

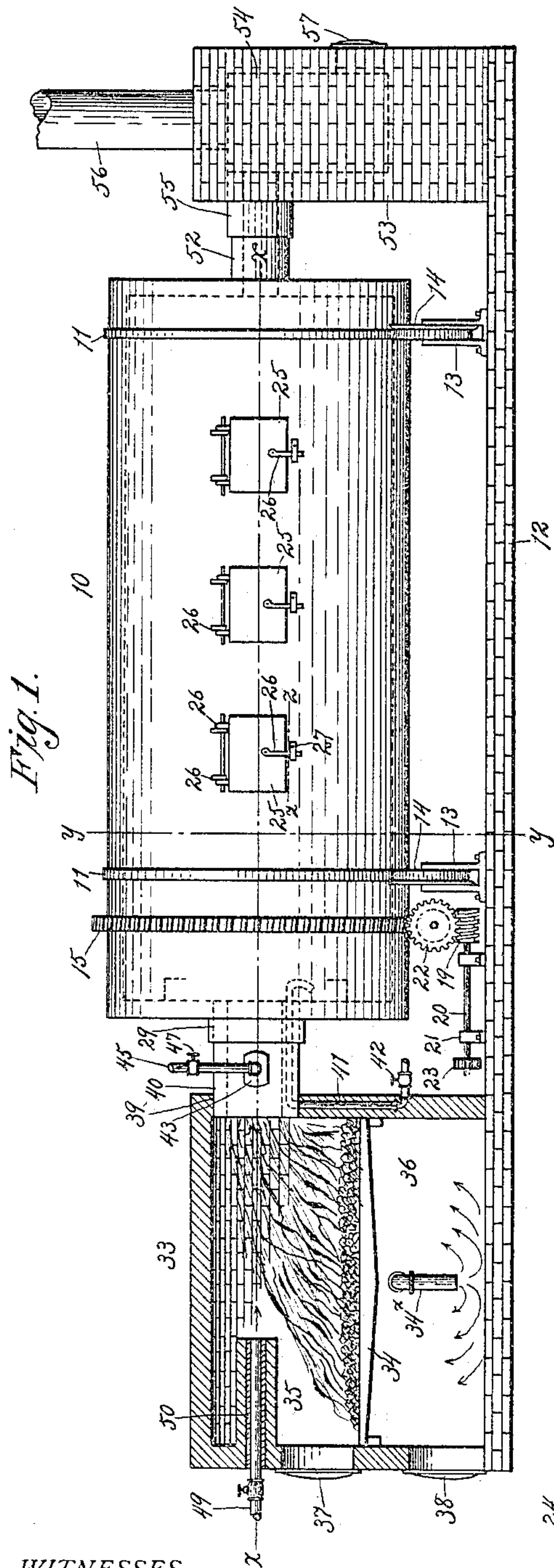
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L. H. ALLEN.
ORE ROASTING AND OXIDIZING APPARATUS.

APPLICATION FILED SEPT. 29, 1903.

