April 6, 1954 C. P. DIEHL 2,674,445

FURNACE FOR EXFOLIATING PERLITE OR THE LIKE

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FIG. 1.

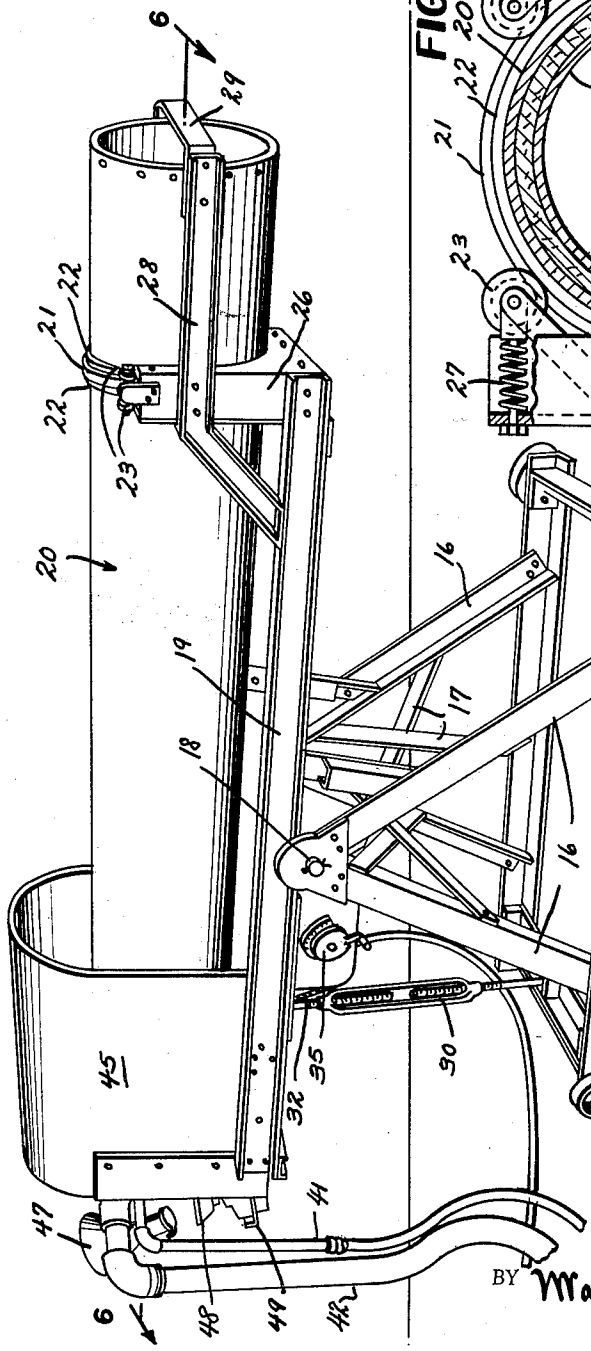


FIG. 7.

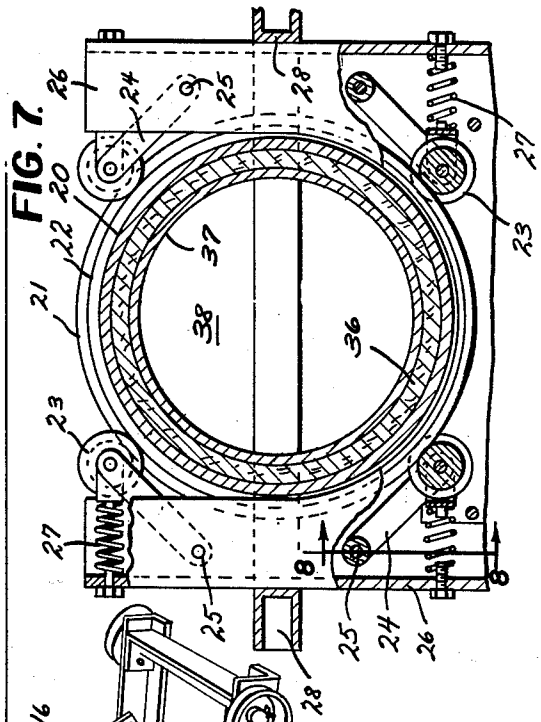
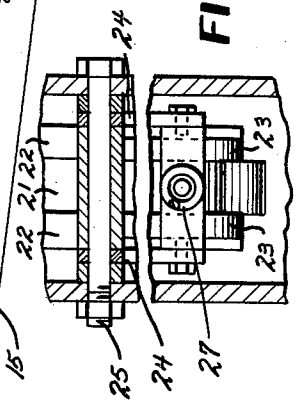


FIG. 8.



