H. T. BENSON.

ORE ROASTING APPARATUS.

APPLICATION FILED AUG. 11, 1915.

1,171,583.

Patented Feb. 15, 1916.

2 SHEETS—SHEET 1.

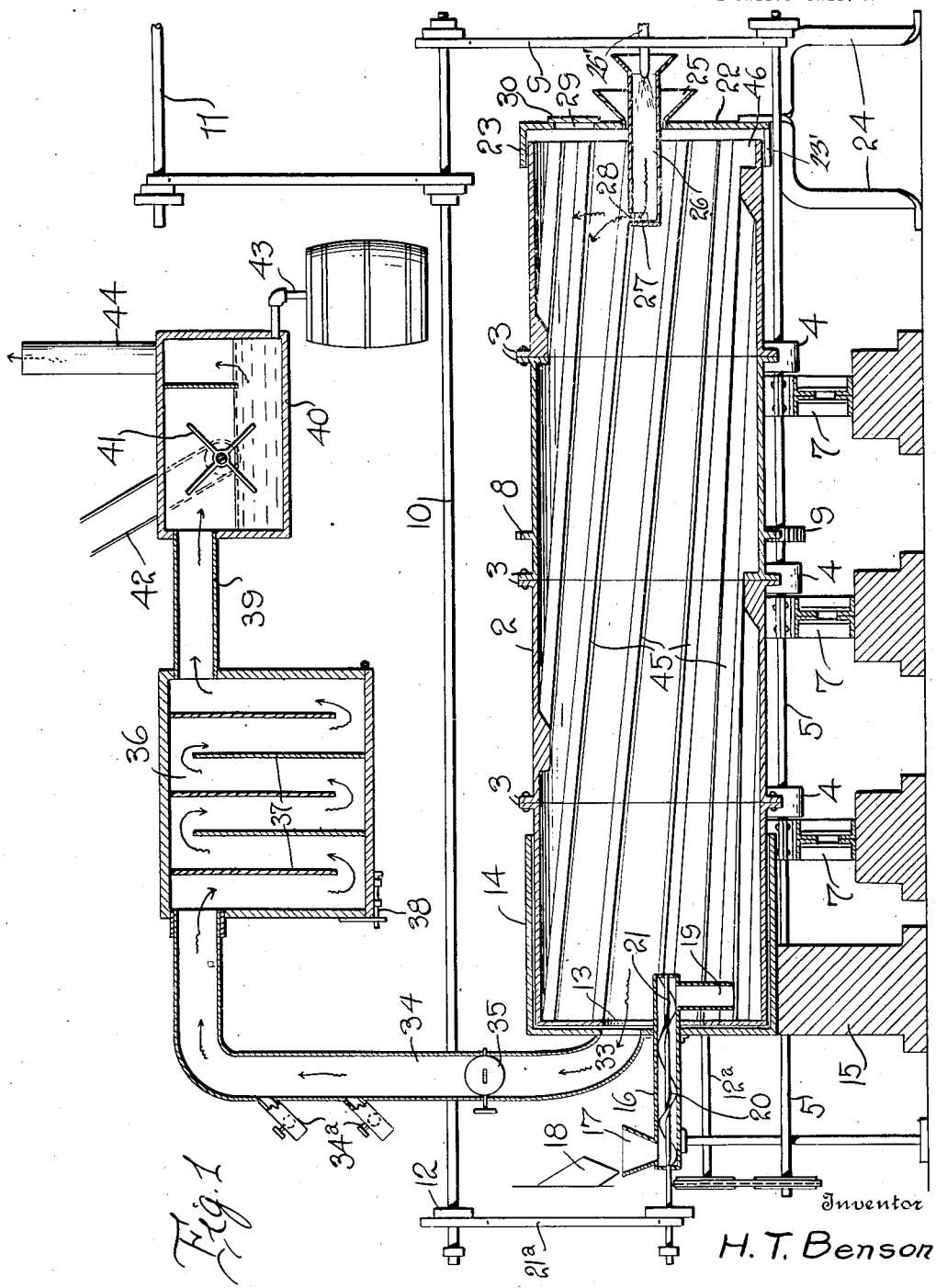


Fig. 1

Inventor

H. T. Benson

By Watson E. Coleman

Attorney

H. T. BENSON.

ORE ROASTING APPARATUS.

