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Patented Aug. 21, 1900.

A. E. JOHNSON.
CALCINING OR ROASTING FURNACE.

(Application filed Mar. 26, 1900.)

(No Model.)

2 Sheets—Sheet 1.

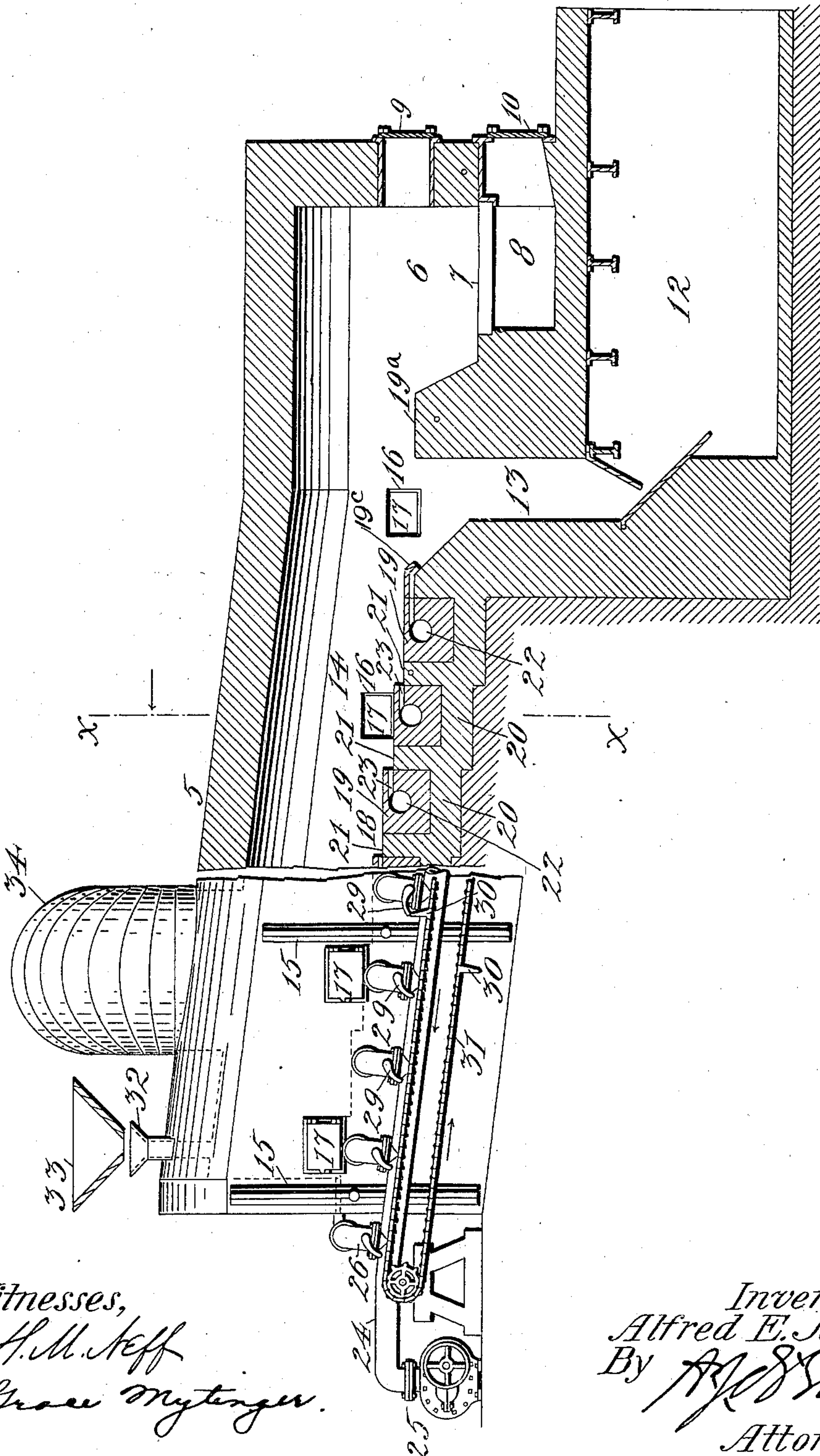


Fig. 1.

