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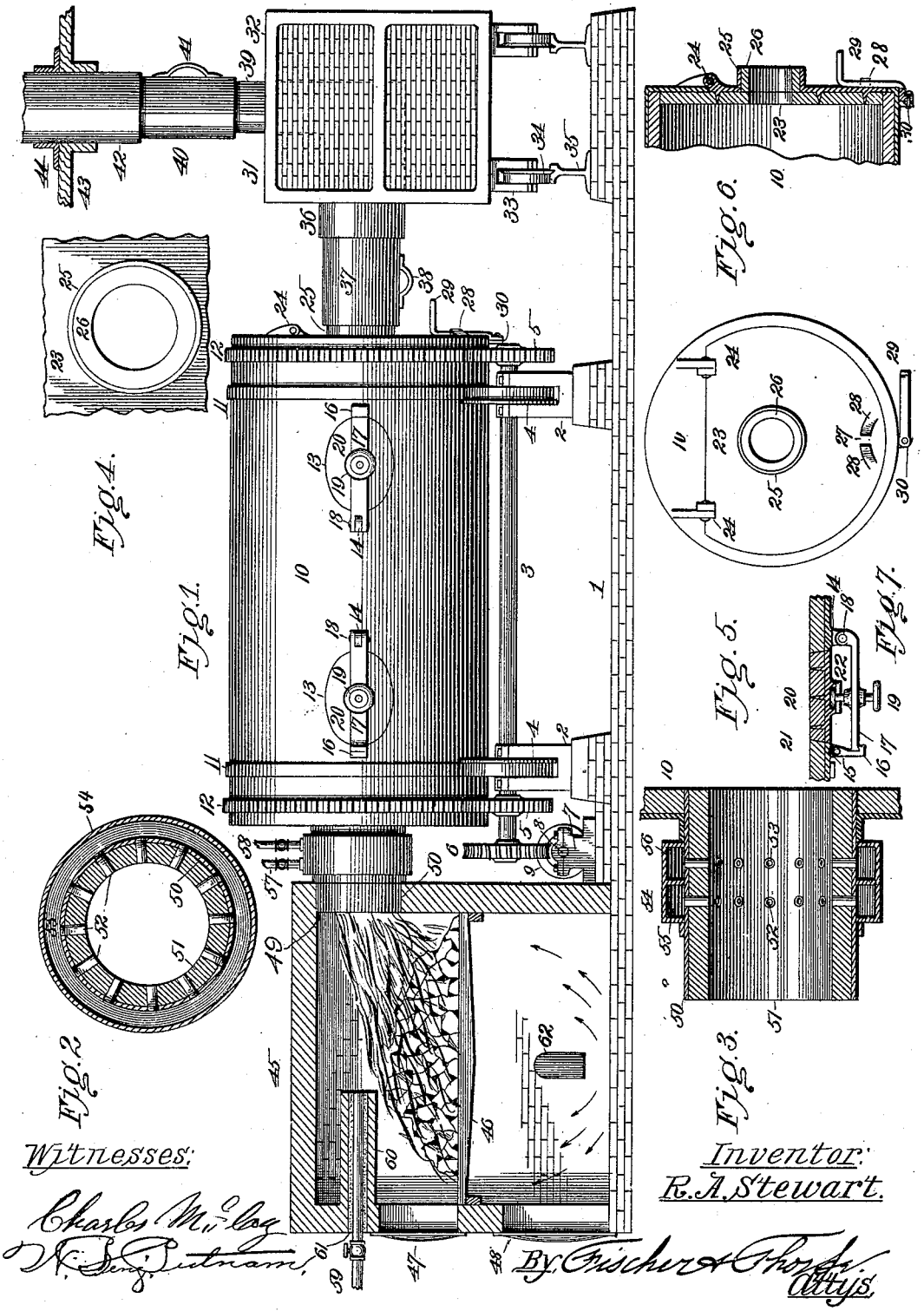
R. A. STEWART.

APPARATUS FOR OXIDIZING OR ROASTING REFRACTORY ORES.

(Application filed Dec. 15, 1899.)

(No Model.)



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APPARATUS FOR OXIDIZING OR ROASTING REFRACTORY ORES.

SPECIFICATION forming part of Letters Patent No. 645,761, dated March 20, 1900.

Application filed December 15, 1899. Serial No. 740,394. (No model.)

To all whom it may concern:

Be it known that I, ROBERT A. STEWART, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented a new and useful Apparatus for Oxidizing or Roasting Refractory Ores, of which the following is a specification.

