No. 824,263. PATENTED JUNE 26, 1906.

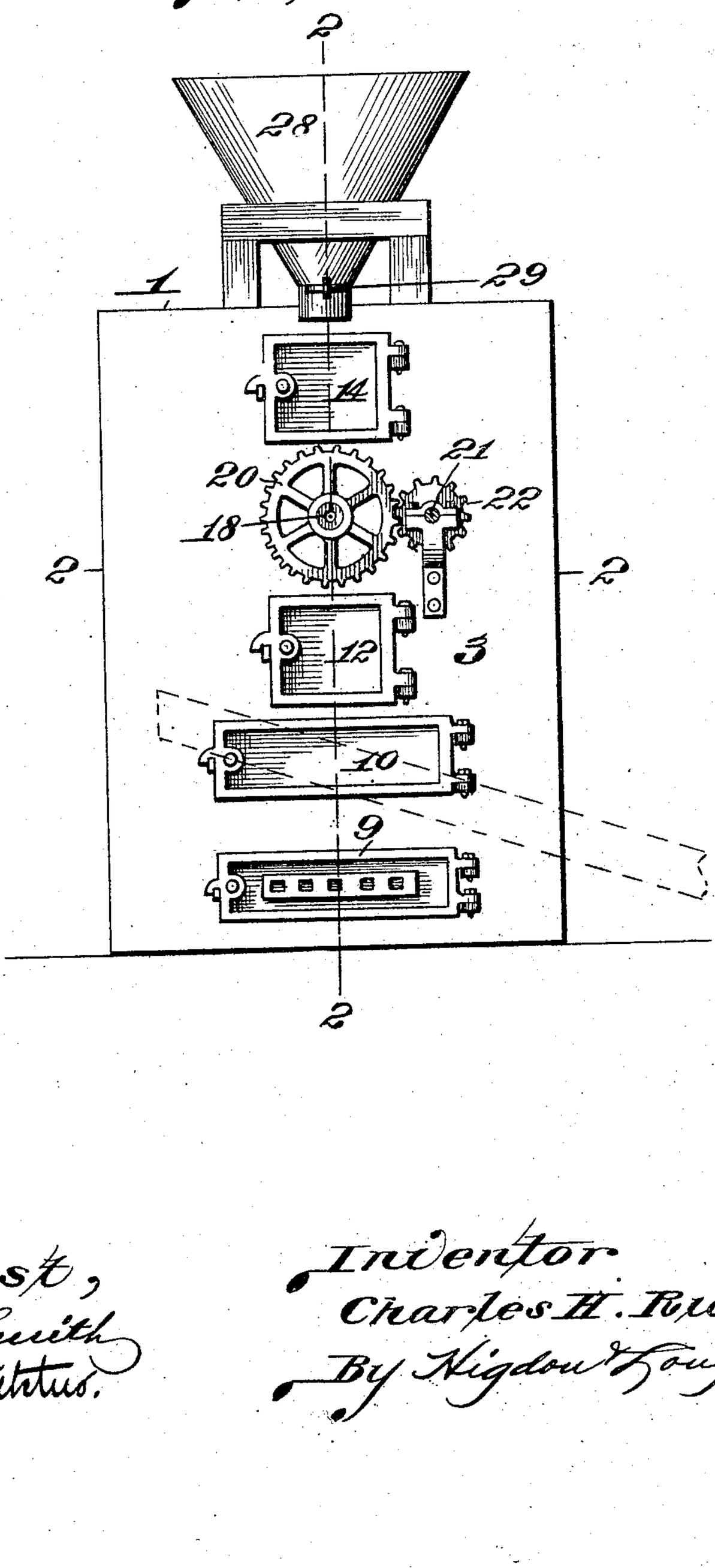
C. H. RIDER.

ORE ROASTING FURNACE.

APPLICATION FILED AUG. 9, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



Attest,
M. P. Smith
H. G. Fletcher.

Inventor
Charles H. Rider,
By Kigdon & Gougar
Attys.

