No. 765,998. PATENTED JULY 26, 1904.

G. H. SHELLABERGER.

ORE ROASTING FURNACE.

APPLICATION FILED FEB. 5, 1904.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

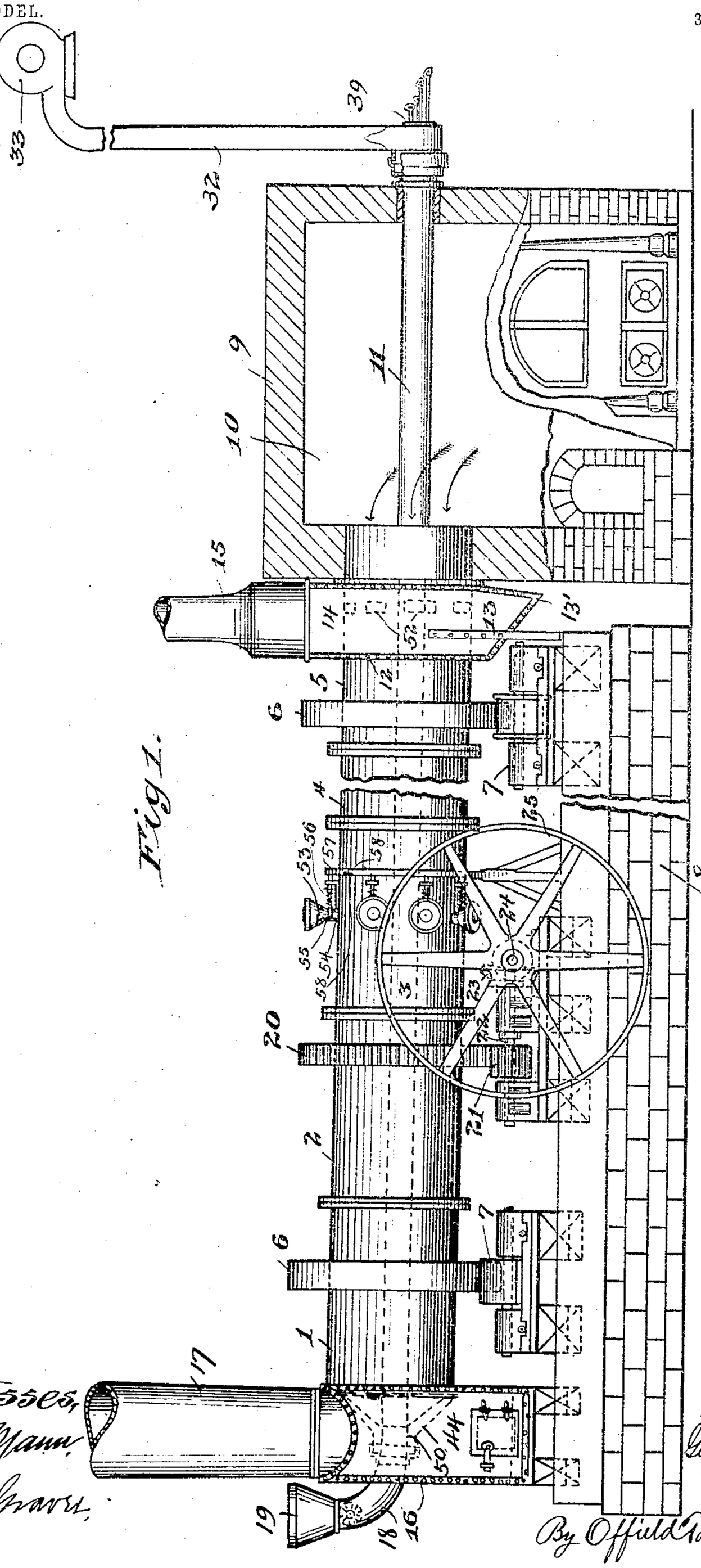
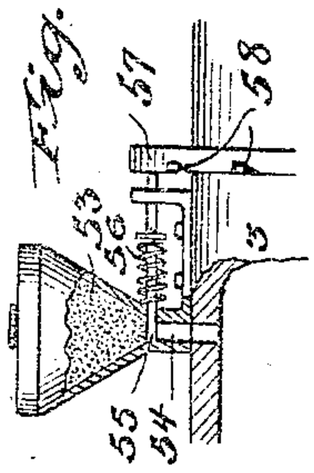


