No. 649,999. Patented May 22, 1900.

J. C. TELLER.

ORE ROASTING FURNACE.

(Application filed July 22, 1898.)

(No Model.) 5 Sheets—Sheet 1.

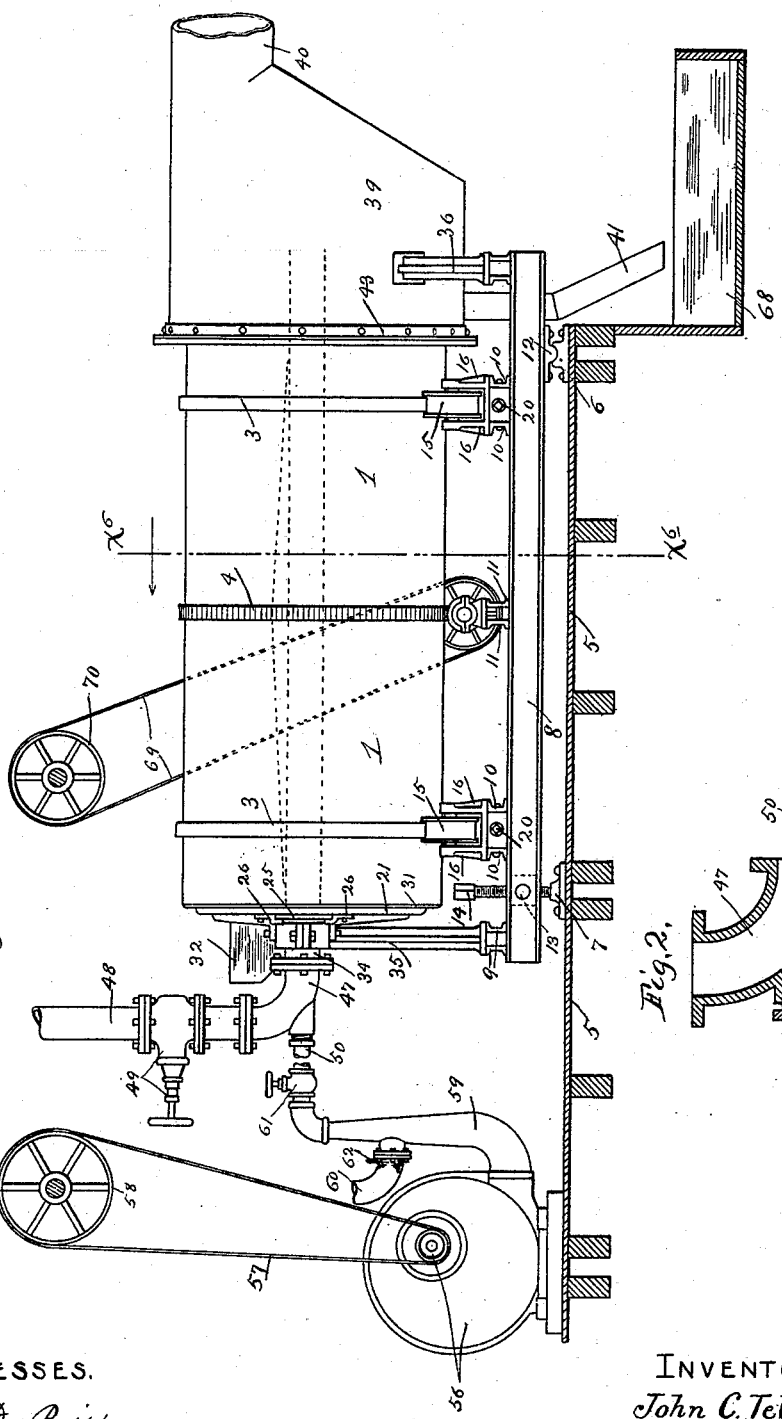

Fig. 1.

Fig. 2.

WITNESSES.

A. D. DuBois.

F. D. Merchant,

INVENTOR.

