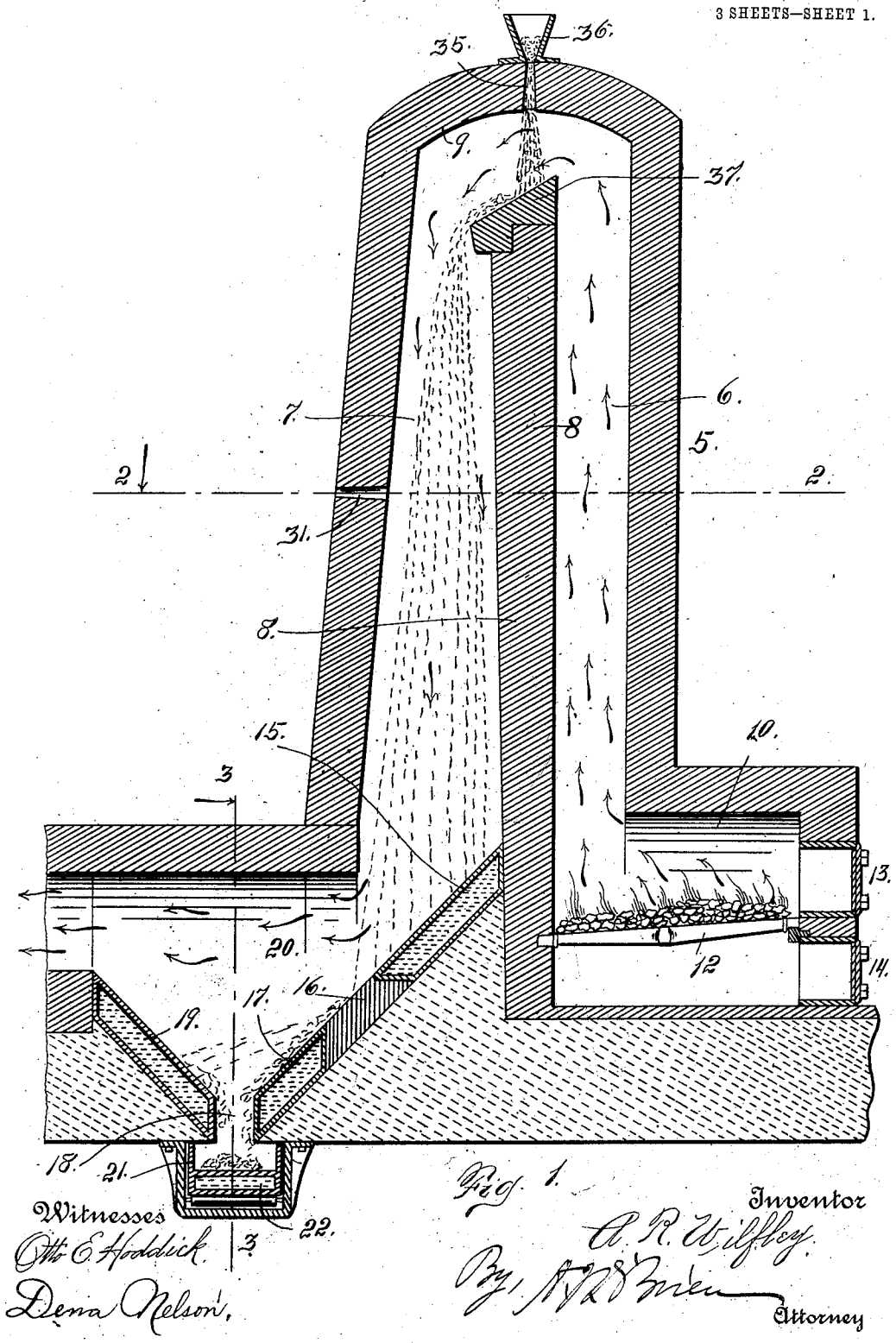
No. 898,024. PATENTED SEPT. 8, 1908.

A. R. WILFLEY.

ROASTING FURNACE.

APPLICATION FILED OCT. 13, 1906.

3 SHEETS—SHEET 1.



Witnesses
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Fig. 1.