Fig. 6.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

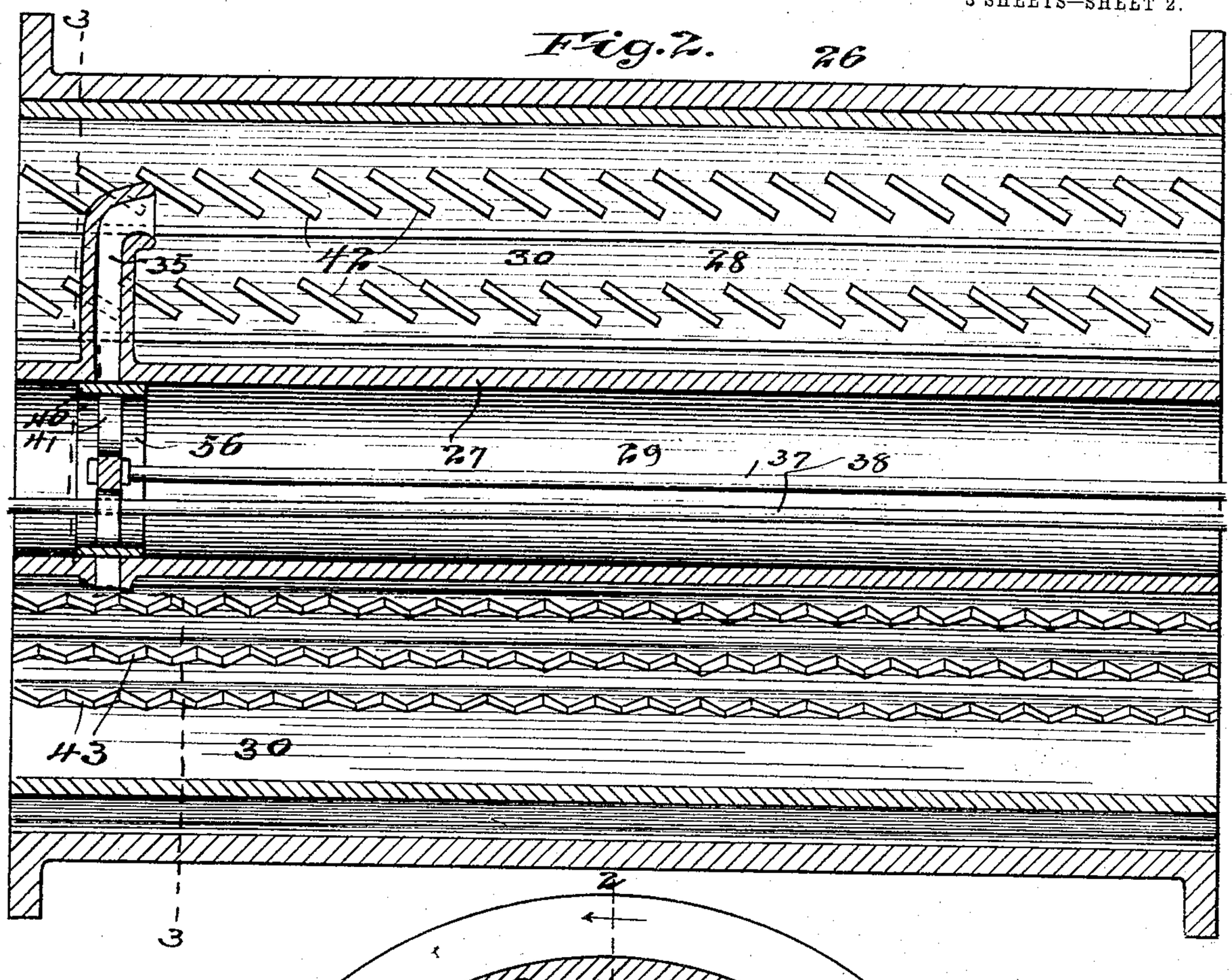
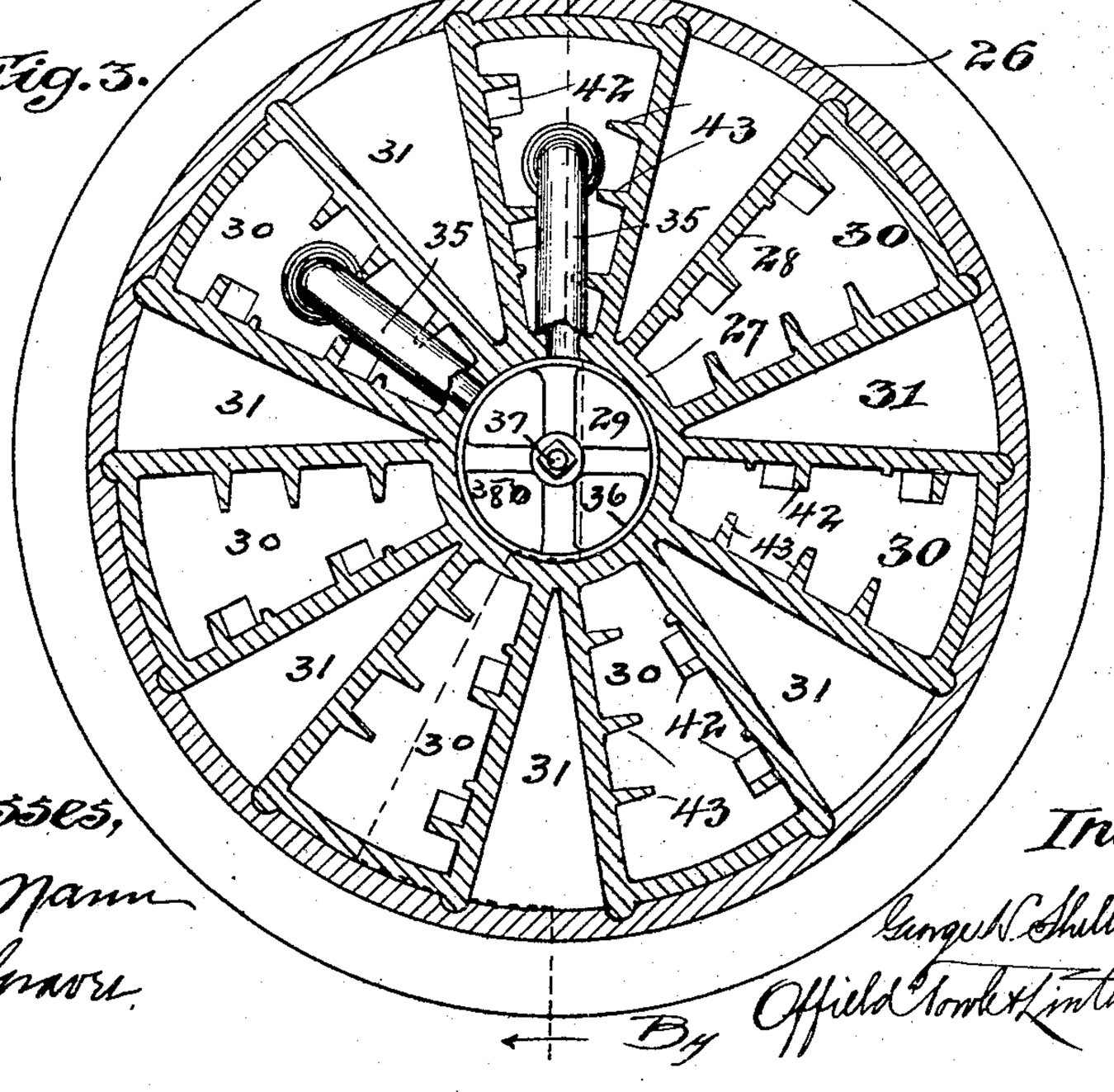