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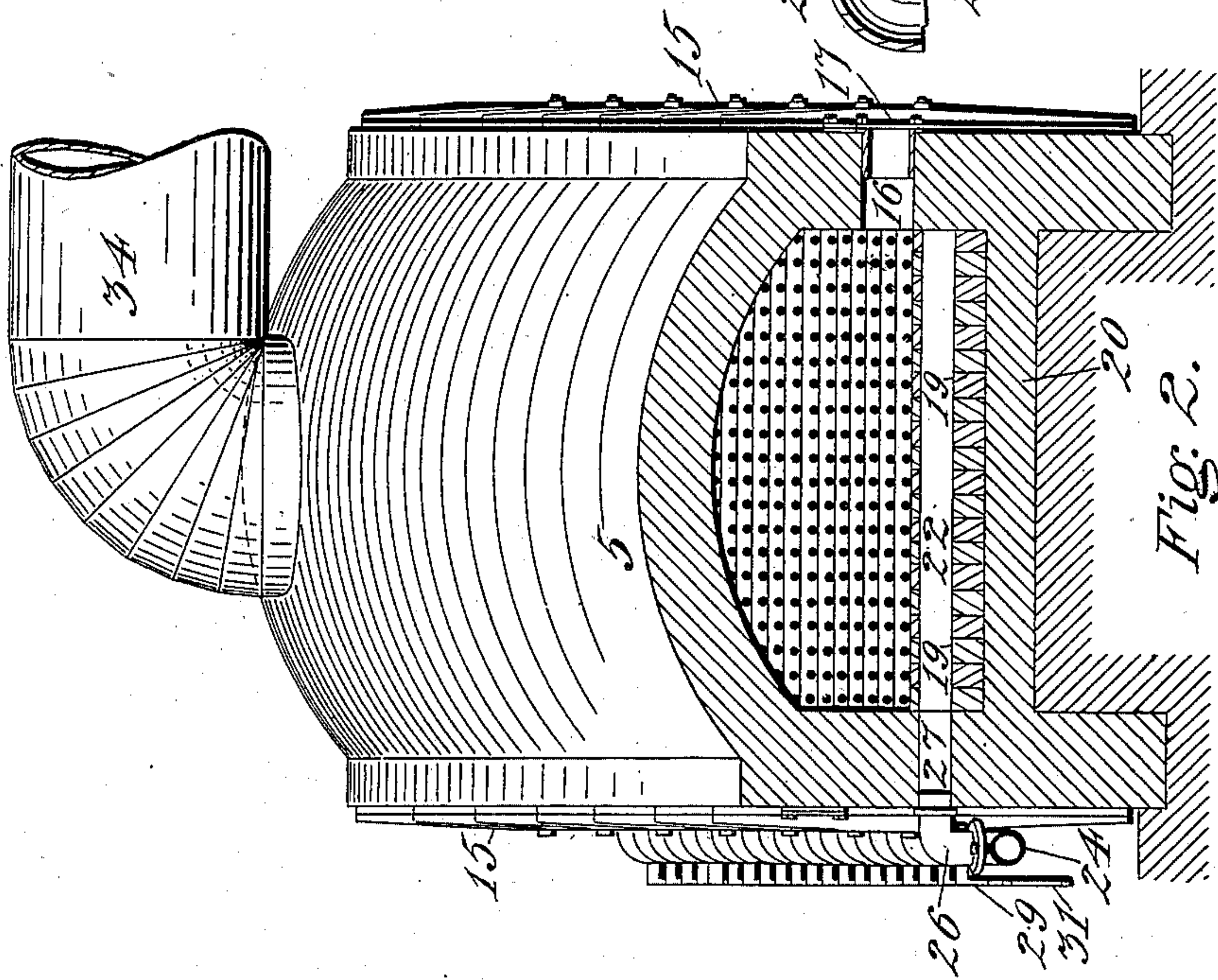