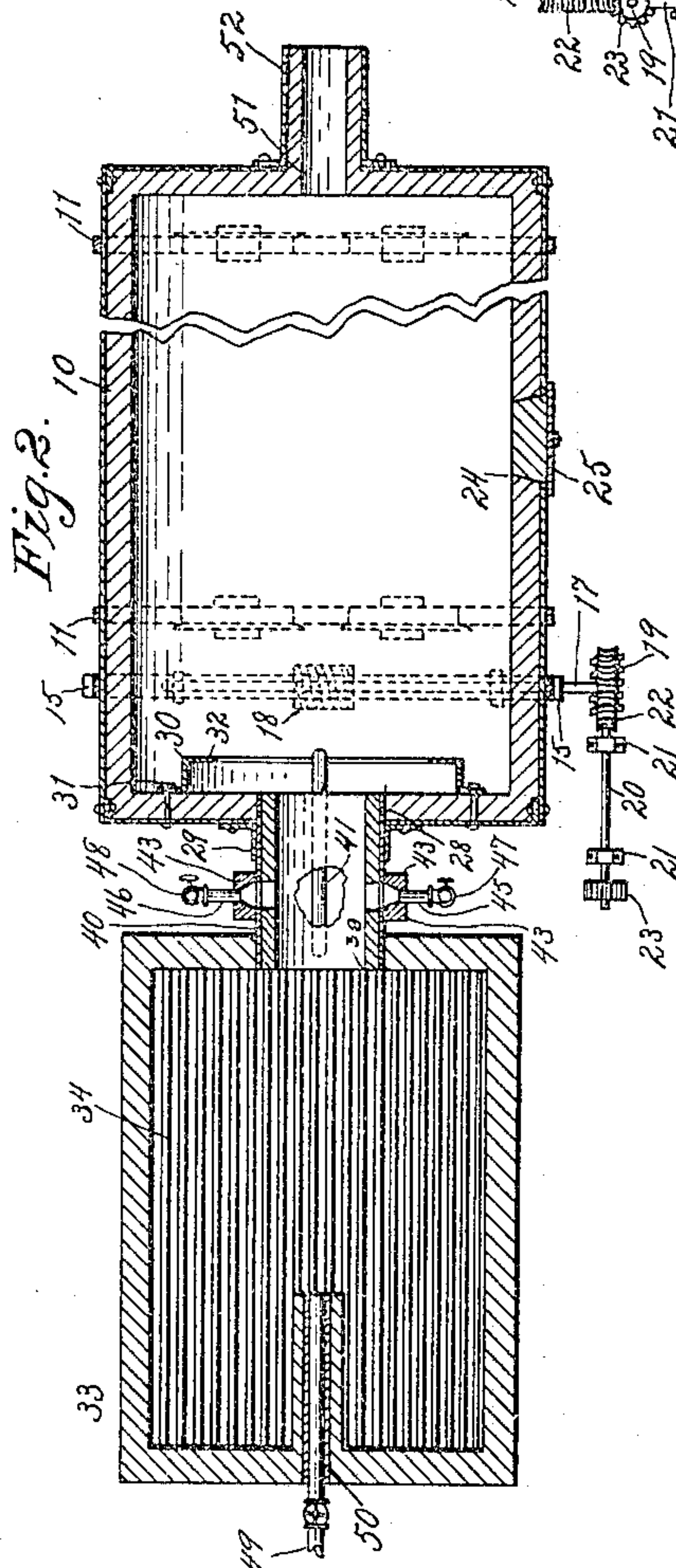
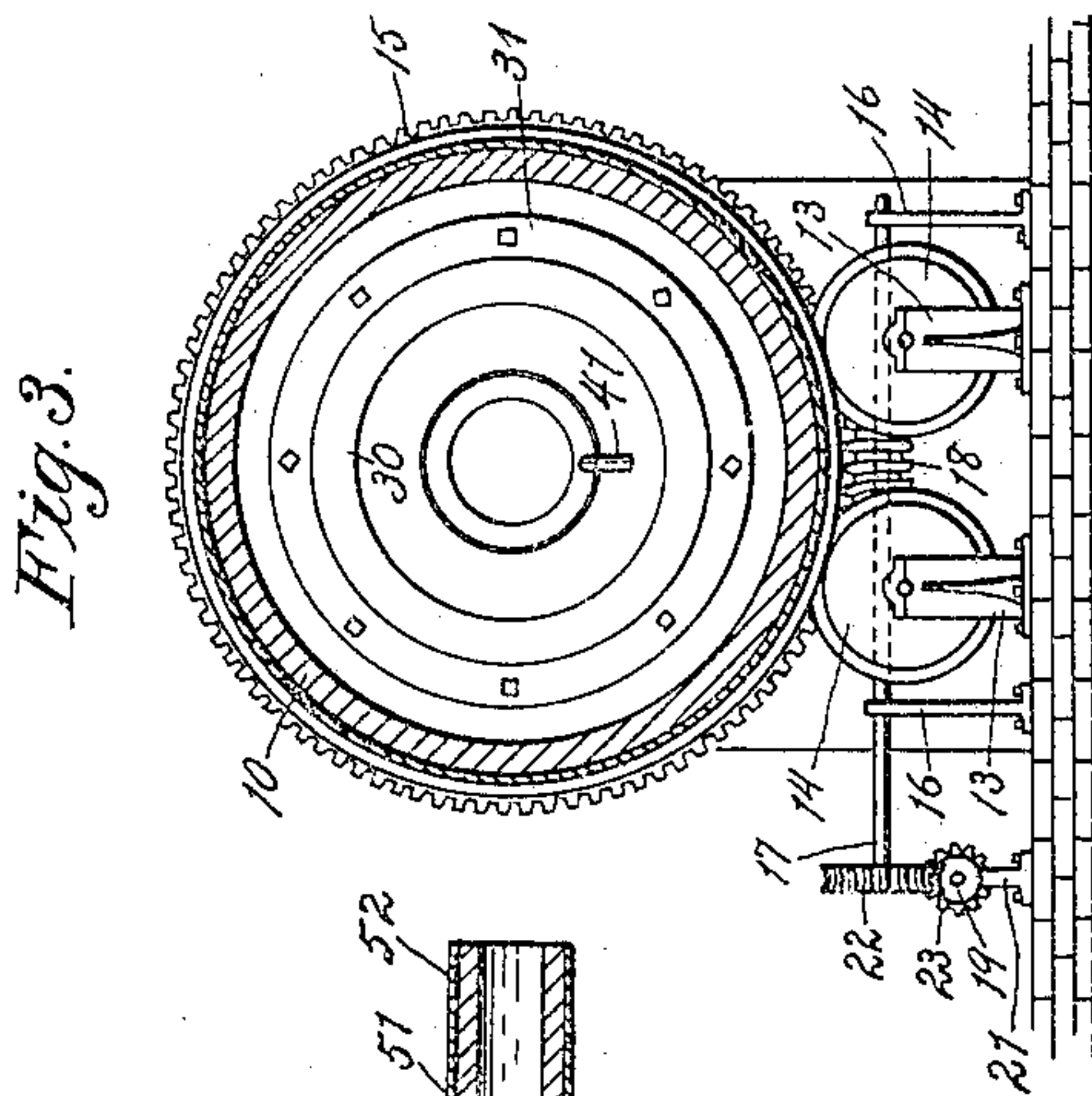