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FIG. 2.

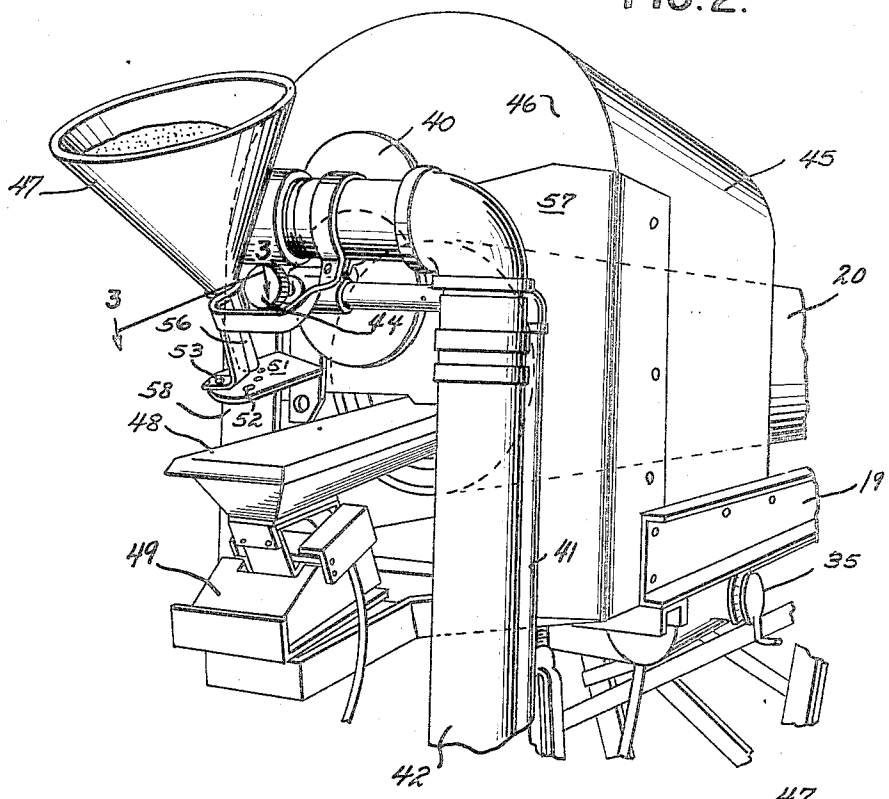


FIG. 3.

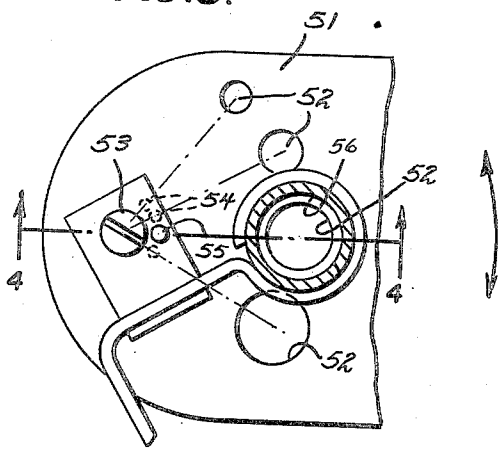
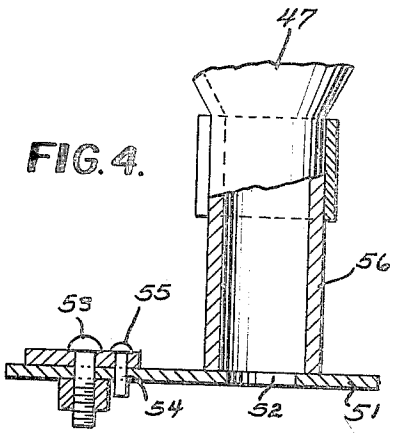


FIG. 4.



