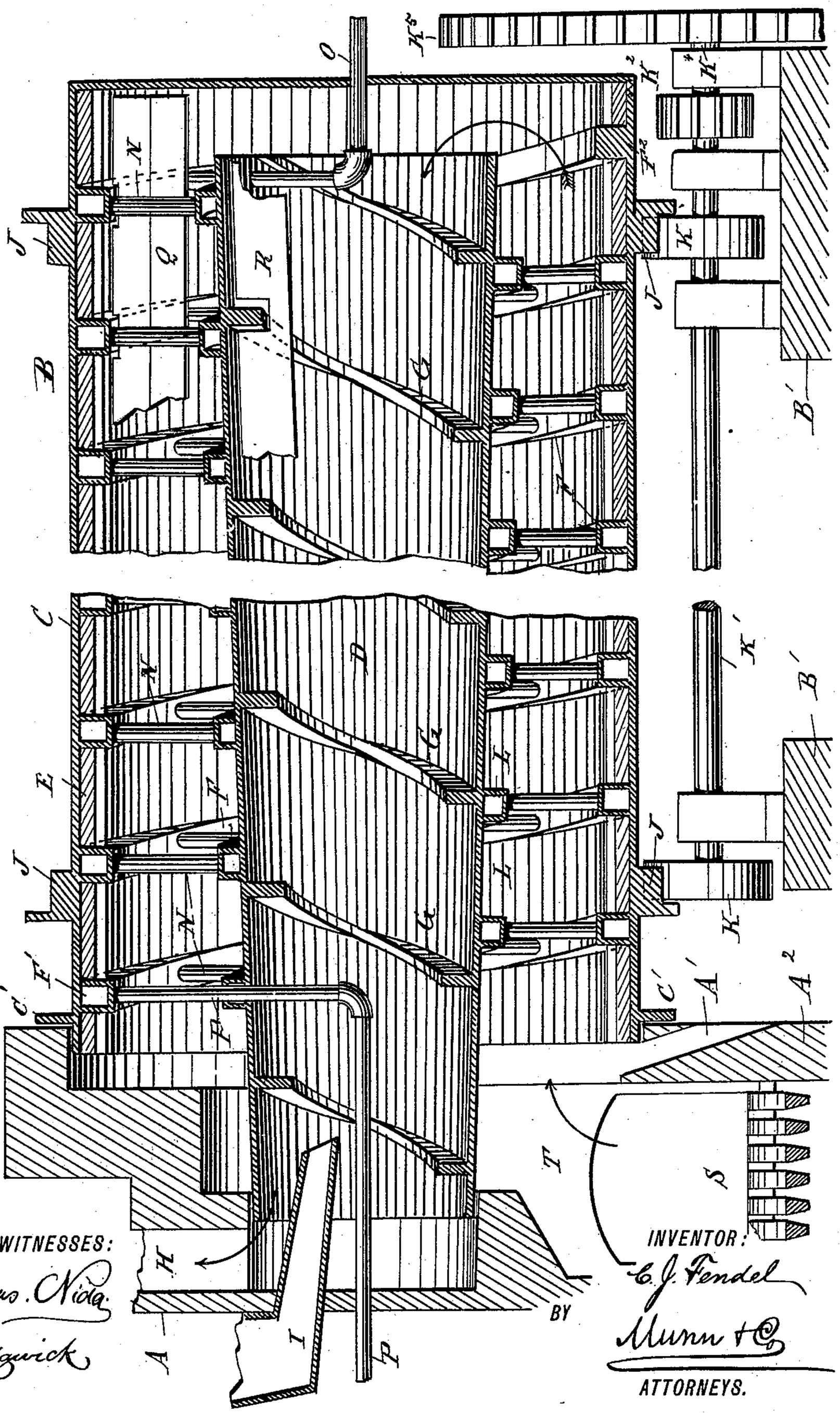
(No Model.) 3 Sheets—Sheet 3.

C. J. FENDEL.

ORE ROASTER.

No. 401,023. Patented Apr. 9, 1889.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

CHARLES J. FENDEL, OF ANACONDA, MONTANA TERRITORY.

ORE-ROASTER.