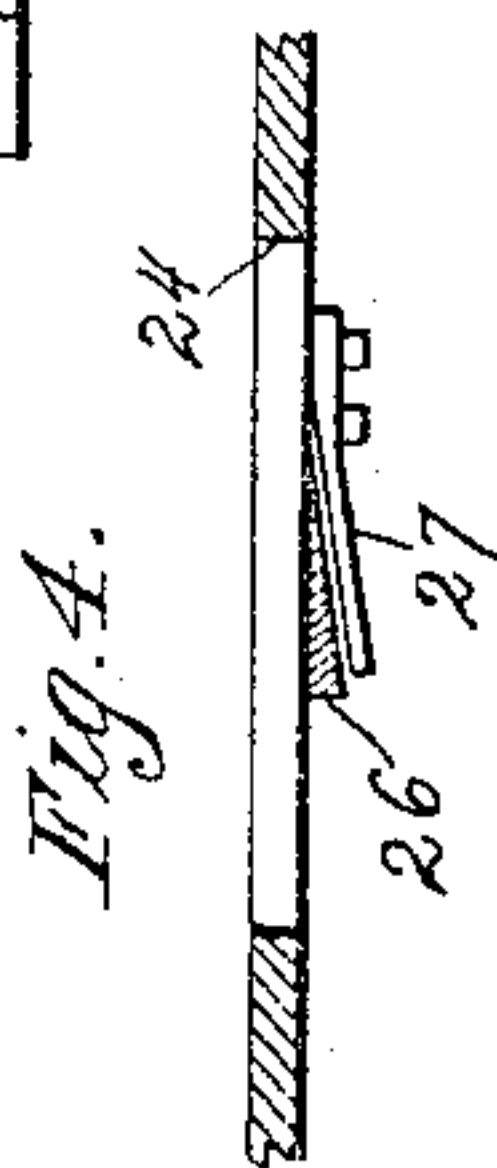
NO MODEL.