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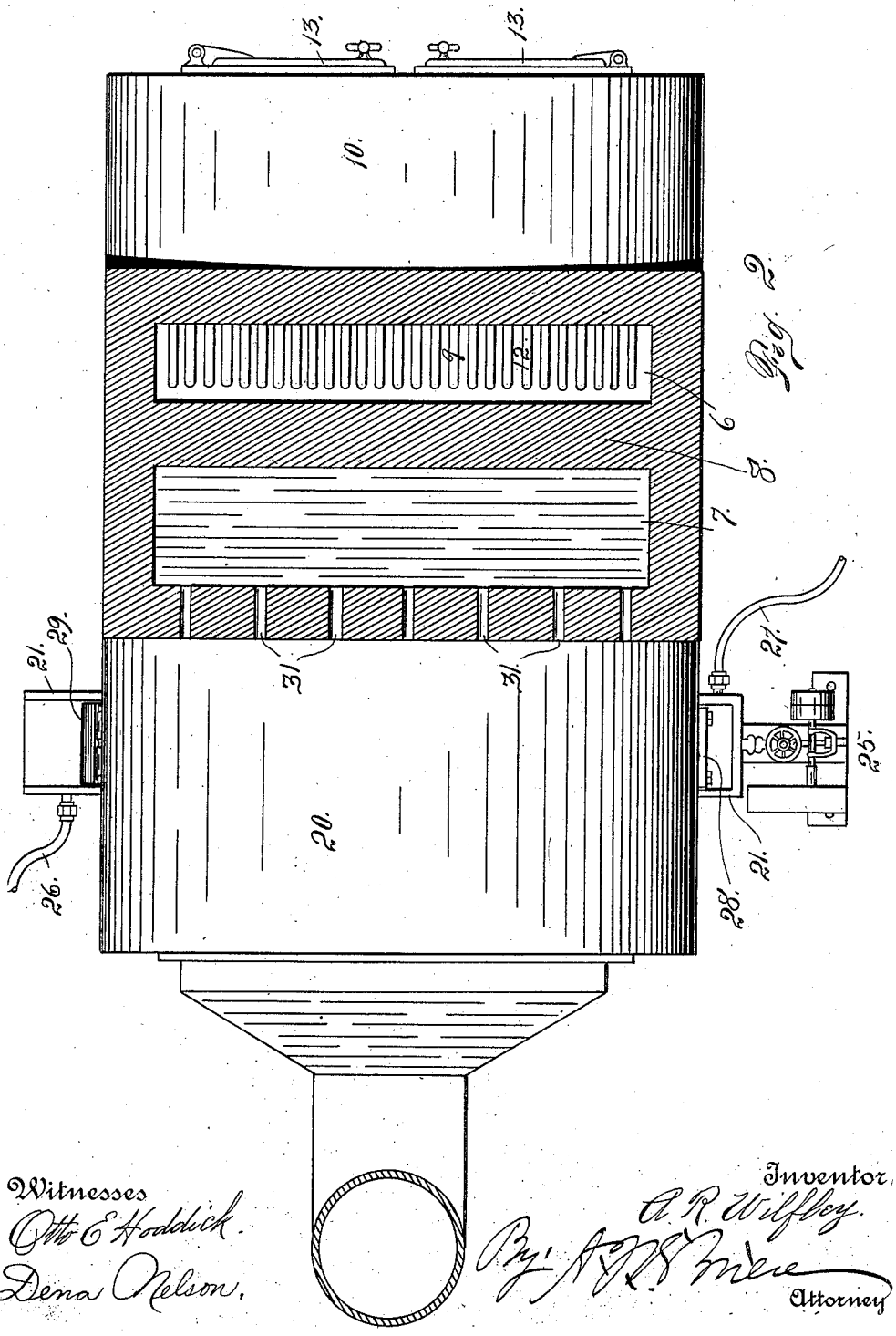

Fig. 2.