SPECIFICATION forming part of Letters Patent No. 401,023, dated April 9, 1889.

Application filed October 11, 1888. Serial No. 287,790. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. FENDEL, of Anaconda, in the county of Deer Lodge and Territory of Montana, have invented a new and Improved Ore-Roaster, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved ore-roaster which is simple and durable in construction and very effective in operation, roasting or calcining the most refractory ores with little fuel and a great saving of labor.

The invention consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the improvement with the furnace in section. Fig. 2 is an enlarged sectional end elevation of the same on the line *x x* of Fig. 1. Fig. 3 is a longitudinal section of the same on the line *y y* of Fig. 2, parts being broken out. Fig. 4 is a sectional plan view of the bed of the improvement on the line *z z* of Fig. 1, and Fig. 5 is a side elevation of a coil of pipe used in connection with the improvement.

The improved ore-roaster consists, principally, of the furnace A and the drum B, mounted to rotate and heated by the furnace A. The drum B is provided with an outer cylinder, C, which incloses an inner conical cylinder, D, extending at its small end into the furnace A and at its large end reaching to within a short distance of the outer end of the outer cylinder, C. The inner surface of the outer cylinder, C, is lined with fire-brick E, having V-shaped tops, as is plainly illustrated in Fig. 2, so that the ore passing through the said cylinder is broken up and prevented from forming balls. The inner surface of the conical cylinder D is provided with V-shaped ridges D′, formed directly in the metal of which the cylinder D is made.

In the interior of the outer cylinder, C, is formed a spiral, F, extending throughout the length of the cylinder, and in the interior of the inner cylinder, D, is formed a spiral, G, also extending from one end of the cylinder to the other, but running in an opposite direction to the spiral F. The pitch of the spiral G is about twice as great as the pitch of the spiral F, to compensate for the larger diameter of the said spiral F.

The inner small end of the conical cylinder D opens into the flue H of the furnace A, and into this small end discharges a spout, I, passing through the wall of the furnace A, and serving to introduce the green ore into the roaster—that is, into the small end of the conical cylinder D. Now when the drum B is rotated the spiral G causes the ore to travel outward to the end of the cylinder D and then fall into the cylinder C, which, by its spiral F, causes the ore to travel inward, to be finally discharged at the inner end of the cylinder C into a slot, A′, formed in the inner wall, A^2, of the furnace A. The slot A′ leads to the outside of the furnace.

On the outside of the outer cylinder, C, are formed a number of flanged rings, J, resting on friction-pulleys K, secured on the shafts K′, mounted to turn in suitable bearings formed in the bed B′, extending outward from the furnace A in line with the drum B. On the outer end of each shaft K′ is secured a gear-wheel, K^2, which meshes into the gear-wheel K^3, secured to the main driving-shaft K^4, carrying a gear-wheel or pulley, K^5, receiving a rotary motion from suitable means. Thus when the pulley or gear-wheel K^5 is rotated it rotates the shaft K^4 and imparts a like rotary motion to the shafts K′, which, by their friction-pulleys K, rotate the drum B.

On the outside of the conical cylinder D is formed a spiral, L, running in line with the spiral F, as is plainly shown in Fig. 3. The spiral F is formed of alternate hollow and solid sections F′ and F^2, and the spiral L is formed of similar alternate hollow and solid sections L′ and L^2; but a hollow section, F′, of the spiral F is radially in line with a solid section, L^2, of the spiral L, and the solid section F^2 of the spiral F is radially in line with the hollow section L′ of the spiral L. (See Fig. 2.)

The spirals L and F are connected with

each other by hollow radial spokes N, arranged in such a manner that the end of one spoke opens into one end of a hollow section, F′, of the spiral F, and the other end of the said spoke opens into one end of the corresponding hollow section, L′, of the spiral L, so that the several succeeding hollow sections F′ and L′ in the spirals F and L are in communication with each other, as plainly shown in Fig. 2. The last spoke N, between the cylinders C and D, is connected with a pipe, O, connected with a suitable source of water-supply, and the innermost hollow section, F′, of the spiral F is connected with a pipe, P, extending centrally through the cylinder D and out through the wall of the furnace A. Now when water is passed through the pipe O it passes through the spokes N and from one hollow section F′ of the spiral F to the next following section L′ of the spiral L, and then into the next following hollow section F′ of the spiral F, and so on, from one hollow section in one spiral to the other hollow section in the other spiral until the water finally passes into the pipe P and out of the same. The water thus passing through the spirals F and L serves to cool spokes N, so as to keep them cool and from burning, and thus be able to sustain the weight of inner conical cylinder, D. Air might be forced through and serve the same purpose, but water will be best.