John C. Teller.

By his Attorney,

Jas. F. Williamson.

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(No Model.) 5 Sheets—Sheet 2.

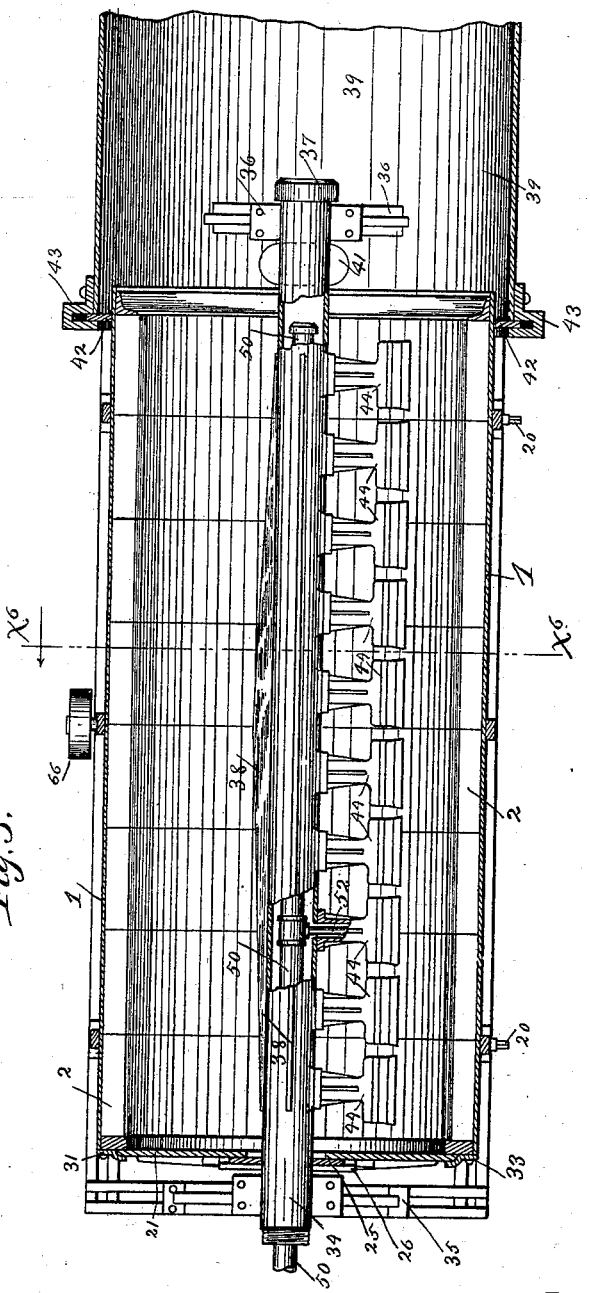

Fig. 3.

WITNESSES.

A. D. Du Bois.

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Fig. 5.