Fig. 3.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 4.

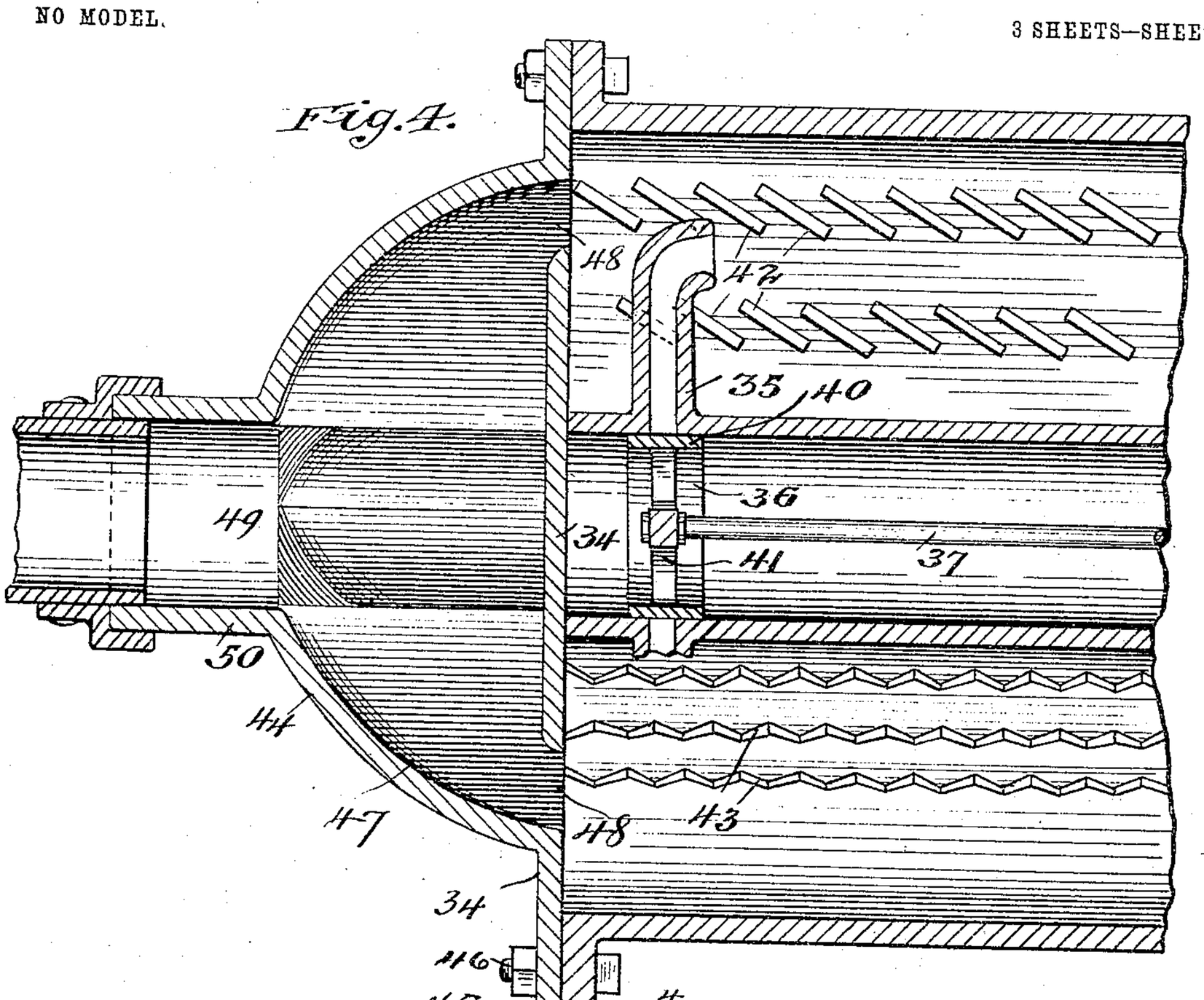
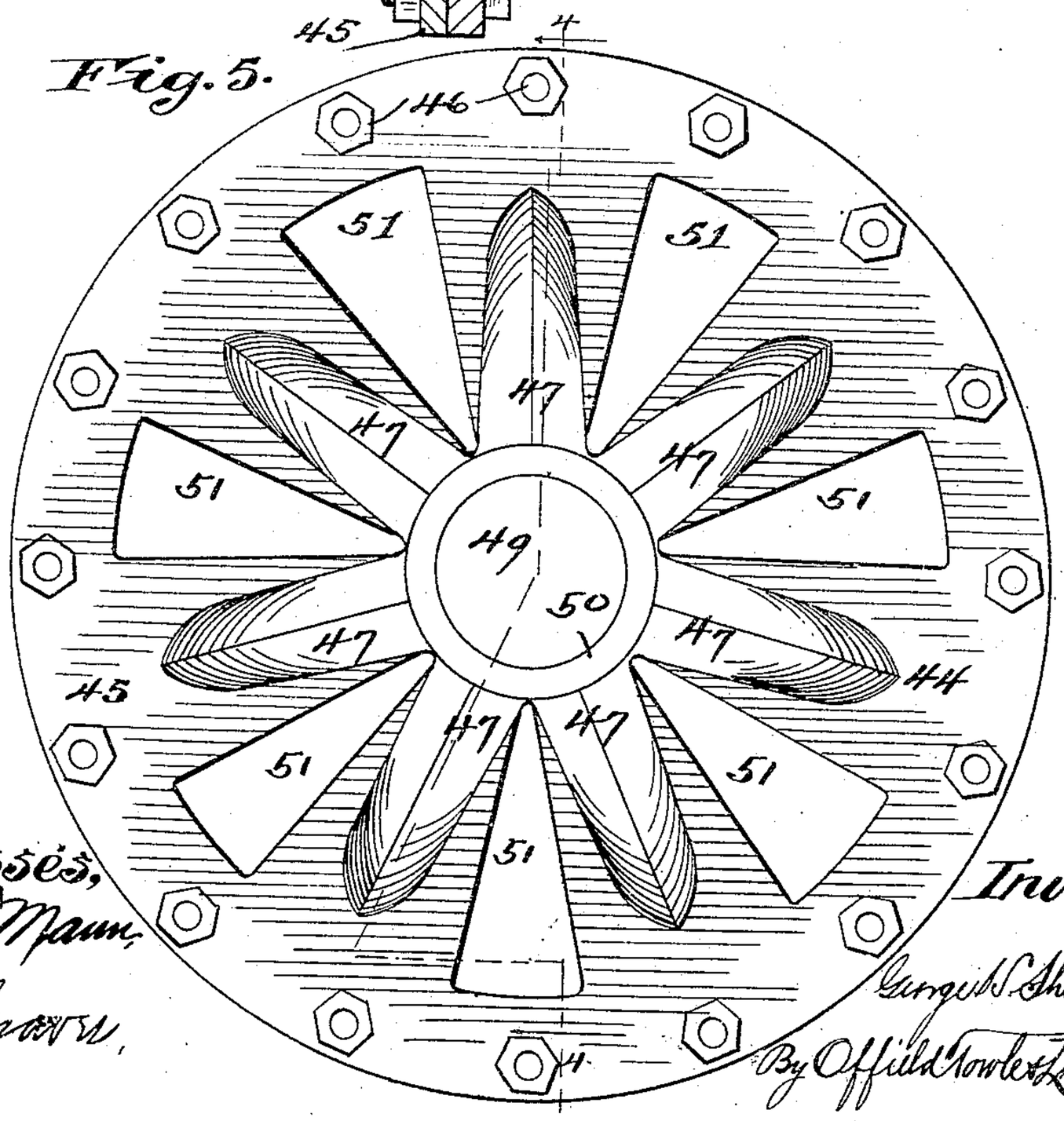


