J. B. GAFFNEY.

ROTARY FURNACE.

APPLICATION FILED MAR. 20, 1918.

1,318,141.

Patented Oct. 7, 1919.

2 SHEETS—SHEET 1.

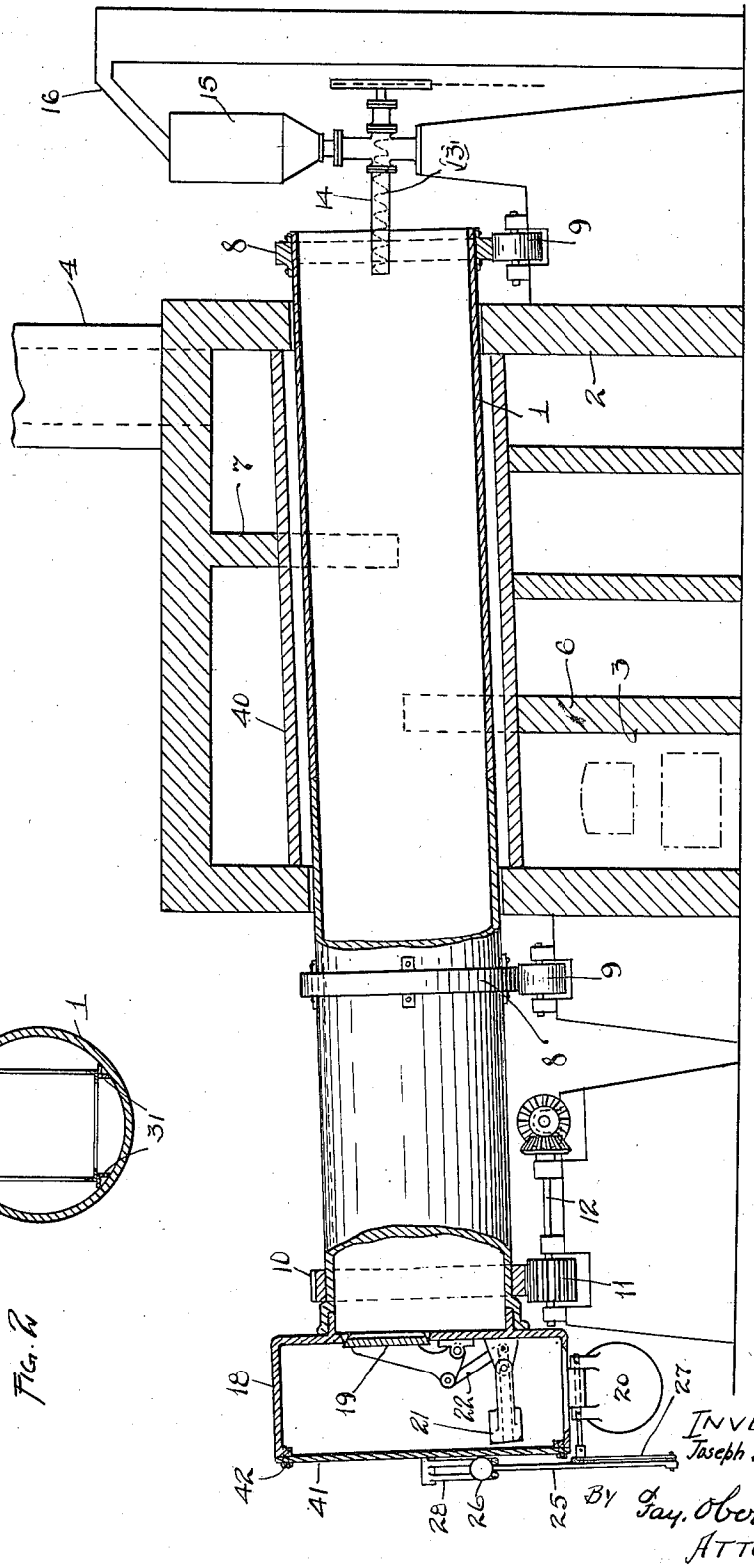


FIG. 1

FIG. 2

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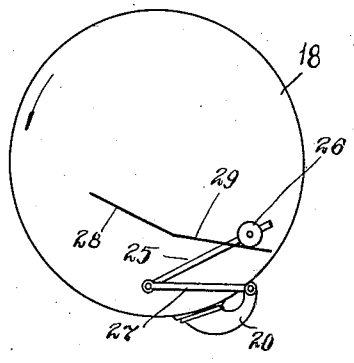