APPLICATION FILED AUG. 11, 1915.

1,171,583.

Patented Feb. 15, 1916.

2 SHEETS—SHEET 2.

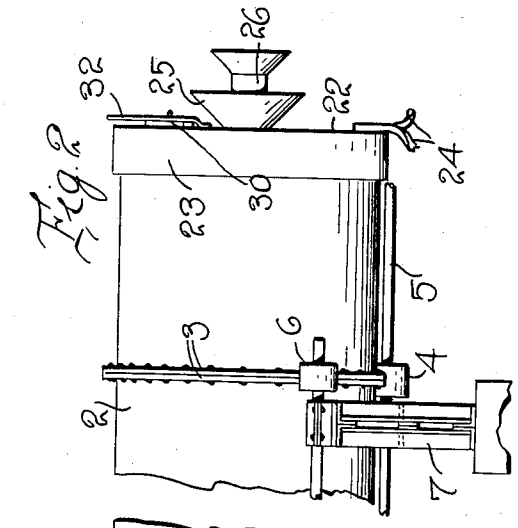


Fig. 2

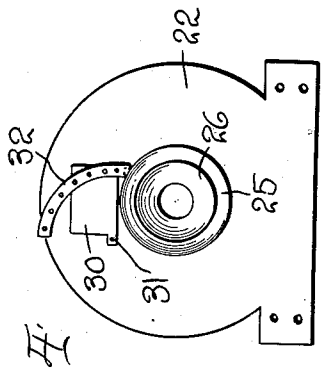
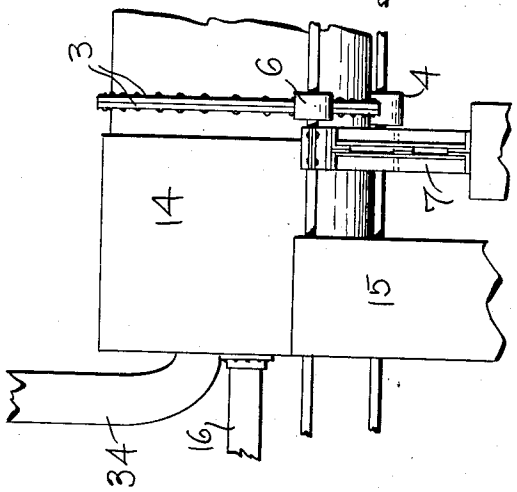


Fig. 4



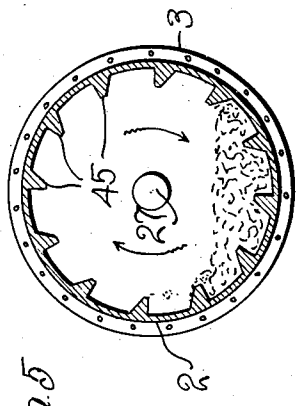


Fig. 5

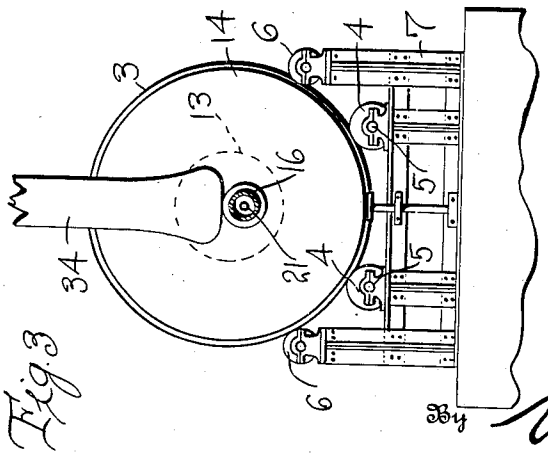


Fig. 3

Inventor

H. T. Benson

By Watson E. Coleman

Attorney

UNITED STATES PATENT OFFICE.