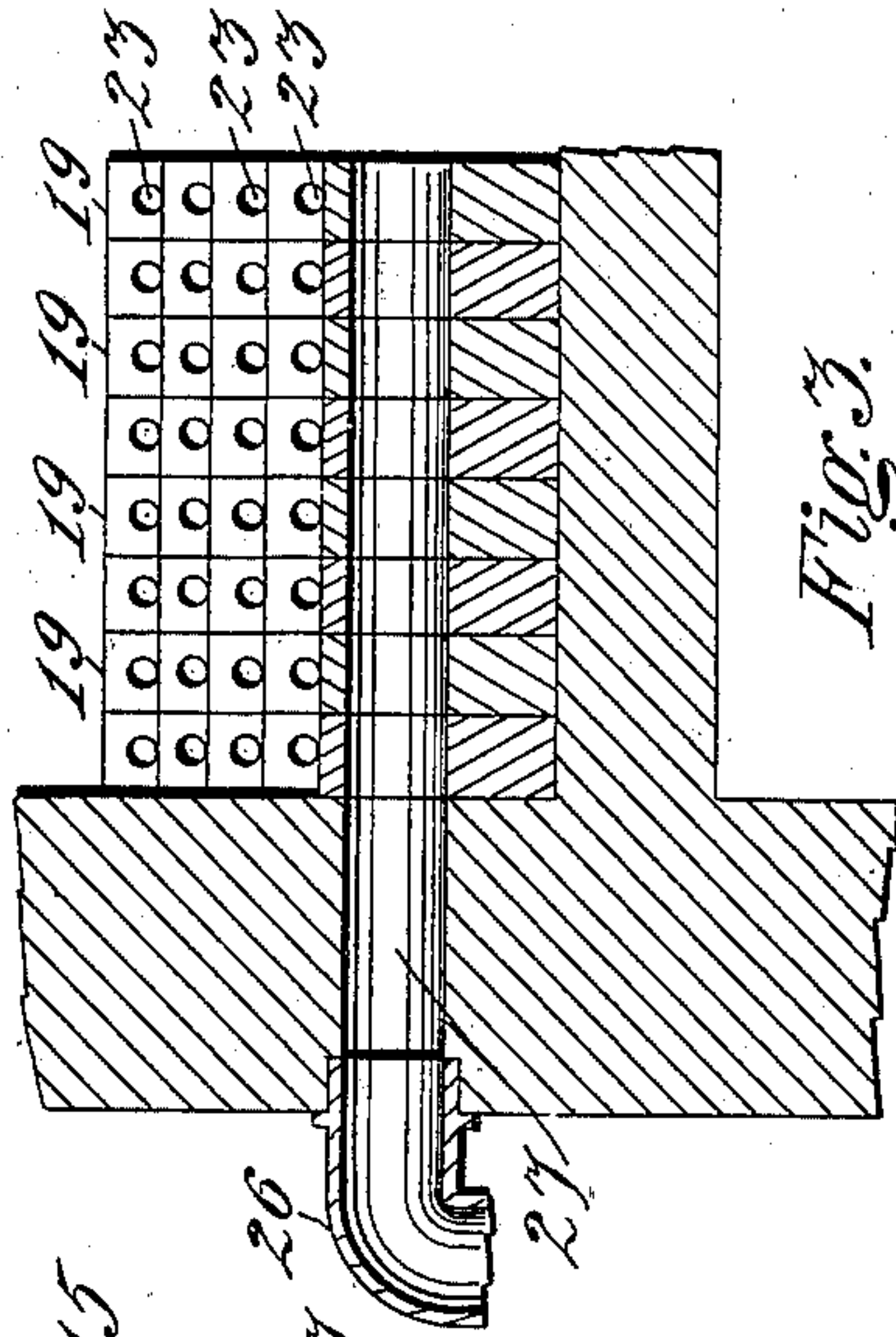
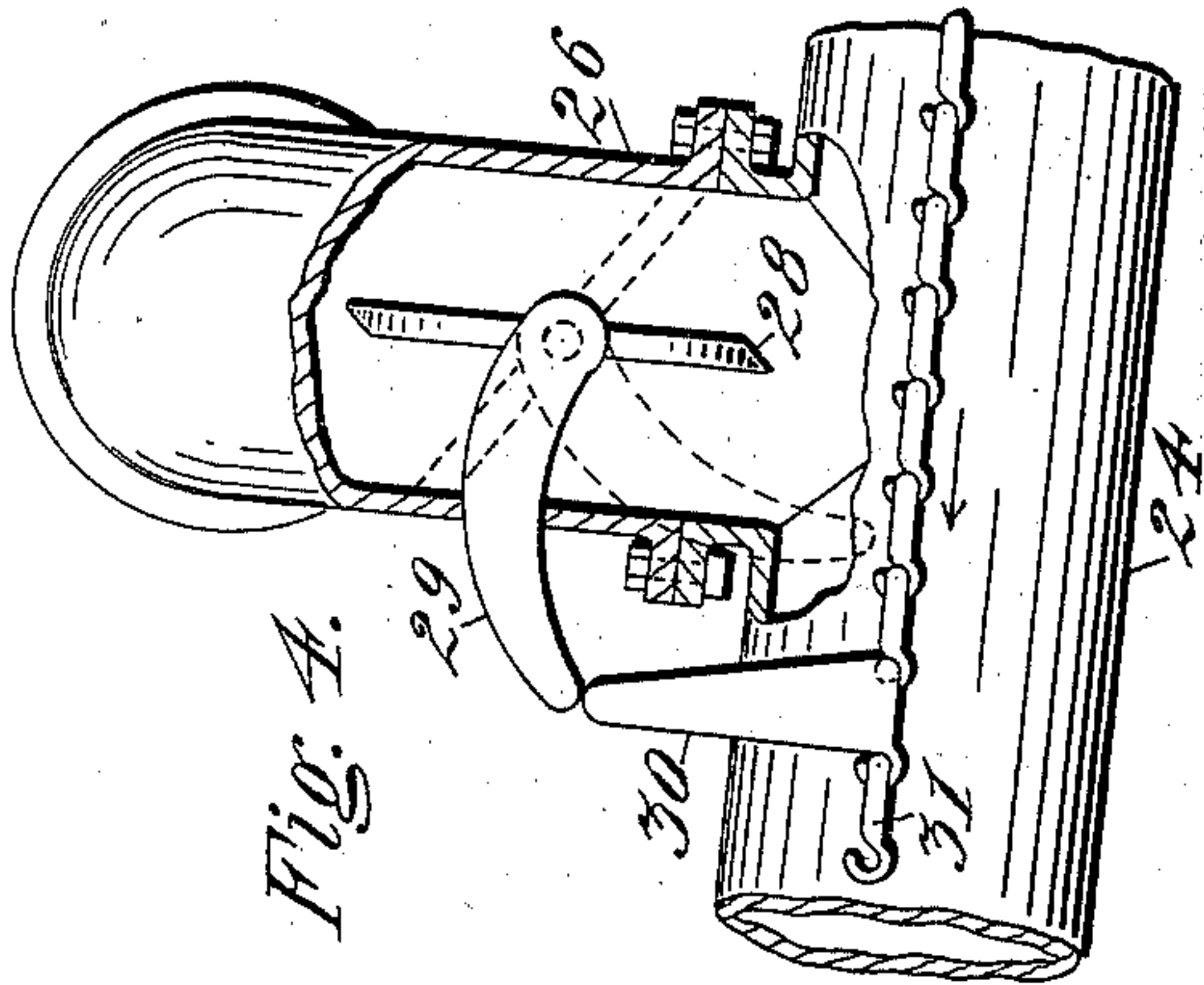
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2 Sheets—Sheet 2.