WITNESSES:

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ORE ROASTING AND OXIDIZING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 766,156, dated July 26, 1904.

Application filed September 29, 1903. Serial No. 175,034. (No model.)

To all whom it may concern:

Be it known that I, LYMAN H. ALLEN, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Ore Roasting and Oxidizing Apparatus; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

The primary object of the invention is the reduction of refractory ores, which are subjected to oxidation by the action of heat and vapor, the invention having particular reference, first, to the generating of vapor required for the oxidation of the ores by the action of the flame; secondly, the application of the blasts of steam and air to the reducing-flame, and, third, to increase the scarifying action of the oxidizing-flame.

The invention consists in the novel features of the apparatus hereinafter described, and specifically pointed out in the claims.

In the drawings, Figure 1 is a side elevation of the improved ore roasting and oxidizing apparatus, the furnace being shown in vertical section. Fig. 2 is a horizontal sectional view of the furnace and a broken view of the cylinder or retort, taken on the line *x x* of Fig. 1. Fig. 3 is a vertical sectional view of the ore-roasting cylinder, taken upon the line *y y* of Fig. 1 and showing the annular vaporizer at the forward end. Fig. 4 is a detail sectional view of a portion of the ore-roasting cylinder and door, showing the latch and keeper in section and taken upon the line *z z* of Fig. 1.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

Referring to the drawings, 10 designates an ore-roasting cylinder or retort of large dimensions, and which is lined interiorly with fireproof clay or brick. Extending around the cylinder near each end are bands 11 11.

Upon a suitable foundation 12, extending the length of the apparatus, are vertical standards 13 13, secured to the foundation and arranged in pairs beneath the respective ends of the cylinder and upon both sides of the vertical axis, in which standards are journaled the cylinder-supporting flanged rollers 14, which rollers engage with the bands 11 11, so as to resist longitudinal movement of the cylinder.

15 designates a circular rack extending around the forward end of the cylinder. To the foundation 12 beneath the forward end of the cylinder are secured standards 16 16, in which is journaled a shaft 17, extending transversely to the cylinder, upon which shaft is a worm-gear 18, engaging with the rack 15 on the cylinder. Upon the outer end of shaft 17 is a worm-wheel 22. Extending at right angles to shaft 17 is a shaft 20, journaled in bearings 21, said shaft carrying at one end a worm 19, engaging with the worm-wheel 22, and a band-pulley 23 at the other end. Through the band-wheel connected with a suitable motor power is communicated to the shaft 20 and a slow rotary movement communicated to the cylinder 10 through the worm-gear 18.

24 designates openings in the sides of the cylinder for the entrance of the ores. These openings are in line with each other, and, as shown, the intermediate opening is about equidistant from the ends of the cylinder, so as to conveniently discharge the contents of the cylinder at that point. Doors 25 are hinged at 26 to the sides of the cylinder and close the openings 24, these doors being provided with a latch 26, the lower edge of which is drawn to an edge, and when the door is closed the latch is moved forcibly within a keeper 27 on the side of the cylinder, the inner side of which keeper is inclined inwardly, as seen in Fig. 4. In charging the cylinder with the ores its rotary movement is checked when the openings are in a vertical position or at points highest in elevation, and where the cylinder is in position for dis-

charging its contents the portion is reversed, the doors being opened and depend from the hinges, so that full access is obtained to the central position as well as the ends of the cylinder.