HARRISON T. BENSON, OF DENVER, COLORADO, ASSIGNOR OF ONE-HALF TO WINFIELD S. BARNES, OF PHILADELPHIA, PENNSYLVANIA.

ORE-ROASTING APPARATUS.

1,171,583. Specification of Letters Patent. Patented Feb. 15, 1916.

Application filed August 11, 1915. Serial No. 44,990.

To all whom it may concern:

Be it known that I, HARRISON T. BENSON, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Ore-Roasting Apparatus, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to apparatus for roasting ore, and particularly to that class of apparatus in which the ore is fed into a roasting cylinder which is constantly rotated, the ore being carried from the inlet end of the cylinder to the discharge end thereof and there ejected.

The primary object of my invention is the provision of a roasting furnace of this type wherein means are provided for preventing the pulverizing of the particles of ore and the too great agitation of the latter which would cause the detachment of large quantities of dust particles.

A further object of my invention is to improve the means whereby the heating agent in the form of a blast is injected into the furnace, and specifically to improve the construction of the blast tube so as to secure a greater distribution of heat, and in this connection to improve the means whereby air is admitted to the furnace to support combustion.

Still another object is the provision of means whereby the dust, products of combustion and the gases arising from the roasting ore are carried up into a settling chamber, and the gases eventually passed into a condenser.

Still another object is to improve upon the details of construction of ore roasters of this character.

My invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of a furnace constructed in accordance with my invention, and of the settling tank and condenser; Fig. 2 is a side elevation of the furnace shown in Fig. 1, the settling tank and condenser being omitted; Fig. 3 is a front end elevation of the construction shown in Fig. 2; Fig. 4 is a face view of the cap 23; and Fig. 5 is a transverse section of the ore roasting cylinder.

Referring to these drawings, it will be seen that my improved roasting furnace comprises a cylinder 2, which, as illustrated, is preferably made up of a plurality of sections having abutting flanges 3 which are bolted to each other. All of the sections are open ended. The cylinder is rotatably mounted upon two sets of rollers 4 which are disposed each set on one side of the middle vertical plane of the furnace. These rollers are mounted upon shafts 5. The cylinder is likewise supported upon a series of idler rollers 6 which are supported in suitable bearings on the base 7 and preferably the cylinder is rotated by means of a toothed annulus 8 mounted upon the cylinder at any desired point and engaged by a gear wheel 9 mounted upon one of the shafts 5. One or both of the shafts 5 at its rear end is operatively connected as by means of a belt 9 to a counter shaft 10 in turn driven from a line shaft 11. This counter shaft 10 at one end carries the belt pulleys 12 whereby the mechanism for feeding the ore is driven. Each of the shafts 5 is operatively geared with each other and with the shaft 12^a supporting the rollers 6 as by means of sprocket chains. One end of the cylinder is formed with a relatively large central opening 13 as illustrated in Fig. 3 in dotted lines. Inclosing this end of the cylinder is an annular hood 14 whose side wall is spaced from the wall of the cylinder and whose end wall is spaced from the end wall of the cylinder. This hood 14 is non-rotatable and is supported by means of the bridge wall 15 or in any other suitable manner.

Extending into a central opening in the hood 14 is a feed tube 16. This tube at its outer end is provided with the receiving hopper 17 into which an ore spout 18 discharges leading from a source of ore supply. The tube 16 extends into the adjacent end of the cylinder and then is provided with a downwardly directed spout 19. This spout discharges relatively adjacent to the lower portion of the cylinder. Within the tube 16 there is provided the screw conveyer 20 mounted upon a shaft 21 which in turn is driven by a belt 21^a from the pulleys 12. Cone pulleys are used upon the shafts 10 and 21 so that the speed of rotation of the shaft 21 may be regulated.