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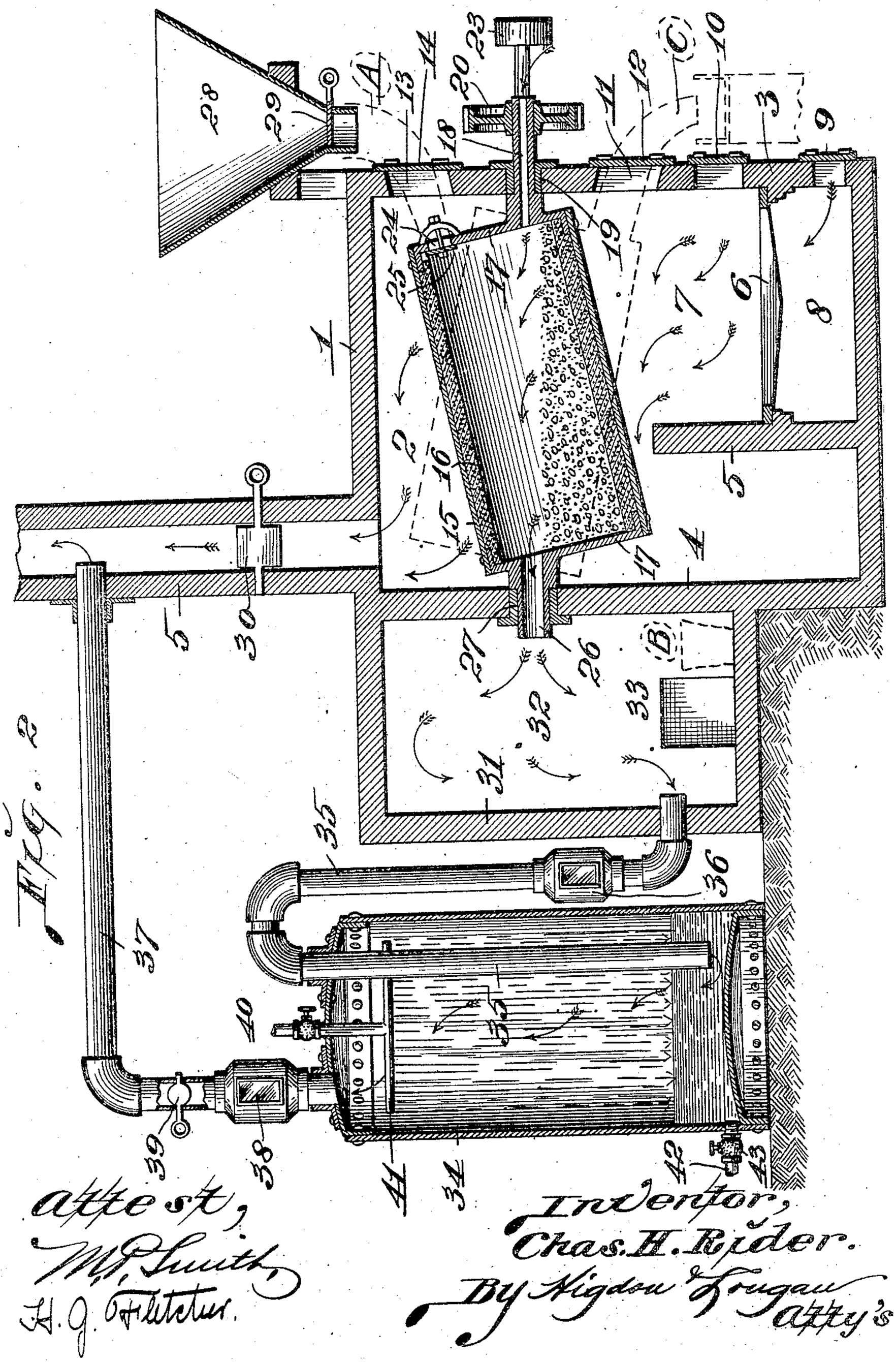

Fig. 2.

Attest,
M. P. Smith,
H. G. Fletcher.

Inventor,
Chas. H. Rider.
By Higdon & Longan
Atty's

UNITED STATES PATENT OFFICE.

CHARLES H. RIDER, OF ST. LOUIS, MISSOURI.

ORE-ROASTING FURNACE.

No. 824,263. Specification of Letters Patent. Patented June 26, 1906.

Application filed August 9, 1905. Serial No. 273,401.

To all whom it may concern:

Be it known that I, CHARLES H. RIDER, a citizen of the United States, and a resident of St. Louis, Missouri, have invented certain new and useful Improvements in Ore-Roasting and Fume and Gas Condensing Furnaces, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to an ore-roasting and fume and gas condensing furnace; and the object of my invention is to construct a furnace wherein ore may be very thoroughly and quickly roasted with a minimum amount of fuel and labor, and which furnace is so constructed as to condense gases into acids and all metallic vapors and gases into oxids and chlorids.

My invention consists in certain novel features of construction and arrangement of parts, which will be hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of a furnace constructed in accordance with my invention. Fig. 2 is a vertical section taken longitudinally through the center of the furnace upon the line 2 2 of Fig. 1.