Witnesses,
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UNITED STATES PATENT OFFICE.

ALFRED E. JOHNSON, OF VICTOR, COLORADO.

CALCINING OR ROASTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 656,580, dated August 21, 1900.

Application filed March 26, 1900. Serial No. 10,159. (No model.)

To all whom it may concern:

Be it known that I, ALFRED E. JOHNSON, a citizen of the United States of America, residing at Victor, in the county of Teller and State of Colorado, have invented certain new and useful Improvements in Calcining or Roasting Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in calcining or roasting furnaces, my object being to cause the ore or other material to travel over the hearth without the aid of mechanical devices moving on the hearth or within the furnace-chamber and to facilitate oxidation by bringing atmospheric air intimately in contact with the air particles. The difficulty of using traveling mechanical devices in a furnace of this character consists in the fact that owing to the degree of heat necessary to produce the required result upon the ore these devices soon get out of repair and are therefore useless.

My improvement consists, generically, in the introduction of air to the hearth in such a manner as to cause the ore to travel thereover, thus obviating the necessity of any moving mechanical parts located within the furnace.

The invention will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a side view of my improved furnace, shown partly in elevation and partly in section. Fig. 2 is a cross-section taken on the line X X, Fig. 1, viewed in the direction of the arrow. Fig. 3 is a fragmentary cross-section taken through one of the branch pipes of the air-conduit, the parts being shown on a larger scale than in Figs 1 and 2. Fig. 4 is a fragmentary view of the air-conduit and branch pipe shown partly in section, the parts being still further enlarged.

Similar reference characters indicating corresponding parts in the views, let the numeral 5 designate the body of the furnace, in the front part of which is formed the fire-box

6, provided with a suitable grate 7, beneath which is located the ash-pit 8. Doors 9 and 10 are adapted to close openings communicating with the fire-box and ash-pit, respectively. Beneath the ash-pit is a receptacle 12, into which the ore is discharged after treatment. The ore reaches this receptacle by way of a passage 13, leading from the longitudinal chamber 14, inclosed by the outer walls, which are reinforced by the buckstays 15. The side walls of the furnace are provided with openings 16, normally closed by doors 17, which permit access to the hearth from the outside whenever occasion requires. As shown in the drawings, the hearth 18 is inclined from the rear extremity of the furnace downwardly toward the passage 13, which is located immediately in the rear of the bridge-wall 19^a. The surface of the hearth is stepped and composed for the most part of a number of transverse series of special fire-brick 19, each transverse series being located in a different horizontal plane. These special fire-brick 19 may be made of any desired size, and they are set into the fire-brick bed 20 of the furnace. The several series of fire-brick 19 are separated by partitions 21 of the bed. The bricks of each horizontal series of fire-brick 19 are provided with registering openings 22, forming a transverse passage from one side of the furnace to the other. (See Figs. 2 and 3.) From the opening 22 in each brick 19 leads a duct 23, forwardly terminating at the upper surface of a partition 21. The forward row of special fire-brick 19 are each provided with a forward extension 19^c, which is bent down to engagement with the rear inclined wall of the passage 13. The forwardly-extending ducts leading from the forward opening 22 are formed partly in the extension 19^c, whereby the air-jets are directed downwardly into the passage 13.

Suitably arranged along one side of the furnace, near the bottom thereof, on the outside is a conduit 24, connected at one extremity with a suitable blower 25, adapted to supply the conduit with air under suitable pressure. Communicating with these conduits and leading therefrom at suitable intervals are elbow-shaped branch pipes 26, which enter openings 27, formed in the side wall of the furnace and communicating with the openings 22 of

the special fire-brick 19. The quantity of air passing through each elbow-shaped pipe 26 is controlled by the valve 28, whose stem is journaled therein. One extremity of each valve-stem protrudes and is provided with a crank 29, of sufficient weight to hold the valve normally closed, as indicated by dotted lines in Fig. 4. As shown in the drawings, these valves are arranged to be intermittently and successively operated by means of trips 30, attached to an endless chain 31, suitably supported to be propelled alongside of the air-pipe, whereby the gravity-cranks 29 lie in the path of the trips 30 of the chain. This chain travels in the direction indicated by the arrows in Figs. 1 and 4 and may be provided with any desired number of trips 30, two being shown in the drawings.

The ore to be treated is fed to the rear or upper extremity of the hearth in any suitable manner. As shown in the drawings, a funnel-shaped pipe 32, communicating with the furnace-chamber 14, is located at the upper extremity of the furnace below the mouth of a hopper 33, from which the ore may be fed. It must be understood, however, that any suitable feed mechanism may be employed. The simplest possible form of feed construction is shown in the drawings, since nothing is claimed on this part of the apparatus. The ore being fed into the chamber 14 falls upon the upper extremity of the hearth and is acted on by air-jets from the uppermost elbow 26, which communicates with openings formed in the rear end wall of the furnace, similar to the passages 23 in the special fire-brick 19. The air acting on the ore drives it downwardly to the next step of the hearth, where it is in position to be acted on by the air from the rearmost series of passages 23, which carry it to the next step, where it is again acted on by the air, and so on until it has been made to travel the entire length of the hearth, after which it falls into the passage 13 and thence to the receptacle 12.