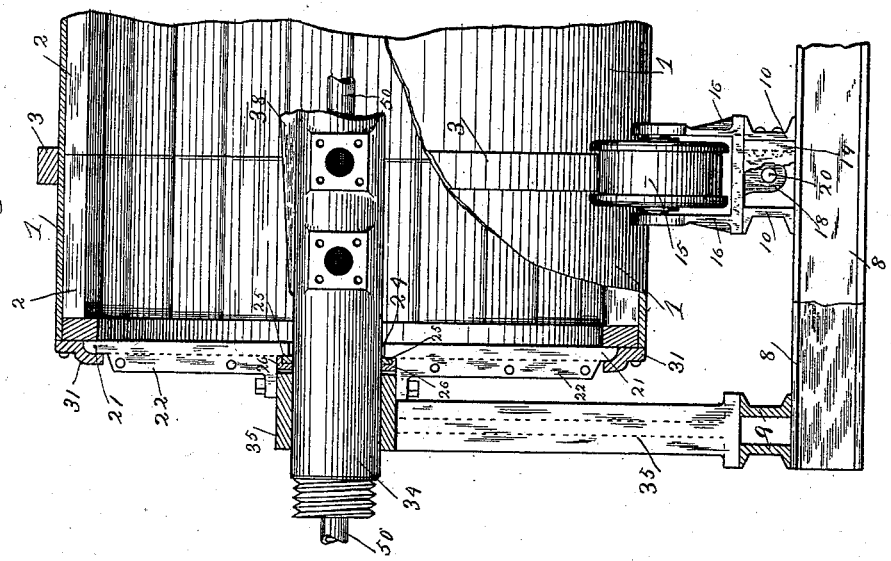
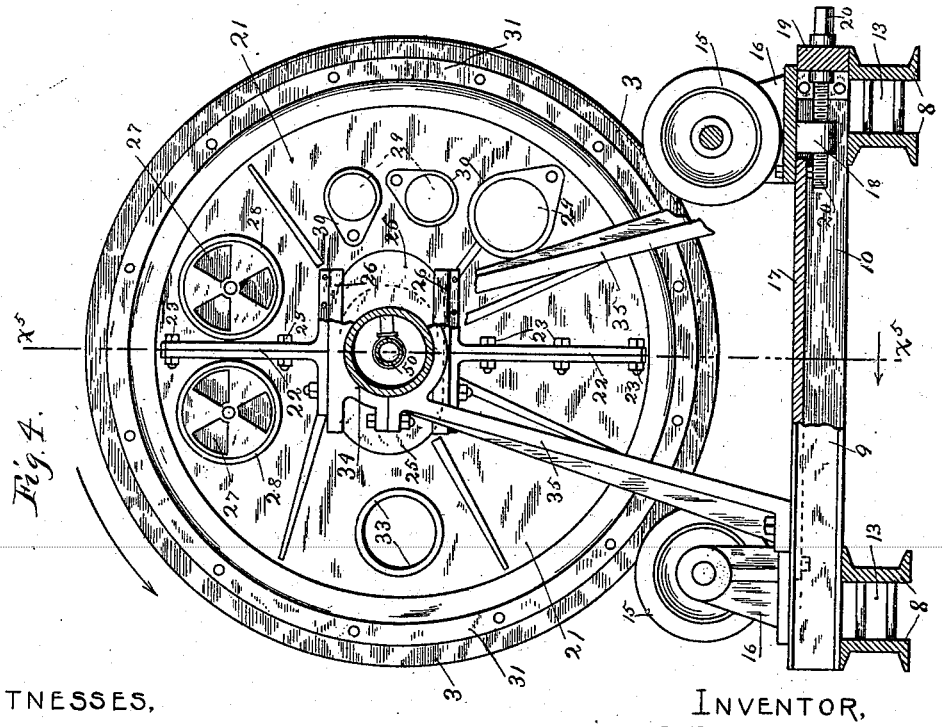


Fig. 4.