The opposite end of the cylinder confronts a cap plate 22 having an inwardly extending

annular flange 23 which is spaced from the cylinder and is fixedly supported by means of legs or braces 24 extending down to the foundation or base of the machine, the flange 23 being cut away for any desired length, circumferentially considered at the bottom, as indicated at 23′, to provide a discharge opening for the roasted ore. This plate 22 which forms the end of the furnace is provided with a central opening having an outwardly flaring flange 25. Disposed within the central opening in the plate 22 and extending out beyond the flaring flange 25 is a blast pipe 26 whereby the blast of ignited gas may be injected into the furnace. The end of this blast pipe 26 is closed by means of a baffle plate 27 but the upper face of the pipe is formed with a laterally extending slot 28. Thus the blast of ignited gas is directed upward and toward the side walls of the furnace, and the heat is more fully distributed than it would be if the blast pipe 26 opened at its end or were provided with a relatively small opening directed toward one point of the furnace. Any source of gas to the pipe 26 may be employed, as, for example, the pipe 26′ shown conventionally in Fig. 1. The end wall 22 is also formed with an air inlet opening 29 whose area is controlled by means of a damper 30 as illustrated in Fig. 4. This damper is rectangular in form and is pivoted at one corner as at 31 and operates between the end plate 22 and an arcuate strip 32 which is perforated. A pin passes through the damper plate and through any desired perforation in the arcuate strip so that the damper plate may be held in any adjusted position and thus the amount of air passing into the opening 29 to support combustion within the furnace may be controlled.

In the opposite end of the furnace the hood 14 is formed with an outlet opening 33 from which extends a flue 34 provided with a damper 35 and with valved air inlet openings 34ª, and this flue opens into a chamber 36. This chamber is a settling chamber and is provided with a plurality of baffle walls 37 arranged in staggered relation so that the products of combustion together with the dust and gases which may be driven off through the flue 34 will be caused to take a circuitous course and are prevented from rapid movement so that the dust and solid particles discharged through the pipe 34 will have a chance to settle and collect within the chamber 36. Thus any valuable matter contained in the dust driven off with the products of combustion may be afterward removed by opening the bottom of the chamber, this bottom being normally held closed by means of a bolt 38. From the settling chamber the gases which have been to a large extent purified of solid particles are carried by means of the pipe 39 to a condenser or separator 40. This consists of a chamber which is partially filled with water. The gases pass into this chamber and are forced into the water and condensed by means of a splasher 41 driven by means of a belt 42 or in any other suitable manner. Sulfurous acid is retained in this chamber and removed by means of the pipe 43 into a barrel or other receptacle while the remainder of the gases pass off through the flue 44 in a thoroughly purified condition.

Extending longitudinally along the wall of the cylinder on the inner face thereof and cast with each section are a plurality of shelves 45. These shelves are inclined downward from one end of the cylinder to the other, and each shelf is formed in cross section as illustrated in Fig. 5, that is, assuming that the cylinder is rotating in the direction of the arrow in Fig. 5, the rear faces of the shelves are radial to the axis of rotation of the cylinder while the forward faces of the shelves are inclined relative to the radial faces. Thus as the cylinder rotates the blades or shelves will not act to push the ore around but will roll the ore over. Some part of the ore will of course be carried up on these shelves but the inclination of the forward face of each shelf will be such that as the shelf rises the ore will gently roll off the shelf back to the bed of roasting ore and will not be carried up the upper portion of the cylinder and then dropped as it would be if the forward faces of the shelves were radial to the axis of rotation of the cylinder.