My invention relates to apparatus for converting refractory into free-milling ore; and it consists in certain novel and peculiar features of construction and combinations of parts, as hereinafter described and claimed.

To the principle on which my invention is based, and, in fact, to the elements constituting the apparatus, I make no claim, except as regards their peculiarity of construction and arrangement and the advantages which such peculiarities impart in the reduction of refractory to free-milling ore.

One object, therefore, of my invention is to produce apparatus whereby the process of charging the apparatus with refractory ore and transforming such ore into free-milling ore and then discharging the latter into a convenient receptacle may be rendered more expeditious, and therefore economical, than has been possible heretofore; and a further object is to provide a construction whereby an ample supply of oxygen is introduced within the ore-cylinder to not only support combustion, but also to thoroughly and effectively oxidize the contents of the cylinder.

A still further object is to produce an apparatus which is of simple, strong, and durable construction.

In order that the invention may be fully understood, reference is to be had to the accompanying drawings, in which—

Figure 1 represents a view, partly in vertical section and partly in side elevation, of an apparatus embodying my invention. Fig. 2 is an enlarged cross-section of the cylinder-neck. Fig. 3 is a vertical longitudinal section of the cylinder-neck. Fig. 4 is a face view of part of the hinged door at the rear end of the cylinder, the same being illustrated on the same scale as Fig. 2. Fig. 5 is a view of the rear end of the cylinder. Fig. 6 is a vertical central section of the rear end of the cylinder. Fig. 7 is a section illustrating the means for securing the manhole-covers in position.

Referring to the drawings in detail, 1 designates a brick or other solid foundation, and 2 a set of bearing-standards erected thereon. 3 designates a shaft journaled in each longitudinally-alined pair of standards, and 4 flanged guide or supporting rollers journaled on said shafts within said standards. In practice there are four of these standards, arranged rectangularly with relation to each other, and in consequence two shafts and four rollers, in order to form a reliable support for the cylinder hereinafter described; but as this cylinder-supporting mechanism is not claimed as new it is shown only in side elevation, and as a result one pair of standards, one set of rollers, and one shaft only appear. Rigidly mounted on one of said shafts outward of its rollers 4 are the cog-pinions 5, and upon one end of the same shaft by preference is secured a worm-wheel 6.

7 designates one or more bearings erected on the foundation 1, and 8 a worm-shaft journaled therein and meshing with the worm-wheel 6, wheel 9 being belted or otherwise geared to a suitable motor for operating said worm-shaft and the parts in gear therewith, as will hereinafter appear.

10 designates a large oxidizing or roasting cylinder lined with fire-brick or equivalent material in the customary manner, and 11 a pair of bands shrunk or otherwise rigidly secured upon the cylinder and engaged by the flanged rollers 4 at opposite sides of and equal distances from the axis of the cylinder, the flanges of said wheels bearing against the inner edges of said bands to prevent any longitudinal movement or creepage of the cylinder.

12 designates large cog-rims secured rigidly upon the cylinder near its ends and meshing continuously with the cog-pinions 5, the latter thus serving to impart a slow rotating movement to the cylinder.

At suitable distances apart the cylinder is provided with the manholes 13 and at opposite ends of the same with the lugs 14 and 15. Hooks 16 are pivoted to the lugs 15 and when the cylinder is in operation are engaged by the free ends of the bridge-bars 17, pivoted,

as at 18, to the lugs 14. 19 designates clamping-screws extending operatively through the center of said bars and having their enlarged inner ends swiveled in the circular cavities 21, formed in the faces of the manhole-covers 20, the connection between the clamping-screws and said covers being made permanent by means of the plates 22, embracing the screws outward of their enlarged ends and secured rigidly to the covers.

When necessary to discharge the contents of the cylinder, the motion of the latter is arrested when the manholes are vertical with its axis. The operator in charge then turns the clamping-screws in the proper direction to move the bridge-bar 17 inward until the pivoted hook 16 can be thrown out of engagement therewith. As soon as this is accomplished the weight of the cover is sufficient to cause it to swing down with the bridge-bar to a vertically-pendent position and permit the greater part of the contents of the cylinder to escape through the manholes into a suitable receptacle placed to receive it. In this connection it may be stated that two manholes are employed in order to facilitate the operation of discharging the oxidized ore from the cylinder and of recharging the latter with refractory ore, this recharging of course taking place when the uncovered manholes are above the axis of the cylinder. The operation of securing the covers in position is the reverse of that above described—that is to say, the hook 16 is pushed to one side to permit the cover carried by the pivoted bridge-bar to be positioned in the hole, and then said hook is caused to overlap the free end of the bridge-bar 17 and the screw 19 turned in the opposite direction. The tendency of the screw to move forward is of course resisted as soon as the cover is seated tightly in the hole, and as the manipulation of the screw continues the bridge-bar is moved outward until it is clamped with great power against the said hook, the engaging surface of the bar and the lug being inclined, (see Fig. 5,) in order that there may be no possible chance of accidental disengagement when once properly secured together.