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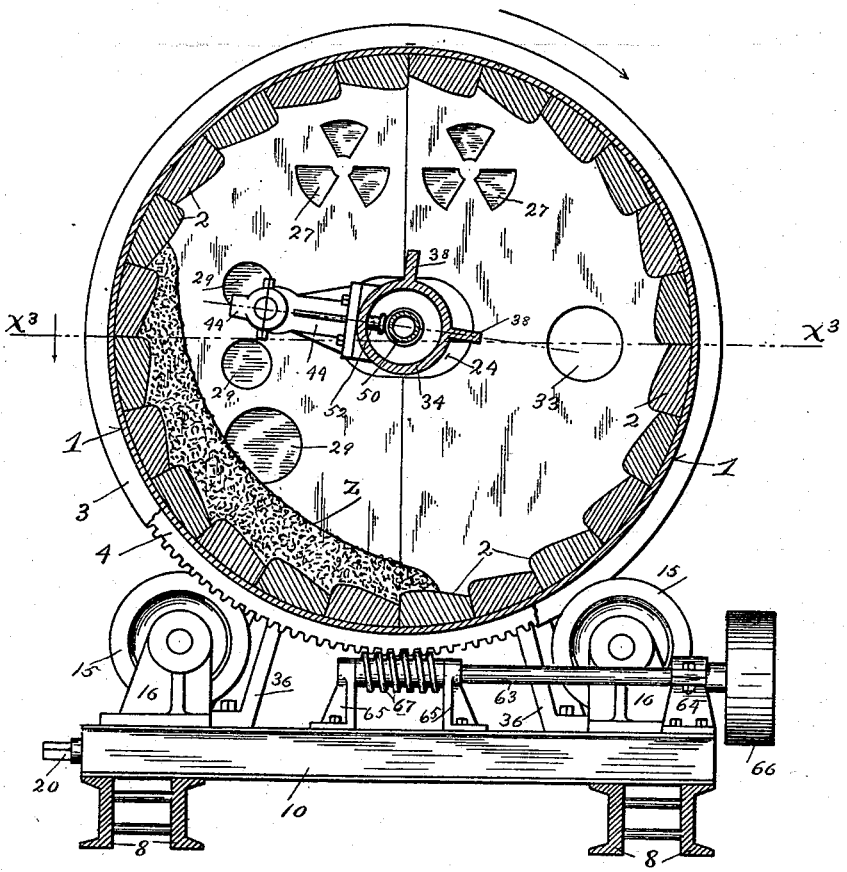
(No Model.) 5 Sheets—Sheet 4.

Fig. 6.



WITNESSES,
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ORE ROASTING FURNACE.

(Application filed July 22, 1898.)

(No Model.) 5 Sheets—Sheet 5.

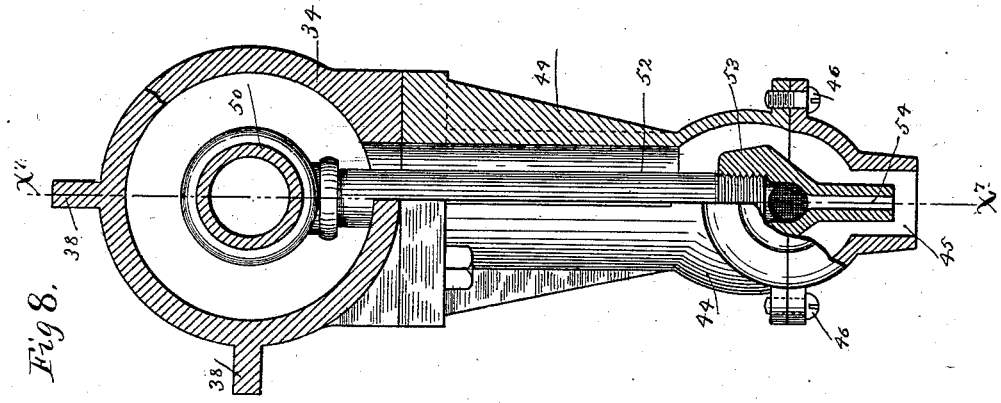

Fig 8.