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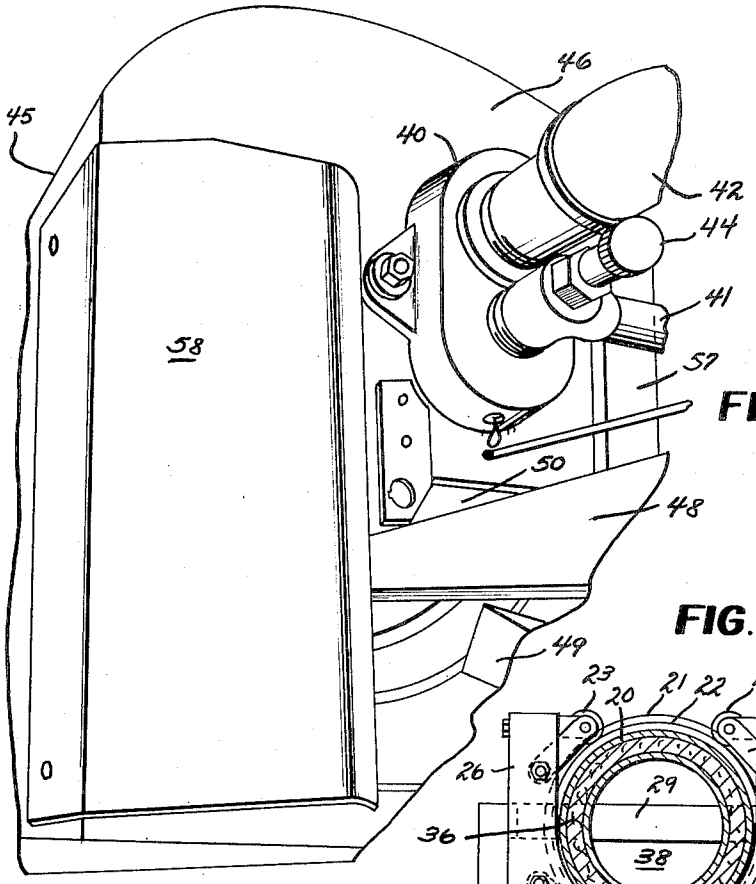


FIG. 5.

FIG. 9.

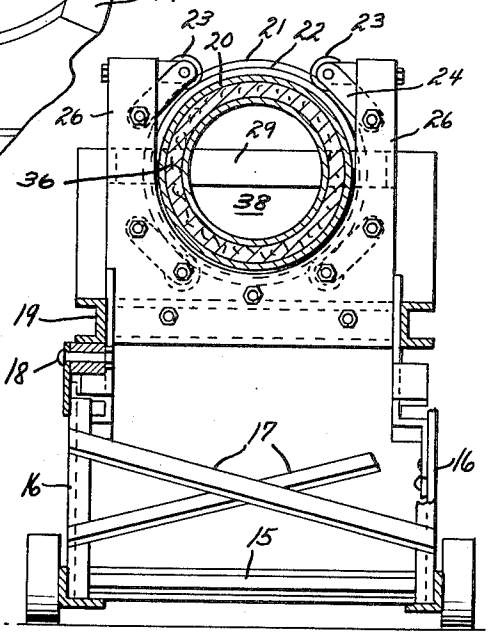
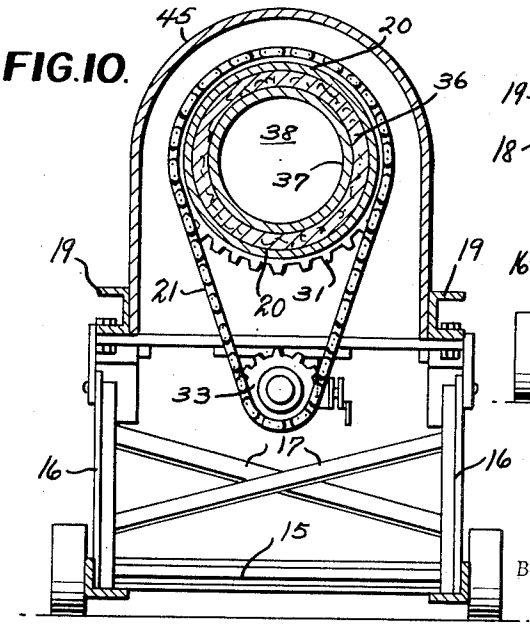