Fig. 5.



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No. 765,998. Patented July 26, 1904.

UNITED STATES PATENT OFFICE.

GEORGE H. SHELLABERGER, OF DEKALB, ILLINOIS, ASSIGNOR TO APEX MANUFACTURING COMPANY, OF KANSAS CITY, MISSOURI, A CORPORATION OF ARIZONA TERRITORY.

ORE-ROASTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 765,998, dated July 26, 1904.

Application filed February 5, 1904. Serial No. 192,217. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. SHELLABERGER, a resident of Dekalb, in the county of Dekalb and State of Illinois, have invented certain new and useful Improvements in Ore-Roasting Furnaces, of which the following is a specification.

This invention relates to improvements in ore-roasting furnaces, and refers more specifically to an improved type of rotary furnace wherein the interior of the furnace-body is divided into a plurality of ore-roasting chambers and corresponding series of interspaced heat-flues with an air-trunk common to all of the several roasting-chambers.

Among the salient objects of the present invention are to provide a construction in which the interior of the furnace is divided into a plurality of ore-chambers radially disposed around a central air-trunk, from which latter communicating passages extend to the several ore-chambers; to provide a construction of the character above referred to in which each ore-chamber is provided with a plurality of air-inlets leading from the common air-trunk, which air-inlets are controlled by valves located within said air-trunk; to provide a construction in which the ore-roasting furnace-body is so constructed and combined with a heat-generating furnace that the main air-trunk enters through and is directly exposed within the combustion-chamber of the heat-generating furnace, and in general to provide improved details of construction and arrangement in a furnace of the general character referred to.