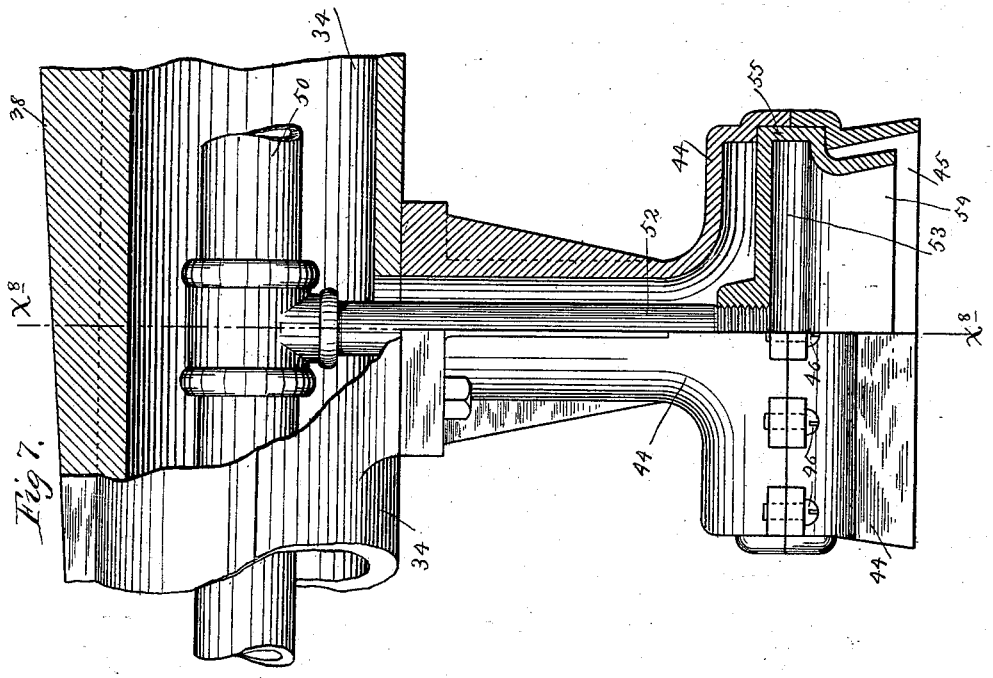

Fig 7.

WITNESSES,

A. D. DuBois.

F. D. Merchant.

INVENTOR,

John C. Teller

By his Attorney

Jas. F. Williamson

UNITED STATES PATENT OFFICE.

JOHN C. TELLER, OF MINNEAPOLIS, MINNESOTA.

ORE-ROASTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 649,999, dated May 22, 1900.

Application filed July 22, 1898. Serial No. 686,566. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. TELLER, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Ore-Roasting Furnaces; and I do hereby 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.

My invention has for its object to provide an improved apparatus for the treatment of refractory ore.

The invention will be hereinafter described, and defined in the claims.

The preferred form of my apparatus is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Figure 1 is a view principally in side elevation, but with some parts shown in section and others broken away. Fig. 2 is a vertical longitudinal section of an elbow-joint used in the device. Fig. 3 is a horizontal section taken centrally and longitudinally through the rotary drum and other parts on the line x^3 x^3 of Fig. 6. Fig. 4 is a front elevation of the apparatus with the breeching removed and some parts shown in section. Fig. 5 is a view principally in vertical central section on the line x^5 x^5 of Fig. 4, but with some parts left in full, showing the front end of the rotary drum and its mountings. Fig. 6 is a transverse vertical section taken on the line x^6 x^6 of Figs. 1 and 3. Fig. 7 is a detail view, partly in plan and partly in horizontal section, on the line x^7 x^7 of Fig. 8, showing one of the twyers and its connecting supply-pipes; and Fig. 8 is a view of the parts shown in Fig. 7, partly in end elevation and partly in section, on the line x^8 x^8 of Fig. 7.

The main body of the roaster is in the form of a large rotary drum or cylinder 1, the interior of which is lined with fire-brick 2, the sections of which form the drum with a corrugated or stepped interior surface. Near its ends the drum or cylinder 1 is provided with a pair of annular flanges or hoops 3, and at its intermediate portion it is provided with an annular screw-gear 4. This drum is mounted as follows:

5 indicates the floor of a building or structure, on which fulcrum-sockets 6 and bearing-plates 7 are rigidly secured.

8 9 10 11 indicate a tilting platform of skeleton form, made up of the parallel longitudinal channel-irons 8 and the transverse pairs of channel-irons 9, 10, and 11, rigidly secured thereto. Near their rear ends the pairs of channel-irons 8 are provided with fulcrum-blocks 12, that are seated in the fulcrum-socket 6, and near their forward ends each pair of channel-irons 8 is provided with a nut-block 13, through which vertical adjusting-screws 14 work, with their lower ends bearing one on each of the bearing-plates 7. By means of these screws 14 the skeleton platform may be tilted on its fulcrum 6 12.