FIG. 10.



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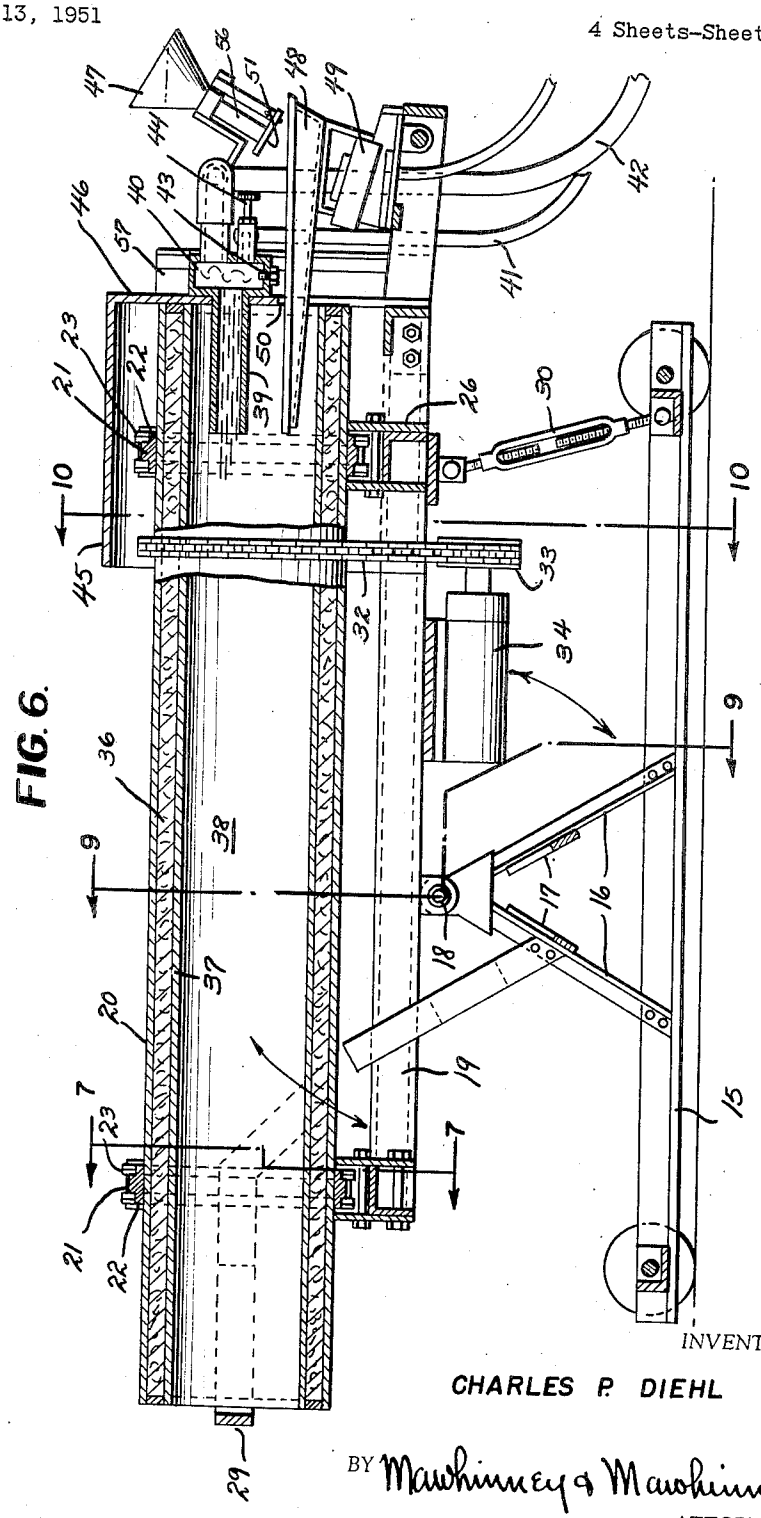


FIG. 6.