28 designates a circular opening in the forward end of the cylinder concentric with the longitudinal axis, around which opening, on the outer surface of said cylinder, extends an annular collar 29. To the inner side of the forward end of the cylinder is secured the annular vaporizing-receptacle 30. This receptacle is about one-third less circumferentially than that of the inner circumference of the cylinder, and consists of a circular plate of the requisite width, the inner edges 31 of which are bent outwardly at right angles to form a flange, which is secured to the end of the cylinder, and the outer edges 32 bent at right angles inwardly and so as to form a pocket and of a capacity ample for the supply of water.

33 designates a reducing-furnace adjacent to the forward end of the cylinder 10 and upon the foundation 12, the height of which is less than that of the ore-roasting cylinder. Within the furnace is a horizontal grate 34, approximately midway the height of the furnace, above which grate is the combustion-chamber 35 and below the ash-pit 36, access to the former chamber being obtained by means of the door 37 and to the latter by means of the door 38, both of which doors are at the forward end of the furnace.

34^x designates an air-blast pipe, extending through the side wall of the furnace into the ash-pit.

At the rear end of the furnace and communicating with the upper rear portion of the combustion-chamber is a circular opening 39, in which is fixed the inner end of a flame-conducting cylinder 40, the inner circumference of which is lined with fireproof clay or brick. The outer end of the cylinder extends within the annular collar 29 in the forward end of the ore-roasting cylinder or retort 10 to a position in line with the inner surface of the forward end of said cylinder, the cylinder 40 forming a conductor for the reducing-flame and around which the ore-roasting cylinder 10 is afforded a rotary movement. Inserted in the rear end wall of the furnace beneath the cylinder 40 is a water-supply pipe 41, the upper end of which pipe extends through the side wall of the cylinder, thence extended along the inner side wall of the cylinder 40 below the surface of the fireproof lining in the direction of the ore-roasting cylinder to a position in line with the inwardly-bent flange of the open vaporizing-receptacle, at which point the end of the pipe is extended downwardly and bent inwardly in the direction of the inner surface of the forward end of cylinder 10. The lower end of pipe 41 extends out-

wardly from the furnace-wall and is connected with any suitable source of supply of water, which is controlled in quantity by the valve 42.

43 designates chambered enlargements on the outer surfaces of the cylinder 40, directly opposite in position the chambers 43, leading through the inner wall of the fireproof material and communicating with the interior of the cylinder. With one of the chambers 43 in one of the enlargements is connected an outgoing steam-supply pipe 45, which is supplied with exhaust-steam when required, as further explained, which is conducted under pressure from an engine (not shown) and the waste utilized. With the other chamber 43 is connected an outgoing air-supply pipe 46, the air to which is supplied under pressure from an air-blast fan. (Not shown.) In the pipe 45 is a valve 47, and in the pipe 46 is a valve 48, both of which valves are normally closed under ordinary conditions, dependable upon the quality of the ore to be converted or transformed, as hereinafter described.

49 designates an air-blast pipe, which extends through the front end wall into the combination-chamber and upon a line axially with the cylinder 40. This pipe is protected with an external covering of fire-clay and between the fire-clay and the pipe with an asbestos packing 50 and is arranged to transmit a blast upon the elements of combustion on the grate 34 of the furnace, and the resulting flame is an oxyhydrogen reducing-flame.

51 designates an opening in the rear end of the roasting-cylinder 10 for the escape of the gases and products of combustion, which is smaller in circumference than the opening 28 at the forward end. Extending around the opening 51 is an outwardly-extended annular flue 52.