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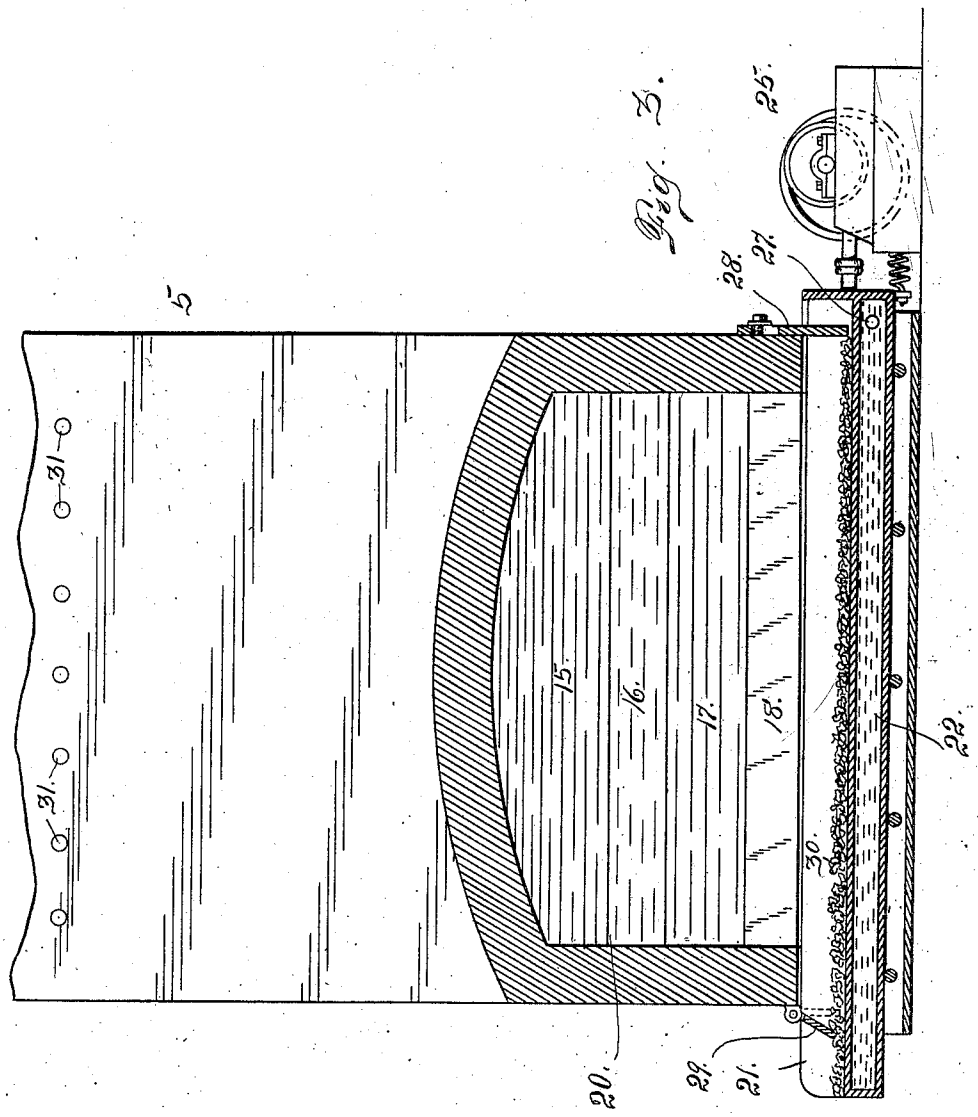
3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

ARTHUR R. WILFLEY, OF DENVER, COLORADO.

ROASTING-FURNACE.

No. 898,024. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed October 13, 1906. Serial No. 338,726.

To all whom it may concern:

Be it known that I, ARTHUR R. WILFLEY, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in 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 letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in roasting furnaces of the class adapted to produce a magnetic roast or a roast preparatory to the treatment of ores by magnetism, whereby the magnetic particles are separated from the non-magnetic particles. Heretofore so far as I am aware great difficulty has been experienced in obtaining a proper roast of this character, since it is very easy to overheat the ore and cause the particles thereof to become sufficiently soft or slightly fused, to cause them to cling or adhere together thus fouling or contaminating the particles and defeating the object of the roasting operation, since the clinging particles cannot be magnetically separated.