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UNITED STATES PATENT OFFICE

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FURNACE FOR EXFOLIATING PERLITE OR THE LIKE

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Application February 13, 1951, Serial No. 210,775

3 Claims. (Cl. 263—33)

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In the mining industry there are certain types of ores which are not amenable to low-cost processing to recover the values therein, especially ores containing gold, silver, tungsten and the platinum group of metals. The particular reason for this is the presence of other minerals which interfere with standard methods of procedure.

Ores which contain the sulfides of the metals desired to be recovered require special treatment, which adds greatly to the expense of processing. Therefore, medium and low-grade ores cannot be handled profitably and so these deposits must be abandoned.

It has now been determined that if these sulfide ores are ground to the required degree of fineness (for instance 100 to 200 mesh) and then concentrated, and these concentrates then have added to them the required proportion of calcium of magnesium carbonate or carbonates (or other non-metallic carbonate or carbonates) ground to the same mesh and thoroughly mixed, and thereafter this mixture subjected to the required temperature in a specially constructed revolving furnace according to the invention, a reaction takes place whereby the sulfur content of the ore is converted to sulfur dioxide (SO_2) which in turn is absorbed by the non-metallic carbonate or carbonates present, leaving the metal or metals in a convenient form for profitable recovery. This is especially true when the ore contains gold, suphur, tungsten or both silver and gold.

The recovery method used may then be either the mercury plate or bowl, or the cyanide process.

Another type of ore is that which contains gold in finely divided particles, yet when ground to 100 to 200 mesh and then concentrated and the concentrates run over the mercury plate the gold fails to be picked up by the mercury because of the presence in the ore of talc or clay which forms a slime and prevents the deposition of the gold on the mercury plate. By heat treating the concentrates in the improved specially designed revolving furnace, with or without the addition of other minerals or chemicals, such slime formation is inhibited and the gold particles adhere to the mercury on the plate or in the bowl.

Talc ($Mg_3Si_4O_{10}(OH)_2$) may be fired in a furnace to drive off the water and will then become hard and durable. The thermal decomposition of talc has been studied and it has been found that one molecule of water is driven off between 380° and 500° C., and the remaining molecule (of combined water) between 800° and

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840° C. In the process the specific gravity increases from 2.83 to 2.91, and at the higher temperature the talc decomposes to enstatite and amorphous silica. Inversion of the enstatite to clinoenstatite takes place between 1,200° and 1,300° C., with conversion of the amorphous silica to cristobalite. The results support the view that water in talc in excess of one molecule is not water of constitution, but may be held electrostatically between clevage planes.

Electronics may also be effectively used with mercury plate or bowl. Also the cyanide process may be used.

Besides the above mentioned types of ores, there are also the so-called black sands which are so numerous along the Oregon and Washington coast lines, and other localities, and which contain very profitable amounts of gold, platinum and other metals. No successful method or process has yet been devised to recover the values from these sands but by the use of the present invention involving the specially designed and devised heat treating revolving furnace to convert the black iron oxide (Fe_3O_4) to the red iron oxide (Fe_2O_3) the gold and platinum and other metals are released for easy recovery by standard methods. The sands may be ground to any mesh desirable to facilitate the heat treatment and after process for successful recovery of the values.

The invention has for its principal object to provide an improved heat treating revolving furnace for the processing of ore for the purposes above stated.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein the symbols refer to like or corresponding parts throughout the several views.

Figure 1 is a perspective view of an improved furnace constructed in accordance with the present invention.

Figure 2 is a fragmentary perspective, taken on an enlarged scale and showing more particularly the air and gaseous fuel connections and the device for introducing the material to be treated.