The rear end of the cylinder consists, in the main, of a door 23, which is hinged, as at 24, and is provided with a discharge-opening surrounded by a circular neck 25, lined with fire-brick 26, like the body of the cylinder, and vertically below said discharge-opening the door is provided with a notch 27, formed by and between the segmental cam-shoulders 28, cast with or secured to the door. The door is adapted to be locked reliably in its closed position by means of the lever 29, pivoted to the lug 30 of the cylinder and adapted to be forced upward over one inclined shoulder 28 or the other until it registers with and snaps back into the notch 27, thus locking the door reliably closed. To open the door, the lever is grasped and sprung outward slightly and then swung pivotally toward one side or the other, as shown in Fig. 5. After the door is unlocked it may be swung open and maintained in such position by a pulley and tackle (not shown) or any other suitable means in order that the operator may dislodge and discharge the remaining contents of the cylinder through either of the manhole-openings or said door-opening.

To make it possible to open the cylinder-door, I provide a stack 31, preferably of brick and inclosed in a suitable metallic frame 32 to hold it intact. This frame is provided with depending bearings 33, in which are journaled flanged wheels 34, mounted upon the track-rails 35, extending at right angles to the cylinder and secured upon the foundation 1 in any suitable manner. The stack also comprises the stationary sleeve 36 and the sliding sleeve 37, the latter at one end externally embracing the sleeve 25 of the cylinder and projecting into sleeve 36 at the other, and in order that it may be conveniently adjusted it is provided with one or more handles 38.

39 designates a stationary sleeve projecting upward from and forming part of the stack, and 40 a sliding sleeve mounted thereon, provided with a handle or handles 41. The upper end of the sleeve 40 projects into the stationary pipe 42, extending down through the supporting-platform 43 and provided with an angle-band 44, resting upon said platform.

When it is desired to obtain access to the cylinder through the door-opening in its end, the operator grasps handle 41 and slides sleeve 40 down upon sleeve 39 until the former is entirely disengaged from the stationary pipe 42. He then grasps handle 38 and slides sleeve 37 outward until it is entirely disengaged from sleeve 25. The stack may now be rolled along the track until the door is free to open to its widest extent. The reverse of the operation just described reassembles the stack in its proper relation to the cylinder, as will be readily understood.

45 designates a furnace erected at the front end of the cylinder and divided by the customary grate 46 into an upper or combustion chamber and the lower chamber or ash-pit, entrance to the former being controlled by a door 47 and to the latter by a door 48. At the rear end of the combustion-chamber is an opening 49, (shown only in Fig. 1,) in which is secured the cylinder 50, said cylinder forming a neck for and about which the roasting-cylinder 10 rotates, as shown in Fig. 3, said cylindrical neck being also lined with fire-brick, as shown at 51, and provided with two sets of radial pipes 52 and 53, extending through the wall of the neck and communicating at their outer ends with the annular chamber 54, said chamber being centrally partitioned to provide the steam-chamber 55 and the air-chamber 56, the former being connected to the valve-controlled steam-supply pipe 57 and the latter to the valve-controlled

air-supply pipe 58, through which pipes steam and air under pressure are adapted to be discharged radially into the cylinder for a purpose which is hereinafter explained.