In my improved construction I make provision for subjecting the ore under treatment and while falling, to the action of a downwardly traveling current of hot air whereby the ore and hot air current are traveling in the same direction. Heretofore it has been attempted to obtain a roast of this character by dropping the ore downwardly in a shaft containing an upwardly traveling current of hot air and flame. This has resulted in overheating the finer or lighter particles of ore, and insufficiently heating the heavier particles of ore, for the reason that the falling or downward travel of the finer particles, is retarded by the upwardly traveling hot air current, while the heavier particles are of sufficient gravity to fall directly downwardly without obstruction. Hence the finer particles which require less time for roasting, are subjected to the heat during a longer period than the coarser particles, thus giving results exactly opposite those desired. By causing the ore to be treated, to move downwardly in the same direction as the heat current, this difficulty is overcome; and by providing a cooling medium preferably a water jacket at the bottom of the shaft or roasting compartment, with which the falling particles of ore come in contact, the evil influences of excessive heat (attended by the clinging of the ore particles together) are overcome. The finer particles of ore are immediately sufficiently cooled by contact with this jacket and it is these particles that are exceedingly liable to be heated too much; while the coarser particles, though only partially cooled by their first contact with the water jacket, will be sufficiently cooled before they leave the furnace, by reason of the extensive water jacketed surface with which they are brought in contact before they reach the atmosphere. In fact it is my intention to cool the entire body of ore beyond the roasting point before it reaches the outer air since if this is not done, the oxygen of the air uniting with the exceedingly hot ore, will produce an over-roast of the outer layer of the mass and thus counteract or retard the beneficial effects obtained within the furnace.

Having briefly outlined my improved construction as well as the function it is intended to perform, I will proceed to describe the same in detail reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a vertical section taken through a furnace equipped with my improvements. Fig. 2 is a cross section taken on the line 2—2 Fig. 1 looking downwardly. Fig. 3 is a section taken on the line 3—3 Fig. 1 looking toward the right, the upper portion of the furnace being broken away.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate an upright roasting chamber provided with two vertically disposed compartments 6 and 7 separated by a partition 8 whose upper extremity terminates a short distance below the arch 9 at the top of the furnace whereby the two flues or compartments 6 and 7 communicate with each other at the top. The lower extremity of the flue 6, is in communication with a fire box 10 having a grate 12, and doors 13 and 14 communicating with the fire box, and the ash pit, respectively.

The flue 7 is narrowest at the top and increases in size as it extends downwardly therefrom. At the bottom of this flue is located a water jacket member 15 which forms a bottom inclined downwardly from the par-

tition 8. Below this water jacket member 15 is a fire clay member 16, while below the last named member is another water jacket member 17. The three members 15, 16 and 17 are inclined in the same direction and form a continuous surface down which the ore slides as it leaves the flue 7. At the lower extremity of the water jacket member 17, is an outlet passage 18 while on the opposite side of this passage is a water jacket member 19 also sloping toward the said passage and adapted to guide downwardly into the said passage, any particles or pieces of ore which may bound from the inclined surface composed of members 15, 16 and 17. Some of the particles, particularly the larger particles, when they strike the inclined members at the bottom of the flues 7, are liable to bound across the chamber 20 and strike upon the opposite water jacket 19. When this occurs these particles as before stated are guided downwardly into the outlet passage 18 whence they pass into a vibrating trough or receptacle 21 provided with a water jacket bottom 22. Provision is made for imparting a longitudinal reciprocation or vibratory movement to this trough whereby the roasted ore is caused to travel toward the left referring to Fig. 3. The means for imparting the said movement may be of any suitable character and is designated in the drawing generally by the numeral 25. Suitable provision is made for the introduction of cooling water at one extremity of the jacket 22 and allowing it to pass out at the opposite extremity. In Fig. 2 of the drawing these inlet and outlet conduits are designated 26 and 27, respectively.

It is not desirable that the ore after reaching the vibrating trough, should be subjected to the action of the outer air or atmosphere. The rear extremity of the trough or that farther to the right in Fig. 3 is therefore practically closed by a depending gate 28, while to the opposite side of the furnace is attached a depending swinging gate 29 which hangs downwardly into the trough, but swings outwardly in response to the action of the traveling ore which is designated by the numeral 30. In this way the atmospheric air is practically excluded or kept away from the ore until the latter is fed out of the trough through the action of the vibrating movement of the latter; and by this time the ore will be sufficiently cooled to prevent any injury by reason of bringing it in contact with the air.

The outer wall of the flue or roasting compartment 7, is provided with a series of air inlet ports 31 which have a tendency to somewhat reduce the temperature of the ore while it is falling downwardly in the said flue. By reason of the fact that the flue expands as it extends downwardly from the top, the cooling action is further facilitated. Were it not for these features, the tendency of the downwardly falling ore would be to increase in temperature, owing to the combustible elements as sulfur contained therein.