Figure 3 is a section taken on the line 3—3 in Figure 2.

Figure 4 is a section taken on the line 4—4 in Figure 3 with parts shown in elevation.

Figure 5 is a fragmentary perspective view of the rear portion of the device showing the air and gas fuel connections, the vaporizing device, ignition method and associated parts.

Figure 6 is a longitudinal sectional view taken on the line 6—6 of Figure 1.

Figure 7 is a transverse sectional view taken on the line 7—7 in Figure 6.

Figure 8 is a vertical sectional view taken on the line 8—8 in Figure 7.

Figure 9 is a transverse section taken on the line 9—9 in Figure 6, and

Figure 10 is a transverse section taken on the line 10—10 in Figure 6.

Referring more particularly to the drawings 15 designates a truck or wheeled carriage on which are erected standards 16 reinforced by appropriate braces 17 and carrying at the upper ends a pivot or pivots 18 upon which a tilting platform 19 is mounted for vertical tilting movement.

The tilting frame 19 carries a rotary tube 20 having two or more rotating bands 21 secured to the tube and having stepped down shoulders 22 at opposite sides of the higher central portion of the bands to accommodate pairs of rollers 23 for the rotary support of the tube 20 and to prevent the tube from sliding axially through the roller support.

Such rollers 23 may be provided in four pairs as indicated in Figure 7. The rollers are carried in pairs by links 24 pivoted at 25 in supports 26 affixed to forward and rear portions of the tilting frame 19. Springs 27 are interposed between the rollers 23 and the supports 26 for urging the rollers 23 yieldably against the shoulders 22 at opposite sides of the raised bands 21.

The supports 26 at the outer end of the tilting frame 19 have affixed thereto side braces 28 which also may be affixed to the tilting frame 19 at their inner ends and are joined at their outer ends by an end connecting brace 29 which extends across the open discharge end of the rotary tube 20.

Turn buckles 30 are connected between the truck 15 and the rear portion of the tilting frame 19 for the purpose of adjusting said tilting frame 19 angularly about the fulcrum or pivot 18.

A driven sprocket 31, Figure 10, is affixed about the rotary tube 20 with which a chain 32 is engaged for driving the rotary tube 20. The chain 32 is driven from a drive sprocket 33 on the armature shaft of a motor 34 which is under the control and which may be regulated as to speed by a motor control switch 35.

The outer steel tube 20 is provided interiorly with an asbestos packing 36 within which is a fire proof lining 37 defining the internal tube cylinder or firing chamber 38.

A flame nozzle 39 projects into the cylinder 38 at its inner or charging end, such flame nozzle adapted to receive a suitable mixture of air and gas fuel from a vaporizer 40 which may be situated just beyond the charging end of the cylinder 38. A gas fuel line 41 from an appropriate source of fuel supply connects with the vaporizer 40 as does also an air line 42. The amount of fuel supplied may be under the control of a fuel valve 44. At any appropriate point in the vaporizer 40 is a firing opening closed normally by a screw or other plug 43.

A dust hood is provided having a side wall 45 and an end wall 46. The end wall substantially closes the charging end of the cylinder 38 while the side wall 45 is of greater diameter than the casing 20 and extends sufficiently forward preferably to encase the drive sprocket and chain gearing and one of the roller supports for the casing.

A hopper or mineral bin 47 for containing material to be reduced or treated is arranged above a vibratory feed pan 48 which receives a vibratory motion from a vibrator 49 which may be electrically or otherwise operated. The inner end of the feed pan 48 projects through an opening 50 in the end hood wall 46.

As shown more particularly in Figures 2, 3 and 4, a feed control plate is preferably provided having a series of ports 52 which are graduated in size and which are struck upon the same radius from a central pivot 53 about which the plate may rotate to bring a selected opening 52 beneath the hopper or funnel spout 56. The adjustment may be preserved by dropping a locking pin 55 in a selected opening 54 which registers with the same when its corresponding port 52 is in alignment with the funnel spout 56.