53 designates a smoke-stack, located adjacent to the rear end of the ore-roasting cylinder 10, which is stationary in position on the foundation 12. This stack has a fume-chamber 54, (shown in dotted lines,) and leading from said chamber in the direction of the cylinder 10 is a sleeve 55, which receives the outer end of the flue 52 on said cylinder, which is free to rotate within the sleeve. A pipe 56 leads from the fume-chamber upwardly, and a door 57, on the side of the stack 53 opposite to that having the sleeve 55, affords access to the lower portion of the fume-chamber.

During the centrifugal movement of the ore-roasting cylinder 10 water is flowing into the vaporizing-receptacle 30 through pipe 41, the advantage of which in mining regions is that the apparatus generates its own steam in the absence of the necessary supply from other sources, which would cripple the engine. The blast of air through pipe 49 upon the products of combustion upon the furnace-grate produce a reducing-flame of great intensity, which

under the force of the air-blast in the ash-pit which feeds the fire is projected through the cylinder 40 into the ore-roasting cylinder. The flame affords requisite oxygen for the
 5 oxidation of the ores, and the vapor which becomes superheated from the vaporizing receptacle 30 is decomposed, the hydrogen gas evolved uniting with the oxygen in the flame and an oxyhydrogen flame projected the length
 10 of the cylinder, and as the outward passage of the gases and products of combustion are retarded in passing out of the cylinder the overturned ores are attacked by the oxyhydrogen gas, with which it comes in contact under
 15 pressure, the ores being scarified by the heat. The sulfur from the ores mixes with the hydrogen of the gases and passes out of the cylinder. The oxygen uniting with the oxygen of the ores converts the ores into free-
 20 milling ore. The reduction of the ores is thus effected without an excess of hydrogen, which unavoidably follows other methods of ore treatment, especially readily-oxidizable ores.

In the reduction of high-grade and arsenical
 25 ores requiring an increased percentage of oxygen the water-supply to the vaporizing-receptacle 30 is cut off by the valve 42 and the supply of steam and air admitted to the cylinder 40 through pipes 45 and 46. The
 30 air and steam thus admitted under pressure expand in the chambers 43, which afford a wide expansive area, and the steam and air meet and commingle under direct opposite pressure, the reducing-flame superheating and
 35 decomposing the steam, the oxygen uniting with the carbon in the furnace-gases, and the oxidizing-gases, which are admitted expansively from the chamber 43 to the ore-roasting cylinder 10, are diffused circuitously, the
 40 accreted oxygen in the oxidizing atmosphere attacking the scarified ores, which become rapidly porous, the sulfureted hydrogen passing off as before.

It is obvious that the vaporizer may be supplied with the liquid more directly than as

illustrated, the water which maintains a level during the rotation of the cylinder being rapidly converted into steam. The particular form and construction of the apparatus as
 50 illustrated may be varied and such modifications employed as fall within the scope of the invention.

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

1. An apparatus for reducing ores comprising a rotary ore-retaining cylinder having a flame-conducting opening at its forward end, a reducing-furnace, a flame-conducting cylinder leading from the furnace within the opening
 60 in said cylinder, means for drawing off the gases from the cylinder and an open water-receptacle concentric with the inner side of the cylinder and located at its forward end adapted for the storage of the liquid to be
 65 vaporized and a water-pipe leading within the flame-conducting opening of the cylinder and discharging downwardly within the open water-receptacle.

2. An apparatus for reducing ores comprising a rotary ore-retaining cylinder having a
 70 flame-conducting opening in its forward end and a discharge-opening in its rear end for the gases of less area than the flame-conducting opening, a reducing-furnace, a flame-conducting cylinder leading from the furnace
 75 within the opening in said cylinder, an open water-receptacle concentric with the inner surface of the cylinder and located at its forward end adapted for the storage of the water
 80 to be vaporized, a water-supply pipe leading within the flame-conducting cylinder and within the rotary ore-retaining cylinder and having its inner end extended downwardly in the direction of the open water-receptacle and
 85 bent inwardly toward the end of the cylinder.

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Witnesses:

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