To the above ends the invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims, and the invention will be readily understood from the following description, reference being had to the accompanying drawings, in which—

Figure 1 is a view, chiefly in side elevation, but with parts in vertical section, of a furnace constituting a preferred embodiment of the invention. Fig. 2 is a longitudinally-sectional view of one of the intermediate furnace-body sections, taken on the indirect line 2 2 of Fig. 3 and showing a preferred internal construction. Fig. 3 is a transverse section taken on line 3 3 of Fig. 2 and looking in the direction of the arrows. Fig. 4 is a view of a fragmentary portion of the receiving end section of the furnace and connected parts, taken on line 4 4 of Fig. 5. Fig. 5 is an end elevation of the parts shown in Fig. 4. Fig. 6 is an enlarged detail view.

Referring to the drawings, 1, 2, 3, 4, and 5 designate a series of furnace-body sections which are preferably externally cylindric and are united end to end to form an extended rotary furnace-body of internal tubular construction. At suitable intervals apart the furnace-body is provided with bearing-rings 6, the lower sides of which seat and rotate within suitable journal-cradles 7, mounted upon a suitable masonry foundation, (designated as a whole 8.)

9 designates as a whole a heat-generating furnace, shown as located at that end of the ore-furnace body from which the ore is delivered, the combustion-chamber 10 of the furnace being in open communication with the heat-flues of the ore-furnace, as hereinafter described, and a centrally-disposed air-trunk 11, forming a part of the rotary ore-furnace body, being arranged to extend entirely through the heat-generating furnace, so that its exterior is directly exposed to the gases of combustion. Adjacent to the inner wall of the heat-generating furnace is located a housing 12, which surrounds a portion of one of the furnace-body sections and constitutes a hopper 13 as to its lower end and a fume-chamber 14 as to its upper portion, the latter being arranged to communicate with a fume-stack 15. At its opposite end the ore-furnace body extends within a housing 16, constituting a smoke-chamber, which communicates with a smoke-stack 17 and through which housing 15 extends a feed-chute 18. The feed-chute 18 constitutes the delivery member of an ore-hopper 19 and communicates at its lower end with a plurality of ore-chambers, as will hereinafter be described.

The ore-furnace is rotated as a whole by means of suitable mechanism, that shown herein comprising a gear-ring 20, mounted upon the exterior of the furnace-body and engaged and driven by a pinion 21, mounted upon a drive-shaft 22, which carries also a bevel-gear 23. The bevel-gear is actuated from a transverse shaft 24, upon which is mounted a drive-pulley 25, which may be driven by means of any suitable belt connection.

Describing now more particularly the internal construction of the ore-furnace and referring to the preferred construction shown in Figs. 2 and 3, each cylindric section comprises an outer cylindric shell or wall 26, an inner concentrically-disposed wall 27, and a series of radially-disposed partition members 28, whereby the interior of the section is divided into a central air-trunk 29, a series of concentrically-disposed ore-chambers 30, and a series of interspaced heat-flues 31. It will be understood that the air-trunk 29 and several chambers and flues of each section extend through uninterruptedly from end to end of the furnace-body when the several sections are assembled.

The main air-trunk is at a point just outside of the heat-generating furnace connected with a suitable source of air under pressure—as, for example, with a trunk or pipe 32 of a blower 33. The opposite end of said main trunk is closed by the end wall 34 of the receiving end sections of the furnace-body. Each section of the furnace-body is provided with a series of radially-extending tubular air-pipes 35, extending from the main air-trunk outwardly into the several ore-chambers and at their discharge ends deflected toward the delivery end of the furnace-body.

In order to control the several air-pipes 35, a series of piston-valves 36 are arranged within the main air-trunk 29 at points radially opposite the respective series of pipes 35, each piston-valve being provided with an independent stem, as 37 38, which stems extend longitudinally through the air-trunk and out through a swivel-plate 39, journaled in the air-pipe 32 axially opposite the end of the air-trunk. The several piston-valves are made of skeleton form, each comprising an outer piston-ring 40 and a central spider 41 connected therewith, so as to permit the free passage of air longitudinally through the trunk.