In the use of the improved furnace, the fire-starting plug 43 is first removed and compressed air and compressed gas fuel permitted to enter through lines 42 and 41 to the vaporizer 40. A match may be applied as shown in Figure 5 at the opening created by the removing of the plug 43, which will ignite the vaporized fuel in the vaporizer 40. Such ignited fuel will issue through the flame nozzle 39 and be directed into the cylinder 38. The motor 34 is energized through the switch 35 and through the chain 21 and sprocket gearing will rotate the tube 20 and its cylinder or chamber 38. This cylinder and tube may be tilted about the axis 18 by the turn buckle 30 in order that such cylinder may assume the proper angle. The rate of rotation of the cylinder 38 may be adjusted at the switch 35 which is associated with a rheostat. The vibrator 49 is also energized which will communicate to the vibratory feed pan 48 a vibratory motion. The crushed material delivered from the hopper 47 into the feed pan 48 is released into the cylinder at a point adjacent the inner end of the flame nozzle 39. Such material then proceeds through the rotating cylinder 38 and out at the opposite end into a barrel or other container. The ore is cleansed and the impurities eliminated.

Preparatory to placing the ore in the hopper 47, the same is reduced to a required mesh. The time of treatment of such ore can be regulated and depends upon the particle size of such ore and the particular ore treated. The rate of movement of the material through the cylinder can be controlled by the angle of tilt and also by the rotation rate of the cylinder. During treatment, sulfur, carbon dioxide and other impurities are eliminated.

The machine is designed for the use of gas, either manufactured or natural, or of oil. The machine is extremely useful for exploding or exfoliating perlite and other suitable minerals.

It is to be noted that the flame does not touch the ore. The vibratory pan 48 discharges the ore particles beneath the flame nozzle 39 and such particles tend to fall to the lower portion of the cylinder 38 which is in continuous rotation thus tending to carry the material through the cylinder in a substantially spiral path subjected to the heat generated in the chamber by the burning of the fuel issuing from the nozzle 39. The cylinder may be heated to any length desired and to any degree necessary to any purpose. The cylinder and tube may be elevated or lowered as required through the turn buckle 30.

At 57 and 58 are shown flash guards for the protection of the operator.

Although I have disclosed herein the best form

of the invention known to me at this time, I reserve the right to all such modifications and changes as may come within the scope of the following claims.

What I claim is:

1. A furnace for the purpose described comprising a cylindrical type furnace, a movable support for said furnace, means for pivotally mounting said furnace on said support, means for mounting said furnace for rotation upon said support, tilting means for tilting said furnace vertically about its longitudinal axis, a flame nozzle at the charging end of said furnace cylinder carried eccentrically of the longitudinal axis of the cylinder, means to furnish vaporized fuel and air to said nozzle, means parallel and spaced from the nozzle to introduce to the charging end of the cylinder particle-form ore out of contact with the flame from said nozzle, rotary means for imparting rotary motion to said cylinder, and vibrator means for vibratorally feeding the particle form ore into said cylinder and to commence passage of the ore through the cylinder, the rotary motion of said cylinder and its angular tilt accelerating the passage of ore through the cylinder at a predetermined rate of movement.

2. A furnace as claimed in claim 1 wherein said means for mounting the cylindrical furnace for rotation upon said support consists of a base frame having spaced apart cradles for rotatably receiving the cylinder, annular guides carried by said cylinder adapted to register with said

cradles, gear means about the periphery of one of said annular guides, a variable speed electric motor carried by said frame, and connecting drive means between said motor and said gear means on one of said annular guides whereby upon increasing or decreasing the rotational speed of said motor a corresponding change in rotational speed will be imparted to said cylinder.

3. A furnace as claimed in claim 2 wherein said tilting means consists of a turnbuckle one component of which is secured to said movable support and another component of which is secured to the base frame of the mounting for rotation of said cylindrical furnace, whereby the speed of travel of the ore through the cylinder may be increased or decreased dependent upon rotational speed of said cylinder.

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Page Converter Article (21 pages) however only page 3, 4, 16 and 21 of the article need be ordered. Sept. 23, 1949.