FIG. 3

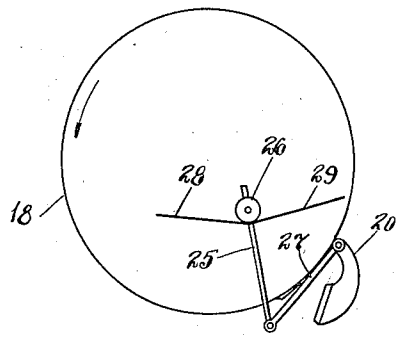


FIG. 4

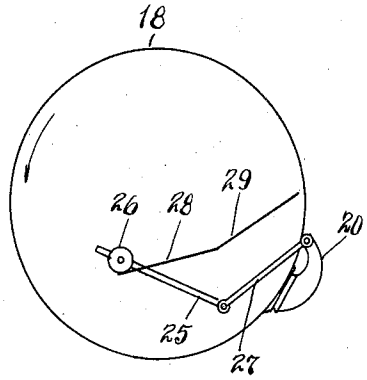


FIG. 5

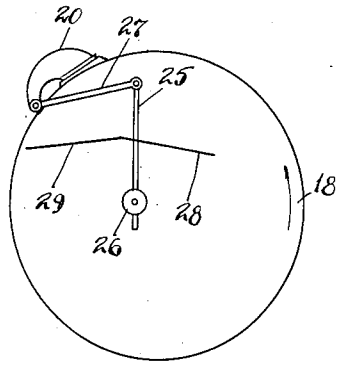


FIG. 6

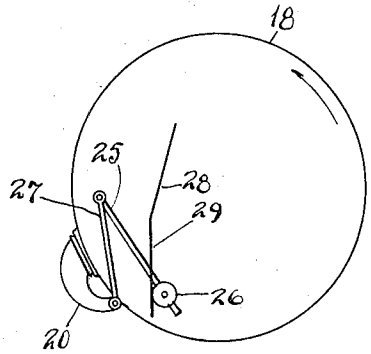


FIG. 7

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ROTARY FURNACE.

1,318,141. Specification of Letters Patent. Patented Oct. 7, 1919.

Application filed March 20, 1918. Serial No. 223,642.

To all whom it may concern:

Be it known that I, JOSEPH B. GAFFNEY, a citizen of the United States, and a resident of Allentown, county of Lehigh, and State of Pennsylvania, have invented a new and useful Improvement in Rotary Furnaces, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which I have contemplated applying that principle so as to distinguish it from other inventions.

The present invention, relating, as indicated, to rotary furnaces, is particularly directed to the provision in such a furnace of improved means for removing the material therefrom without causing the stopping of the apparatus or the introduction to the rotary furnace or container of outside air. Another object of the invention is the provision of means for preventing wear on the furnace chamber and still other means for avoiding caking of the material being treated. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawing:—

Figure 1 is a side elevation partially in section of my improved furnace; Fig. 2 is a transverse section through the same; and Figs. 3, 4, 5, 6 and 7 are end elevations illustrating the operation of the discharge gate.

The present apparatus is adapted to the treatment of various materials which must be maintained out of contact with the atmosphere during the heating of the same and which are constructed to pass the material through various zones of heat and to then remove the material from the apparatus while the apparatus is still in operation.

In Fig. 1 I have shown a general view of the apparatus which consists of a cylindrical furnace chamber 1, mounted at a slight angle to the horizontal and extending through a furnace 2. The combustion chamber of the furnace carrying the grates is indicated at 3, and the products of combustion and the burning gases pass upwardly around the container 1 and along the same to a stack 4. These gases are kept in contact with the chamber 1 for a considerable distance by means of deflecting arches 6 and 7, of which the arch 6 extends upwardly from the bottom of the furnace and is cut out in a semi-circle so that it contacts a sleeve 40 around the cylinder 1. In this way all of the products of combustion are forced to pass upwardly around this cylinder and then along the sleeve by means of a second deflecting wall 7, which extends downwardly from the top of the furnace, and is also cut out in a semi-circle so that it fits closely about the upper half of the sleeve 40. In this way that portion of the cylinder 1 between the left wall of the furnace and the arch 3 is maintained at a very high temperature, while the other portion of the cylinder 1, which is within the furnace, is also heated to varying temperatures by the discharging gases from the fire.

The furnace chamber 1, which is preferably formed of iron or steel, is of course subject to rapid deterioration in that part which is in direct contact with the combustion gases, it having been found that a cylinder of this type when so exposed will wear away at a very fast rate. To avoid this rapid wear of the furnace cylinder a protection or outer sleeve 40 is disposed about that portion of the chamber which is within the furnace. This protecting sleeve 40 may be formed of any suitable material such as refractory blocks and will extend the entire distance through the furnace chamber from one wall of same to the other, and will entirely prevent the combustion gases from directly contacting the furnace chamber 1. It will be understood that as the furnace is preferably being run continuously there will be little loss in temperature in the furnace 1 by reason of this protecting sleeve, but merely the avoidance of the wear on the cylinder caused by the combustion gases.