Furthermore, as the shelves are inclined with relation to the axis of the cylinder the ore will be gradually fed forward to the discharge end of the cylinder as it is turned. The discharge end of the cylinder is formed with a discharge opening 46 whereby the ore which has been fully roasted is discharged. The inclination of the shelves is such that the ore is moved relatively slowly through the cylinder so that it may be thoroughly acted upon by the heat. Furthermore, it will be seen that the greatest heat will be at the discharge end of the cylinder and the ore will be gradually raised in temperature as it moves forward.

As before stated, one of the main objects of this invention is to prevent the pulverizing of the ore by agitating the contents of the cylinder to such a degree that the ore rolls and as a consequence pieces of ore break into small particles and cause the creation of dust. One of the means for eliminating this is the construction and disposition of shelves previously described, and another way in which this breakage of ore into small particles or pulverizing is prevented is by providing the spout 19. This spout discharges at the level of the ore bed. If the spout 19 were taken away the ore would fall from the

feeding tube 16 and would tend to break up and create dust. By providing the spout 19, however, the ore simply fills into the spout and gently feeds into the cylinder. I have found that this is most important inasmuch as a great deal of valuable matter escapes from roasting furnaces by the ore becoming pulverized.

The operation of my invention will be understood from what has gone before. Ore roasting furnaces of this type are well known and the advantages of my specific construction will be obvious to any one skilled in the art of roasting ore.

It will be noted that I attain economy of fuel by securing perfect combustion. This perfect combustion is secured by adjusting the damper plate 30 so that just the proper amount of air is allowed to pass into the roasting furnace as will combine with the ignited gases ejected from the blast pipe and support combustion.

Having thus described my invention, what I claim is:

1. An ore roasting furnace including a roasting cylinder, shelves extending longitudinally on the inside face of the cylinder and inclined relative to the longitudinal axis thereof, the forward faces of the shelves being inclined centrally and rearward whereby the ore may roll from the shelves after the shelves have risen a relatively short distance above the ore bed.

2. An ore roasting furnace, including a roasting cylinder, means for rotating said cylinder, shelves extending longitudinally on the inside face of the cylinder and inclined relative to the longitudinal axis thereof, the forward faces of the shelves being inclined centrally and rearward whereby the ore may roll from the shelves after the shelves have risen a relatively short distance above the ore bed, a stationary hood inclosing one end of said cylinder and having an opening extending therethrough, and a feed pipe extending through said hood and mounted therein and projecting into the cylinder and having a downwardly directed terminal portion discharging ore at a point adjacent the bottom of the cylinder.

3. An ore roasting furnace including a roasting cylinder, a rotatable cylinder, shelves mounted upon the inner face of the cylinder and extending longitudinally thereof and inclined relative to the longitudinal axis, the forward faces of the blades being inclined centrally and rearward relative to the direction of motion of the cylinder, and a feed pipe entering one end of the cylinder and having a downwardly directed terminal portion discharging ore at a point adjacent the bottom of the cylinder.

4. An ore roasting furnace, including a cylinder, means for supporting same, a cap closing one end of said cylinder, and a blast pipe entering said cylinder through said cap and provided at its inner end with a baffle plate, as specified, and at said plate and on the upper face of the pipe with a laterally extending slot.

5. An ore roasting furnace, comprising a rotatable cylinder, means for rotating same, shelves extending on the inside faces of the cylinder and inclined relative to the longitudinal axis thereof, the forward faces of the shelves being inclined centrally and rearward whereby the ore will roll from the shelves after the latter have risen a relatively short distance above the ore bed, a hood inclosing the receiving end of said cylinder, a feed pipe supported in said hood and extending therefrom into the cylinder, and having a downwardly directed terminal portion discharging ore at a point close to the bottom of the cylinder, the cylinder having an opening through which said pipe passes, and a flue connected at one end to said hood in registry with a portion of said opening in the cylinder, as and for the purpose set forth.

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

HARRISON T. BENSON.

Witnesses:

Jos. F. X. QUINN,

ELWOOD L. KIEME.