59 designates a valve-controlled steam-pipe projecting into the combustion-chamber of the furnace and arranged to discharge a steam-jet axially through the neck-passage and into the roasting-cylinder, this pipe being protected by the inclosing fire-brick pipe 60 and the interposed lining 61, of asbestos. The steam from said pipe passing through and over the fire is superheated and decomposed by the union of its oxygen with the carbon from the gases of the furnace, thus increasing the efficiency of the latter. The force of the jet, with the assistance of an air-blast discharged from the pipe 62 down upon the bottom of the ash-pit, as indicated in Fig. 1, creates a forced draft through the furnace and the roasting-cylinder. The particular effect of this forced blast on the steam and air discharged into the neck-passage for the purpose of providing an ample supply of oxygen is to impart a rolling or spiral motion to the same, which tends to facilitate its expansion and accelerate the equalization of the heat, and as the discharge-passage is smaller than the supply-passage creates a pressure, which completes the expansion of this steam and air, and consequently imparts an equal degree of heat to the entire contents of the cylinder, which at this time is slowly revolving in order to gradually expose every particle of ore therein to the action of the steam and air, the sulfur given off by the ore mixing with the hydrogen of the gases and passing off through the stack. The unconsumed oxygen being absorbed by the ore causes the latter to be converted or transformed from refractory ore to oxidized or free-milling ore, as will be readily understood.

In practice the speed of revolution is such that it requires about forty minutes to complete one revolution of the cylinder; but the speed of revolution and the time, usually from one to two hours, which the ore is subjected to this treatment will depend, of course, on the quality or nature of the ores treated and the intensity of the heat generated, as will be understood.

As the operation or manipulation of the various parts has been described in detail, a recapitulation is believed to be unnecessary.

From the above description it will be apparent that I have produced an apparatus for oxidizing refractory ores possessing the features of advantage enumerated as desirable in the statement of invention, and it is to be understood, of course, that while I have illustrated and described the preferred embodiment of the invention I reserve the right to make such changes in its detail construction, form, proportions, or arrangement of the parts as properly fall within the spirit and scope of the claims.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An apparatus of the character described, comprising a rotary ore-retaining cylinder having a neck-passage, and an exit-opening of smaller diameter than said neck-passage, a furnace communicating with said neck-passage, a steam-pipe for discharging steam through the furnace and said neck-passage into said cylinder, and means for discharging steam and air into said neck-passage at an angle to the first-named steam-pipe, substantially as described.

2. An apparatus of the character described, comprising a rotary ore-retaining cylinder having a neck-passage, and an exit-opening of smaller diameter than said neck-passage, a furnace communicating with said neck-passage, a steam-pipe for discharging steam through the furnace and said neck-passage into said cylinder, a chamber encircling and adapted to discharge steam and air under pressure into said neck-passage, and valves for regulating and controlling the supply of steam and air to said chamber, substantially as described.

3. An apparatus of the character described, comprising a rotary ore-retaining cylinder having a neck-passage communicating with its front end, and an exit-opening of smaller diameter than said neck-passage, a furnace communicating with said neck-passage, a steam-pipe for discharging steam through the furnace and said neck-passage into said cylinder, means for discharging steam and air into said neck-passage at an angle to the first-named steam-pipe, and an air-blast arranged to discharge into the furnace, substantially as and for the purpose described.

4. In an apparatus of the character described, a rotary ore-retaining cylinder having a neck-passage and an exit-opening, a furnace communicating with said neck-passage, means for discharging steam and air into the furnace, a door closing the rear end of the cylinder, and provided with an exit-opening, a stack connected to said exit-opening, and means for disconnecting said stack from said exit-opening in order that the door may be opened, substantially as and for the purpose set forth.

5. In an apparatus of the character described, a rotary ore-retaining cylinder having a neck-passage and an exit-opening, a furnace communicating with said neck-passage, means for discharging steam and air into the furnace, a door closing the rear end of the cylinder, and provided with an exit-opening, a movable stack, and a sliding sleeve carried by said stack and connecting the same with said exit-opening, substantially as described.

6. In an apparatus of the character described, a rotary ore-retaining cylinder having a neck-passage and an exit-opening, a furnace communicating with said neck-passage, means for discharging steam and air

into the furnace, a door closing the rear end of the cylinder, and provided with an exit-opening and a surrounding neck, a stack comprising a vertical stationary portion and a movable portion, a pipe telescopically connecting the movable portion to the stationary portion and a pipe telescopically connecting the movable portion and said exit-opening neck, substantially as described.

7. In an apparatus of the character described, a rotary ore-retaining cylinder having a neck-passage, a furnace communicating with said neck-passage, means for discharging steam and air into the neck-passage, a door closing the rear end of the cylinder and provided with an exit-opening and a surrounding neck, a stationary track, and a stack consisting of a movable portion provided with wheels resting upon the said track and a stationary portion, the movable portion having pipes telescopically connected to the stationary portion and to the neck of the exit-opening, substantially as and for the purpose set forth.

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

ROBERT A. STEWART.

Witnesses:
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