15 indicates bearing-sheaves or flanged rollers that work in pairs on the annular hoops 3, and thus support the cylinder or drum 1. These supporting-rollers 15 are pivotally mounted between the prongs of bearing-heads 16, that rest upon and move over the upper edges of the channel-beams 10. The bearing-brackets 16 are connected in pairs by transverse tie-bars 17, which space the members apart a fixed distance and cause the same to move together. The brackets 16, which are at one side of the machine, are provided with depending nut-blocks 18, and the adjacent ends of the beams 10 are rigidly secured together by spacing-blocks 19.

20 indicates screw-rods that are swiveled, one in each of the bearing-blocks 19, and work with screw-threaded engagement through the coöperating nut-blocks 18. The outer ends of these screw-rods 20 are provided with angular heads, to which a wrench may be applied to turn the same, and thus force the pairs of supporting-rollers 15 transversely of the tilting frame. It is obvious that when the pairs of supporting rollers or sheaves 15 are adjusted transversely of the machine the drum or cylinder 1 will be correspondingly adjusted without being raised or lowered by such movement.

The forward or receiving end of the cylinder or drum 1 is closed by a fixed disk-like head 21, which, as shown, is formed in two sections secured together by flanges 22 and nutted bolts 23. Opening through the center of the head 21 is a transversely-elongated

passage 24, which is kept closed by a slide 25, that works in keepers 26 on said head 21. In the upper portion of the fixed head 21 is a pair of draft-passages 27, adapted to be opened and closed by ordinary dampers 28. The head 21 is also provided with a plurality of sight-openings 29, that are opened and closed by pivoted lids or covers 30. The peripheral edge of the fixed head 21 works in the groove or annular seat formed in an annular band 31, secured to the receiving end of the drum or cylinder 1. The ore to be treated is introduced into the drum from a hopper 32 or other source of supply, which hopper has a neck or delivery-spout 33, that opens through said head 21, approximately in horizontal line with its center.

A large gas-supply pipe or tube 34 passes through the center of the sliding cover 25 and extends longitudinally through the drum 1 at a point slightly above its axis. The receiving end of this pipe or tube 34 is rigidly secured in the upper portion of a vertical standard or supporting-bracket 35, that is rigidly secured to the forward pair of transverse channel-bars 9. Likewise the rear end of the pipe or tube 34 is rigidly secured in a similar bracket 36, that rises from and is rigidly secured to the rear pair of transverse angle-bars 9. This rear end of the pipe 34 is closed by a cap 37. As preferably constructed, this pipe 34 is provided with a plurality of longitudinal stiffening-ribs 38, which assist in preventing the same from warping out of shape under the action of the heat within the furnace. It will be noted that the delivery end of the drum or cylinder 1 is left entirely open. In the particular arrangement shown this cylinder or drum is arranged to discharge into a breeching or case 39, which is provided with a gas-draw-off tube 40 and a depending discharge-spout 41, through which the roasted ore will be precipitated by gravity as it is discharged into said breeching from said drum. As shown, a tight joint is formed between the delivery end of the drum 1 and the receiving end of the breeching 39 by means of an annular packing-ring 42, that works in a suitable seat formed in an annular keeper 43 on said breeching. Of course this breeching 39 does not rotate with the drum. The packing-ring 42 should have sufficient play in its seat in the keeper 43 to permit the required lateral adjustments of the drum or cylinder 1 for a purpose to be hereinafter explained, or some other suitable provision should be made to permit of the required movement of the drum with respect to said breeching.

On one side the pipe or tube 34 is provided with a plurality of twyers or discharge-heads 44. The nozzles or discharge ends of these heads 44 are elongated longitudinally of the drum 1 and are provided with correspondingly-elongated discharge-openings 45. As shown, the extremities of the heads or twyers 44 are removable, the sections being rigidly secured together by screws 46.