In order to effect the movement of the ore progressively through the furnace and at the same time to tumble and stir the ore as it traverses the ore-chambers, the interior of each ore-chamber is provided with rabbles or flange-like projections, as indicated at 42 and 43. In the preferred embodiment now illustrated these rabbles are placed upon the radial partition members 28 so that the rabbles face each other. The rabbles 42 are, as best shown in Figs. 2 and 3, in the form of obliquely-disposed blades or flanges projecting from the face of the wall, while the rabbles 43 are in the form of longitudinally-alined saw-tooth-shaped projections. The particular construction and arrangement of these rabbles is not claimed herein, the same being made the subject of claims in a companion application, Serial No. 191,514, filed February 1, 1904.

The ore is fed into the receiving end of each ore-chamber from the hopper 19 as said ore-chambers are severally passing through the lower parts of their revolution. Referring more particularly to Figs. 4 and 5, 44 designates as a whole an end cap member, which is attached to the receiving end of the furnace-body. The member 44 is of peculiar construction in order to provide a plurality of radially-disposed chutes converging to a common center and respectively delivering to the several ore-chambers, while at the same time intervening openings are provided between the several chutes for the exit of the products of combustion from heat-flues. To this end said member 44 comprises a base or plate-like portion 45, adapted to be bolted to the end flange of the body-section, as indicated at 46, the central imperforate portion thereof forming the end closure 34 of the main air-trunk hereinbefore referred to. From said base-plate at points registering with each of the several ore-chambers lead outwardly and convergently a series of chutes 47, each of which is preferably externally convex in cross-section and convexly curved longitudinally, so as to provide in its inner side a curved trough-like chute, which communicates through an opening 48 with the corresponding ore-chamber and at its other end communicates with a common inlet-passage 49, formed by a central tubular extension 50. 51 designates the openings through the base-plate between the several chutes, these openings being desirably and as shown herein made substantially the same in form and size as the ends of the heat-flues and arranged in register with the latter. As clearly shown in Fig. 1, this end of the furnace-body, including the end cap member 44, is inclosed within the housing 16, which communicates with the smoke-stack 17.

As hereinbefore stated, the heat-flues terminate at a point where the furnace-body enters the combustion-chamber of the heat-furnace and open directly into the latter. At points within the housing 12 each ore-chamber 30 is provided with a discharge-opening 52, formed through the outer peripheral wall of the chamber, and it follows that as the furnace-body is rotated and these several delivery-openings brought to the lower side thereof the ore is discharged into the lower part of the housing 12 or hopper 13. The latter is provided with a discharge-opening 13′, which delivers the ore to any suitable conveyer. The fumes or gases which are driven off during the roasting of the ores escape through

the delivery-openings 52 and pass from the housing 12 up through the fume-stack 15.

The operation of the furnace has been clearly indicated in connection with the foregoing description and need not, therefore, be repeated. It may be noted, however, that the ore fed in from the hopper through the delivery-chute 18 is distributed, by means of several chutes 47, to the ore-chambers, each receiving a given quantity upon each revolution of the furnace, and after entering the ore-chambers is fed along through the latter by the tumbling of the ore upon the inclined rabbles. The air introduced to the air-trunk passes through the combustion-chamber of the heating-furnace and is brought to a relatively high temperature before it enters the main body of the ore-furnace. By means of the several piston-valves the escape of the air from the main trunk into the several ore-chambers may be regulated and controlled to a nicety, thus insuring great effectiveness in operation.

In Fig. 1 and detail view, Fig. 6, I have shown an attachment consisting of a device for introducing a granulated refining agent to the ore-chambers—such, for example, as salt. This device comprises a closed hopper or receptacle 53, mounted upon the exterior of the furnace-section (there being preferably one or more for each ore-chamber) and provided with a delivery-pipe 54, which extends through the wall and communicates with the interior of the ore-chamber. 55 designates a slide-valve arranged to control the passage through the pipe 54 and having its stem arranged to reciprocate through one side of the latter. Upon said stem is mounted a spring 56, tending to throw the valve into open position, and adjacent to the end of said stem is mounted a stationary ring 57, which holds the valve normally in closed position. The ring 57 is, however, provided at one or more points in its circumference with cam-notches 58, which when opposite the valve-stem permit the valve to be thrown into open position momentarily and then again force the valve closed. Accordingly as the device is carried bodily around with the rotation of the furnace-body the valve thereof will be opened from time to time, admitting a small charge of salt or other agent without unsealing the ore-chamber to the outer atmosphere. It will be understood, of course, that the hopper is provided with a suitable removable closure through which it may be replenished from time to time.