In the construction of the furnace, as shown, the main body portion 1 thereof is approximately rectangular in form, provided with the usual side walls 2, the front wall 3, the rear wall 4, and the stack 5, which leads upwardly from the upper rear end of the furnace. Transversely arranged in the lower portion of the furnace is a bridge-wall 5, and a grate 6 is positioned between this bridge-wall and the front wall, thus forming the fire-box 7 and the ash-pit 8. An opening through the front wall into the ash-pit is normally closed by a door 9, and an opening into the fire-box above the grate is closed by the door 10. Formed through the front wall of the furnace just above the fire-box opening is an opening 11, normally closed by a door 12, and formed through said front wall at a point near the top of the furnace is a similar opening 13, closed by a door 14.

15 indicates a hollow metal cylinder that is lined on the inside with fire-brick 16 or analogous material, and secured by rivets or in any suitable manner to the ends of this cylinder are the end plates 17. Formed integral with the front one of these plates 17 is a hollow shaft 18, that is arranged to one side of the center of said front plate and extends outwardly therefrom at an angle relative said front plate, and said shaft extends horizontally through a bearing 19, located in the front wall between the openings 11 and 13 therein, and mounted on the outer end of this hollow shaft is a gear-wheel 20. Arranged to one side of the hollow shaft 18 outside the furnace and mounted in suitable bearings is a shaft 21, on which is mounted a pinion 22, that meshes with the gear-wheel 20, and located on said shaft 21 is a pulley 23 or other suitable driving-wheel. Formed through the front one of the plates 17, close to one edge thereof, is an opening 24, which is normally closed by a manhead 25. Formed integral with the rear one of the plates 17 at an angle thereto and the same distance off center as is the hollow shaft 18, is a hollow shaft 26, which is considerably larger in diameter than is the hollow shaft 18, and said hollow shaft 26 extends through the rear wall 4 of the furnace and operates in a bearing 27, located therein. The hollow shafts 18 and 26 being in direct horizontal alinement and arranged at similar angles relative the corresponding end plates 17 cause the body-cylinder to occupy an oblique position within the upper portion of the furnace 1. Located in front of and above the furnace is a hopper 28, the lower end of which terminates just above the bearing 14, and a sliding valve 29 normally closes the lower end of said hopper. Arranged in the stack 5 above the furnace is a damper 30. A wall 31 is built immediately against the rear side of the furnace 1 and incloses a dust and cooling chamber 32, into which the hollow shaft 26 discharges. An access to this chamber is had through a door 33, located at the bottom of one of the side walls of said chamber. Located a short distance to the rear of this chamber is a condensing tower or tank 34, and leading from the lower end of the chamber 32 upwardly and thence downwardly through the top of said tank or tower is a pipe 35, the discharge end of which is arranged adjacent the bottom of the tank or tower and inside thereof. Located in this pipe 35 at any convenient point between the chamber 32 and the tank 34 is a glazed sight-opening 36. A pipe 37 leads from the upper end of the tank 34 upwardly and thence horizontally, its end discharging into the stack 5 at a point above the damper 30, and in said

pipe 37 is located a glazed sight-opening 38, and immediately above said glazed sight-opening is located a damper 39. A water-inlet pipe 40 leads into the upper end of the tank 34, and a suitable sprayer 41 is secured to said water-inlet pipe within said tank 34. A discharge-pipe 42 leads from the lower end of the tank 34, in which pipe is arranged a cut-off valve 43.

The operation of my improved furnace is as follows: The obliquely-arranged cylinder in the furnace is loaded or charged with ore by bringing the opening 24 to a position directly opposite the opening 13, then removing the manhead from the opening 24 and fitting the inner end of a curved spout through said opening 24, the upper end of which spout is fitted onto the lower end of the hopper 28. (See dotted lines A, Fig. 2.) The ore which has been previously dumped into the hopper 28 is now allowed to discharge into the cylinder through this spout by withdrawing the valve 29, and when the proper charge is placed within the cylinder the manhead is returned into position to close the opening 24. The cylinder is rotated by means of a belt traveling over the pulley 23, and this rotary motion is imparted to the gear-wheel 20 by means of the pinion 22, and as a result the hollow shafts 18 and 26 rotate in their corresponding bearings, and the obliquely-arranged cylinder will be likewise rotated. As said cylinder rotates, its ends are alternately elevated and lowered, so that the ore therein will be constantly turned over and over, will have a simultaneous movement to and from the ends of the cylinder, and this constant rotation and rubbing action very thoroughly removes the oxids, chlorids, and sulfates as fast as they form on the molecules of ore, thus presenting fresh surfaces constantly to the action of the air that enters the cylinder through the small hollow shaft 18. The cylinder during this rotation is kept at the proper heat by means of a fire located upon the grate 6, which fire is fed through the opening closed by the door 10. In this manner the entire body of ore is very thoroughly and quickly roasted without the fire and products of combustion coming in direct contact with the ore. The burning sulfur and other volatilized matter arising from the ore that is being roasted within the cylinder pass outwardly through the hollow shaft 26 into the dust and cooling chamber 32, and a certain amount of oxids and similar heavier particles of the fumes will be deposited on the bottom of said chamber. From this chamber the fumes and gases pass into and through the pipe 35 and are discharged into the bottom of the condensing tower or tank 34. Here they are subjected to a spray of water from the sprayer 41, and said fumes will be very thoroughly condensed and settle to the bottom of said tank. The gases containing no value will finally discharge through the pipe 37 into the stack 5 and pass off with the products of combustion arising from the fire in the fire-box 7.