To the receiving end of the pipe 34 an elbow-section 47 is attached, and to this elbow-section 47 is attached a supply-pipe 48, which leads from the source of gas-supply and is provided with a gate-valve 49 for turning on and shutting off the gas. An air-supply pipe 50, which in diameter is considerably less than the pipe 34, extends longitudinally through said pipe 34 and through the elbow 47. Where it passes through the elbow 47, said elbow is provided with a stuffing box or gland 51, that forms a gas-tight joint between the same and said air-pipe 50. Within the pipe 34 the air-pipe 50 is provided with projecting branches 52, that extend one through each of the twyers or heads 44 and terminate in nozzle-sections 53. These nozzle-sections 53 are elongated nearly, but not quite the extent of the openings in the nozzles of the twyers 44, and they are provided with narrow elongated discharge-openings 54. Said nozzle-sections 53 are provided with hub-like projections 55, that are held in suitable seats formed in the sections of the twyers 44. The construction just described is such that the air will be discharged from the twyers in the form of a long thin blade or blast, while the gas will be discharged in an endless rectangular band entirely surrounding the blast of air. It should be noted that the nozzles 54 terminate inward of the discharge extremities of the mouths 45. In virtue of this arrangement the suction or draft produced in the gas-pipe by the air-blast is greatly increased, so that an action resembling very much the action of an atomizer is produced. Otherwise stated, the force of the blast produced through the air-pipe and twyers will vary the flow of the gas without varying the normal pressure on the gas within the storage-gasometer or other source of gas-supply. The plurality of twyers located side by side, as shown, will produce a flame which will extend nearly the entire length of the drum or cylinder 1. This flame may be given great intensity by producing a strong blast through the air-supply pipe. This air-blast may be produced in any suitable manner and by any suitable means. As shown, it is produced from a fan 56, driven from a belt 57 and pulley 58 and connected to said air-pipe 50 by a spout 59, having a relief branch 60. The pipe 50 is shown as provided with a gate-valve 61, and the branch 60 is provided with a valve 62. By opening and closing the valve 62 the intensity of the blast from the twyers may be varied without varying the speed of the fan.

The drum or cylinder 1 is given a slow but continuous rotary motion from a power-driven shaft 63, mounted in bearings 64 65 on the tilting platform and provided at its outer end with a pulley 66 and provided at its inner end with a worm or screw 67, which is in mesh with the annular screw-gear 4 on said drum. The drum is rotated in the direction indicated by arrows marked on Figs. 4 and 6. In Fig. 1, 68 indicates a catch-box into which

the roasted ore is discharged from the spout 41, and in Fig. 6 *z* indicates the crushed ore contained within the drum 1. As shown, the shaft 63 receives motion from a belt 69, that runs over the pulley 66 and over a power-driven pulley 70. Some sort of a flexible joint or yielding section (not shown) would in practice be provided in the section 59 to permit the adjustment of the drum.

The operation of the mechanism above described is substantially as follows: By means of the screws 14 the tilting platform and the rotary drum supported thereby may be given the desired incline or tilt necessary to cause the travel of the ore through the drum at the desired speed, and this incline of the drum, and hence the rate of travel of the ore therethrough, may be varied at will. As previously stated, the ore is supplied to the hopper 32 and is fed into the receiving or forward end of the drum through the spout or tube 33 and after having been acted upon by the burning gases within the drum, will be discharged into the breeching 39, from whence the gases will be drawn off through the neck 40 and the roasted ore will be discharged through the spout 41. Now it is very important to note (see particularly Fig. 6) that the twyers 44 are located above the axis of the drum and are inclined slightly upward in the direction of their discharge ends. Under the rotation of the drum the body or mass of the pulverized ore within the drum will be carried upward in the direction of the rotation of the drum, and if the drum be driven at the proper speed the mass of ore will be carried upward to a point above a horizontal line intersecting or approximately intersecting the axis of the drum. Otherwise stated, the drum should be so speeded that under centrifugal motion the ore will not commence to roll backward under the action of gravity until the upper portion of the mass has been carried sufficiently far above the level of the burner-tips to cause the particles to loosen up and fly from the mass and fall down through the flames from the burners. Otherwise stated, the flames are applied to the flying or loosened particles of the ore which are projected from the mass thereof at the turnover when the force of gravity begins to exceed the force of the centrifugal motion. Still otherwise stated, the flames project through the loosened particles at or just below the overturn or roll-back of the stock. Hence the flames act upon the particles in a loosened-up or flying condition as they are projected from the mass of the stock under the coöperation of gravity and the centrifugal forces. The flames thus enveloping the particles in a loosened or partly-detached condition operate thereon in an extremely-effective way.