In order to elevate the ore to a certain height in the cylinder C, I provide the latter with the angular longitudinal strips Q, secured to the spokes N and extending at their outer ends to within a short distance of the spiral F. In a similar manner radial strips R are secured in the cylinder D, also serving to elevate the ore to a certain height and then dropping the same, whereby the ore is throughout agitated.

The furnace A is preferably made with two inclined grates, S and S′, both leading into the common fire-chamber T, opening into the inner open end of the cylinder C. The latter projects at this inner end into a corresponding recess in the furnace A, and an annular flange, C′, formed on the said cylinder, rests against the outer surface of the furnace A, so as to make the latter and the cylinder C air-tight.

The grates S and S′ are charged from the sides of the furnace A through suitable doors, U and U′, as shown in Fig. 2.

The operation is as follows: A rotary motion is imparted to the drum B, as above described, whereby both cylinders C and D are rotated. At the same time the furnace A is fired, so that the heat developed on the grates S and S′ passes through the fire-box T into the inner open end of the cylinder C, then passes along the said cylinder to its outer closed end, and then passes into the open large end of the conical cylinder D. The heat passes along the said cylinder D toward the furnace A, and is finally discharged, passing out through the flue H formed in the furnace A and connected in the usual manner with the chimney. The ore to be treated passes through the spout I into the small end of the conical cylinder D and is moved outward by the spiral G until the ore drops out of the large end of the cylinder D into the outer end of the cylinder C, in which the ore is moved toward the furnace again by the spiral F. The roasted or calcined ore is finally discharged at the inner end of the cylinder C into the slot A′, which delivers the ore to the outside of the furnace. The ore, while passing through the cylinder D, is constantly broken up by the riffled interior surface, D′, of the said cylinder and also by the agitating-strips R. In a similar manner the ore is constantly broken up in the outer cylinder, C, by the pointed ends of the fire-brick E and by the strips Q, which elevate the ore to a certain height and then drop the same, as before described.

The inner ends of the strips Q may be formed of coils of pipe V, (shown in Fig. 5,) the end of each coil of pipe being connected with the spokes N, so that water passing through the said spokes may also pass through the said coil of pipe V. Thus the intense heat from the furnace A will not burn the strips Q at the inner end of the said cylinder C, at which the most intense heat is developed.

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

1. The combination, in an ore-roaster, with the outer cylinder and the inner cylinder extending therethrough, of the tubes connecting said cylinders, and series of imperforate passages on both cylinders, the tubes alternately connecting the forward end of a passage on one cylinder with the rear end of a passage on the other cylinder and the forward end of the latter passage with the rear end of the next passage on the first-named cylinder, whereby a continuous serpentine passage is formed, substantially as set forth.

2. In an ore-roaster, the combination, with an inner and an outer cylinder, of a spiral formed on the inner surface of the said outer cylinder and made of alternate hollow and solid sections, a second spiral formed on the outer surface of the inner cylinder and also made of hollow and solid sections, and hollow spokes connecting the hollow sections of one spiral with the hollow sections of the other spiral, substantially as shown and described.

3. In an ore-roaster, the combination, with an inner and an outer cylinder, of a spiral formed on the inner surface of the said outer cylinder and made of alternate hollow and

solid sections, a second spiral formed on the outer surface of the inner cylinder and also made of hollow and solid sections, hollow spokes connecting the hollow sections of one spiral with the hollow sections of the other spiral, a water-supply pipe leading to one of the outermost spokes, and a discharge-pipe leading from the last hollow section of one of the spirals to the outside of the roaster, substantially as shown and described.

CHARLES J. FENDEL.

Witnesses:
WILLIAM SOWERBY,
PATRICK HENNESSY.