In order to more thoroughly convert the sulfurous gas into sulfuric acid when roasting a sulfid ore, a receptacle containing nitric acid is placed in the dust-chamber, (see dotted lines B, Fig. 1,) or a small amount of nitrate of soda may be added to the ore before roasting. If it be desired to convert a part of the ore into soluble chlorids, common salt is added to the ore before roasting. To convert oxids into sulfates, sulfur or iron disulfid is added to the ore before roasting.

It has been found in practice with my improved furnace that with one hour's roasting at a low red heat and rotating the cylinder at about fifteen to twenty times per minute will result in a complete oxidation of the iron and will convert copper, nickel, cobalt, gold, and silver and many other metals into soluble sulfates and chlorids (provided salt has been added to the ore) in a very thorough manner and that approximately eighty per cent. of the metallic values can be readily put into solution by leaching with hot water. The balance, or twenty per cent., is easily soluble in the acids condensed in the tank during the roasting of the ore, thus resulting in a complete solution of the metallic values in most all ores without the use of reagents other than those created when roasting the ore.

The charge of ore is discharged from the cylinder by so rotating said cylinder as to bring the opening 24 directly opposite the opening 11, and when the manhead 25 has been removed a removable curved spout, such as C, Fig. 2, is arranged so as to convey ore from the cylinder to a suitable chute outside the furnace.

By my improved furnace there is absolutely no loss in metallic values in the roasting of ore, and said roasting is accomplished with a great saving of fuel, time, and labor, and all the fumes and gases containing metallic values are readily condensed in a very effectual manner within the condensing-tank, from whence they may be readily removed.

The operation of the furnace or of the passage of the fumes and gases may be at all times viewed by means of the glazed sight-openings 36 and 38. The fire and draft thereof from the fire-box 7 pass upwardly through the furnace and out through the stack 5, and this natural draft causes a corresponding draft of air through the ore-condensing cylinder into the dust-chamber and from thence through the pipe 35 into and through the condenser and from thence through the pipe 37 into the stack 5. Thus the fumes from the roasting ore are withdrawn from the cylinder by means of the natural draft of the fire used for roasting the ore.

I claim—

1. In an ore-roasting furnace of the class

described, a roasting-chamber provided with inlet and outlet doors in one wall, an obliquely-disposed cylindrical retort arranged for rotation in the chamber, heads fixed in said retort in one of which heads is formed an opening so located as to coincide with the openings in the wall of the chamber, and a plate normally closing said opening; substantially as specified.

2. In an ore-roasting furnace of the class described, a roasting-chamber provided with inlet and outlet doors in one wall, an obliquely-disposed cylindrical retort arranged for rotation in the chamber, heads fixed in said retort in one of which heads is formed an opening so located as to coincide with the openings in the wall of the chamber, a plate normally closing said opening, a dust-chamber separate from the roasting-chamber into which the draft from the retort discharges, a condenser, and a tubular connection from the dust-chamber to the condenser; substantially as specified.

3. In an ore-roasting furnace of the class described, a roasting-chamber provided with inlet and outlet doors in its front wall and with a stack leading upwardly from its rear end, an obliquely-disposed cylindrical retort arranged for rotation in the chamber, there being an opening in one end of the retort so located as to coincide with the openings in the front wall of the chamber, a plate normally closing said opening, a dust-chamber separate from the main chamber into which the draft from the retort discharges, a condenser, a tubular connection from the dust-chamber to the condenser, and a tubular connection from the condenser to the stack; substantially as specified.

4. In an ore-roasting furnace of the class described, a roasting-chamber provided with inlet and outlet doors in one wall, a retort arranged for rotation in the chamber, there being an opening in one end of the retort so located as to coincide with the openings in the wall of the chamber, a plate normally closing said openings, a feed-hopper arranged above the chamber over one of the openings in the wall thereof, and a discharge-chute arranged beneath the opposite opening in the wall; substantially as specified.

In testimony whereof I have signed my name to this specification in presence of two subscribing witnesses.

CHARLES H. RIDER.

Witnesses:

EDWARD E. LONGAN,

E. M. HARRINGTON.