This novel method is made the subject-matter of a divisional application filed by me of date September 28, 1899, under Serial No. 731,909, entitled "Method of treating refractory ores."

When a greater or less body of ore is kept within the drum, the twyers require adjustment with respect to the drum, so as to bring the nozzles or discharge ends of the twyers proper distances from the body of ore acted upon. This I accomplish by shifting the drum and its supporting-sheaves 15 transversely of the tilting support, this being readily effected by means of the adjusting-screws 20, as previously indicated.

The action of the twyers and the manner in which they cause the gas and air to be commingled and the former to be variably fed by a variation of the intensity of the latter has probably already been clearly stated. However, it may be added that to commingle these fluids—gas and air—immediately inward of the point of combustion produces the most satisfactory results, and so far as I am aware is novel in an apparatus of this character. By means of the dampers 28 an additional supply of air may be let into the drum. In practice I would usually provide a fan or other suction device for producing a forced suction in the gas-discharge tube 40, and hence also in the breeching 39 and drum 1.

It will of course be understood that various alterations in the specific details of construction above described may be made within the scope of my invention, as herein disclosed and claimed.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In an apparatus for the treatment of ores or similar material, the combination with a rotary drum, of the gas-supply pipe 34 and air-supply pipe 56, the former surrounding the latter and extending through said drum, and one or more laterally-projecting twyers consisting of the outer section 44 opening from the gas-pipe 34 and provided with the elongated discharge-opening 45, and the inner stem-sections 52 provided with the elongated nozzle-section 53, terminating within and located concentric of said opening 45, substantially as described.

2. In an apparatus of the character described, the combination with guide rollers or sheaves connected in pairs for adjustment transversely of the machine, of a rotary drum mounted on said supporting rollers or sheaves and laterally adjustable therewith, and a relatively-fixed supply pipe or passage extending into the interior of said drum, and provided with twyers, substantially as described.

3. In an apparatus of the character described, the combination with guide rollers or sheaves, connected in pairs and adjustable by means of coöperating screws and nuts, of a rotary drum mounted on said supporting rollers or sheaves and laterally adjustable therewith, and a relatively-fixed gas-supply pipe extended longitudinally through said drum and provided with laterally-projecting twyers, substantially as and for the purposes set forth.

4. In an apparatus of the character described, the combination with guide rollers or

sheaves connected in pairs, of a rotary drum mounted on said supporting rollers or sheaves and laterally adjustable therewith, means for adjusting said pairs of rollers or sheaves to move said drum laterally, and a relatively-fixed gas-supply pipe or passage extending into the interior of said drum and provided with twyers, substantially as described.

5. The combination with the rotary drum, of a gas-supply pipe extending into said receptacle lengthwise thereof, and provided with radially-projecting twyers in line with each other, having laterally elongated and flaring discharge extremities, with said parts so related as to give a continuous unbroken line of flame lengthwise of the drum, with the projecting jets from the respective twyers overlapping with each other at their outer ends, all substantially as and for the purposes set forth.

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

JOHN C. TELLER.

Witnesses:

JAS. F. WILLIAMSON,

BESSIE B. NELSON.