It will be understood from the foregoing that the details of construction may be modified without departing from the spirit of the invention, and I do not therefore limit myself to the particular details of construction shown herein except to the extent that the same are made the subject of specific claims.

I claim as my invention—

1. In a roasting-furnace, the combination with a movable roasting-furnace body, of a longitudinally-extending air-trunk, an air-flue affording communication between said air-trunk and the roasting-chamber of said furnace-body, and a valve member movably mounted within said air-trunk and moving upon the outlet therefrom to control the admission of air to said air-flue.

2. In an ore-roasting furnace, a furnace-body section comprising a centrally-disposed air-trunk, a concentrically-disposed series of ore-chambers, flues or passages leading out from said air-trunk and communicating with the respective ore-chambers, and one or more valves movably mounted within the air-trunk and controlling said passages leading to the ore-chambers.

3. In an ore-roasting furnace, an extended furnace-body comprising a trunk extending longitudinally throughout the furnace-body, a plurality of ore-chambers likewise extending longitudinally of the furnace-body, air-flues affording communication between said air-trunk and the several ore-chambers, heat-flues interspaced between the several ore-chambers and around the air-trunk, and means for controlling the passages affording communication between the air-trunk and ore-chambers comprising a series of valves movably mounted within the air-trunk and operating-rods connected with said valves and extending out through the end of the furnace-body.

4. In an ore-roasting furnace, a furnace-body section comprising an outer cylindric shell, a concentrically-disposed inner shell, and a series of radially-extending partition members whereby the interior of the section is divided into a central air-trunk and a plurality of ore-chambers and heat-flues arranged in alternate relation around said air-trunk, a series of radially-extending air-tubes, one for each ore-chamber, each communicating at one end with said air-trunk and at its other end terminating approximately central of the corresponding ore-chamber, and valve mechanism within said air-trunk and moving upon the interior wall thereof over the outlets therefrom for controlling the flow of air through said air-tubes.

5. In an ore-roasting furnace, the combination of a revolubly-mounted horizontally-disposed furnace-body having an axially-disposed air-trunk extending throughout the length thereof and a plurality of concentrically-disposed ore-chambers and heat-flues, a heat-generating furnace located at one end of said ore-roasting furnace-body and an air-trunk extension extending through the combustion-chamber of said furnace and connected with the air-trunk of the ore-roasting furnace-body, the exterior of said air-trunk extension being directly exposed to the heat of the combustion-chamber.

6. In an ore-roasting furnace, the combination of a furnace-body provided with one or more extended ore-chambers and an air-trunk

extending throughout the length thereof contiguous to said ore-chambers, one or more communicating passages between said air-trunk and ore-chambers, a heat-generating furnace, an air-pipe extending through and heated in the combustion-chamber of said furnace and communicating with said air-trunk of the furnace-body, and means for supplying air under pressure to said air-pipe.

7. In an ore-roasting furnace, the combination of a horizontally-disposed cylindric furnace-body revolubly mounted and comprising a central air-trunk, a plurality of concentrically-disposed ore-chambers and a plurality of heat-flues interspaced between said ore-chambers, a heat-generating furnace located at one end of said ore-furnace body, and having its combustion-space in communication with the longitudinally-extending heat-flues of the ore-furnace body, a smoke-stack communicating with said heat-flues at the opposite end of said ore-furnace body, an air-trunk extension extending through the combustion-chamber of said heat-generating furnace and connected with the air-trunk of the ore-furnace body, an air-pipe communicating with a source of air-supply and with said air-trunk extension, means for feeding ore into said ore-furnace body at the end thereof remote from the heat-generating furnace, and means for discharging the ore from said ore-furnace body at a point adjacent to the heat-generating furnace but outside of the latter, substantially as described.

8. In an ore-roasting furnace, the combination of a plurality of furnace-body sections joined end to end to form an extended furnace-body, a centrally-disposed air-trunk, a plurality of concentrically-disposed air-chambers, a corresponding series of interspaced heat-flues, radially-extending air-flues affording communication between said air-trunk and each of the several ore-chambers at intervals throughout the length of the furnace-body, a plurality of hollow piston-valves fitting within said air-trunk and controlling the several radial air-flues, and a separate operating-rod operatively connected with each piston-valve and extending thence longitudinally of the air-trunk and out through the end closure of the latter, substantially as described.

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