From the construction shown it will be readily understood that as the trip-carrying chain moves along, traveling in the direction indicated by the arrows in Fig. 1, the gravity-cranks will be acted on successively by the trips, whereby the air-jets act intermittently on the ore lying on each step of the hearth. While this is believed the preferred method of applying the air, it is evident that the air may be continuously delivered to the hearth, if desired. The period between the air discharges at each hearth-step or the successive hearth-steps may be regulated at will by increasing or diminishing the speed of the trip-chain's travel. The oxidizing effect resulting from the introduction of the atmospheric air jets to the hearth whereby the air is brought into the most intimate relation with the ore particles on the hearth is also believed to be an important feature of the invention.

The openings 16 are staggered or alter-

nately arranged on the opposite sides of the furnace, one opening being formed above each transverse series of special fire-brick 19.

As the ore propelled by the air-jets is traveling downwardly on the hearth the heat from the fire-box 6, together with the products of combustion, is traveling upwardly in the chamber 14 above the hearth and in the direction of the elbow-pipe 34, leading to the stack. (Not shown).

It must be understood that I do not limit the improvement to the details of construction herein shown and described, as I am aware that many other forms of construction may be employed without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim is—

1. In a calcining or roasting furnace, the combination with a suitable hearth, of means for introducing air thereto intermittently at suitable points whereby the ore is caused to travel longitudinally over the hearth.

2. In a calcining or roasting furnace, the combination of a suitable hearth provided with parallel transverse openings located at suitable intervals and provided with a series of ducts leading forwardly from each transverse opening and communicating with the furnace-chamber, and means for introducing air under pressure intermittently to the various transverse openings whereby the ore or other material is caused to travel over the hearth.

3. In a calcining or roasting furnace, the combination of a stepped hearth, and means for introducing air under pressure and in a series of jets at each step or level whereby the material under treatment is made to travel over the hearth.

4. In a calcining or roasting furnace, the combination of a stepped hearth, and means for introducing air under pressure successively at the different steps whereby the material under treatment is made to travel over the hearth.

5. In a calcining or roasting furnace, the combination of a stepped hearth, each step having a transverse opening and a series of forwardly-extending ducts communicating therewith and with the furnace-chamber, and means for introducing air under pressure to the said transverse openings of the hearth whereby the material under treatment is made to travel over the hearth.

6. In a calcining or roasting furnace, the combination of a stepped hearth, an air-conduit located outside the furnace, a pressure source connected with said conduit, transverse openings formed in the bed of the hearth and communicating with said conduit, and a series of ducts leading forwardly from each transverse opening and communicating with the furnace-chamber.

7. In a calcining or roasting furnace, the combination of a stepped hearth, an air-conduit located outside the furnace, a pressure

source with which the said conduit is connected, and branch pipes connected with said conduit, the wall and the hearth being provided with transverse openings leading from the branch pipes to the various steps each of which is provided with a series of ducts leading forwardly from said opening.

8. In a calcining or roasting furnace, the combination of a stepped hearth, an air-conduit located outside the furnace, a pressure source with which the said conduit is connected, branch pipes connected with said conduit, the wall and the hearth being provided with openings leading to the various steps and with which the branch pipes are connected, valves located in said branch pipes, valve-spindles, cranks mounted on the spindles and normally holding the valves closed, and exterior means arranged to engage the cranks and open the valves at suitable intervals.

9. In a calcining or roasting furnace, the combination of a stepped hearth, an air-conduit located outside the furnace, a pressure source with which said conduit is connected, branch pipes connected with said conduit, the wall and the hearth being provided with openings leading to the various steps and with which the branch pipes are connected,

valves located in said branch pipes, valve-spindles, cranks fast on the spindles and normally holding the valves closed, and an exteriorly-located endless chain provided with one or more trips arranged to engage the cranks and open the valves.

10. In a calcining or roasting furnace, the combination with the outer walls, of a hearth composed of a series of steps, each step being composed of a number of fire-clay brick arranged side by side and provided with registering openings, and passages leading forwardly from said openings.

11. In a calcining or roasting furnace, the combination with the outer walls, of a hearth composed of a series of steps, each step being composed of a number of fire-clay brick arranged side by side and provided with registering openings, passages leading forwardly from said openings, and suitable means connected with said openings for introducing air under pressure to said hearth-steps.

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

ALFRED E. JOHNSON.

Witnesses:

CHARLES M. TULLY,
C. H. LANING.