From the foregoing description the use and operation of my improved roasting furnace will be readily understood. By supplying the fire box 10 with sufficient fuel, the necessary heat is generated and travels upwardly (under the influence of the draft of the stack not shown), through the flue 6, and then downwardly through the flue 7, and thence through the chamber 20 to the stack which must be of sufficient height to give the desired draft through the flues 6 and 7. The top 9 of the structure is provided with an inlet opening 35 whose upper extremity communicates with a hopper 36 into which the ore to be treated is first fed. This ore drops downwardly and strikes upon the upper extremity 37 of the partition wall 8. The upper extremity of this wall is inclined downwardly from the flue 6 to the flue 7, thus guiding the ore into the flue 7 and causing it to travel downwardly with the heat current from the furnace. During this downward travel, the combustible elements in the ore being subjected to the heat of the furnace, are sufficiently consumed for the purposes of the roast; while the expanding structure of the flue together with the inlet of a limited quantity of atmospheric air through the ports 31, prevent the ore from attaining too high a temperature; and finally by reason of the ore coming in contact with the cooling medium at the bottom of the flue 7, the evil effects of excessive heat are overcome and excellent results obtained.

Having thus described my invention, what I claim is:

1. A roasting furnace of the character described, comprising a source of heat, an upwardly extending flue connected with the heat source, means for feeding the ore to be treated whereby it shall enter the ore flue in the upper part of the latter, a cooling medium located at the bottom of the last named flue with which the falling ore comes in contact, said medium being of such a nature as to cause the falling ore to slide therefrom automatically, and means located at the bottom of the furnace for excluding the atmospheric air substantially as described.

2. An ore roasting furnace comprising a source of heat, a hot air flue leading upwardly from the heat source, an ore roasting flue communicating at the top with the upper extremity of the hot air flue, the ore flue being provided at its discharge extremity with a water jacketed bottom downwardly inclined whereby the ore is cooled and automatically caused to slide from the furnace, to a device that is free from atmospheric air for the purpose set forth.

3. A roasting furnace provided with an up-

wardly extending roasting flue, a source of heat communicating with said flue at the top which is also provided with an inlet for the ore to be treated, the flue having an inclined water jacketed bottom whereby the ore is caused to slide away from the roasting compartment, the structure being provided with an ore outlet at the lower extremity of the said inclined bottom beyond the limits of the flue, and vibrating means located underneath said outlet for receiving the ore and causing it to travel gradually out of the furnace.

4. A furnace of the class described, provided with an upright roasting flue having a feed opening at the top, a source of heat communicating with said flue at the top whereby the hot air is caused to travel downwardly through the said flue, the said flue being provided with a downwardly inclined water jacketed bottom, a discharge opening at the lower extremity of said bottom, a trough having a water jacketed bottom located underneath the outlet opening, and means for imparting a longitudinal vibratory movement to the said trough whereby the roasted ore is caused to travel out of the furnace.

5. A furnace of the class described provided with an upright roasting flue or compartment provided with a feed opening at the top, the said flue increasing in cross sectional area from the top downwardly, the bottom of the flue being provided with a cooling medium arranged to cause the ore to pass automatically beyond the path of the falling ore particles, substantially as described.

6. A roasting furnace of the character described comprising a source of heat, a hot air flue communicating at the bottom with said source of heat, a roasting flue communicating at the top with the hot air flue, the roasting flue expanding as it extends downwardly, the last named flue being provided with a downwardly inclined water jacketed bottom to cause the ore to slide beyond the limits of the flue, to a moving trough for the purpose set forth.

7. A furnace of the class described, provided with a fire box, a hot air flue leading upwardly from the said fire box, a roasting flue communicating at the top with the said hot air flue, the said roasting flue expanding from the top downwardly, a downwardly inclined water jacketed bottom at the lower extremity of the roasting flue, an auxiliary chamber communicating with the bottom of the roasting flue, and provided at the bottom with an ore outlet, a vibrating trough located below said outlet opening, and means located at the opposite extremity of the said trough for excluding atmospheric air, substantially as described.

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

ARTHUR R. WILFLEY.

Witnesses:

DENA NELSON,

A. J. O'BRIEN.