The cylinder 1 is suitably mounted in the usual manner by means of tracks 8 operated on bearings or rollers 9, and is driven by means of a gear 10 mounted cylindrically on the cylinder, and operated by a pinion 11 on the shaft 12. At the upper or right hand end of Fig. 1 is a feeding conveyer in the form of a screw 13 operating in the conduit 14, into which material may be fed by any suitable means from the conduit 16,

and hopper 15. The upper end of the furnace is of course closed except for the opening for the conduit 14 and material may be fed into the furnace chamber 1 at a constant predetermined rate of speed. This material is then carried slowely down the length of the conduit through the rotation of the same and is lifted and dropped back into the bottom of the conduit by means of special plates or angles mounted in the cylinder 1, as will be later described.

At the discharge end of the cylinder 1 there is provided a discharge chamber or casing in the form of a closed cylindrical section 18. This section is of larger diameter than the cylinder 10, and is mounted at the end of the same, concentric therewith. Gates or valves 19 and 20 are pivotally mounted in the section 18, the first of these gates being pivoted about an axis disposed transversely with respect to the center line of the cylinder 1, and the second gate about a longitudinal axis parallel with the center line of the cylinders 1 and 18. Both of the gates or valves are operated automatically. The gate 19 which opens upwardly into the discharge chamber 18 is opened by gravity when this gate is brought into its lower position, in which position a weight 21, connected to the gate by means of a link 22, causes the gate to open and to permit the material in the cylinder 1 to discharge into the casing 18. The time of opening of this chamber will be about one-half of a revolution of the chamber 18 since the gate will be more or less open during all of the time that the weight 21 is above the central horizontal plane through the discharge casing 18.

The valve 20 is also controlled as to its opening by means of a weight 26 carried on the end of an arm 25, which is pivoted to an arm 27 connected to the valve 20 at the pivotal axis of the latter. The weight 26 moves along a guide consisting of two supports 28 and 29, disposed upon the outer end of the discharge casing 18 and making an obtuse angle with each other. In Figs. 3, 4, 5, 6 and 7 successive positions of this gate 20 are shown during one revolution of the furnace chamber and this gate will be timed to remain open only when the gate 19 is closed so that there is never any connection between the interior of the furnace chamber and the outside atmosphere. The furnace chamber and discharge casing 18 are rotated in the direction of the arrow shown in Fig. 3, in which figure the weight 26 has just moved to the right hand end of the guide 29. As the casing 1 rotates into the position shown in Fig. 4 the guide 29 is carried past the horizontal and is inclined in the opposite direction from its position in Fig. 3. The weight 26 then slides down this guide to its interior end where it is stopped against the guide 28, which in this position is still inclined to the horizontal. The valve 20 is opened by the movement of the weight 26 down the guide 29 and will remain open until the chamber is rotated into the position shown in Fig. 5, when the guide 28 is inclined downward from the horizontal and from its interior end, which permits the weight 26 to move to the outer end of this guide 28, and in doing so to pull the valve 20 in its closed position. During the further rotation of the casing, at least until the guide 29 approaches a vertical position, as shown in Fig. 7, the weight 26 will hang vertically downward as indicated in Fig. 6, and throughout this portion of the revolution will keep the valve 20 closed. When the position shown in Fig. 7 is reached the weight 27 will again contact against the outer end of the guide 29 and will stay in that position until this guide 29 has reached a horizontal position and gone sufficiently beyond this position to permit the weight 26 to slide down the guide 29 against the guide 28, as shown in Fig. 4. The moment of opening of the valve 20 may be controlled by shifting the position of the guide 29 so that it just passes the horizontal position at the moment at which it is desired that the valve 20 should open, while the interval of opening of the valve 20 is determined by the angle which is included between the guides 28 and 29. If this angle is made more acute then the guide 20 will remain open for a longer interval.

The adjustment of the relative position of guides and gate may be secured during or after assembly of the discharge casing as the guides are mounted on the end wall 41 of the casing by means of bolts 42 and may be set at different positions to give different times of opening for the gate 20. Ordinarily it will not be necessary to vary the interval of opening of the gate, although this may be readily accomplished by setting the guides in a different angular relation as stated.

While it is intended that the material which will be furnaced in the chamber 1 will be substantially dry and free from moisture, still it is desirable to provide means for avoiding any caking of this material and for maintaining a constant agitation of the material in the furnace. One form of such means is shown in Fig. 2 and consists of a framework which will preferably extend for substantially the entire length of the furnace. This framework is rectangular in cross section, consisting of members 30 connected together at their ends as indicated, and bearing at each corner outwardly facing angles 31. The outside dimension of the circle passing through the outer points or edges of the four angles 31 will be slightly less than the inside diam-

eter of the furnace chamber 1, and thus as the furnace chamber 1 is rotated the framework 31 will pivot about each of the angles 31 in turn and will work its way around the interior wall of the furnace, each of the angles 31 falling into the material in the furnace and breaking up in lumps which may be formed, and also jarring free from the walls of the furnace any material that has begun to stick. This framework, in the course of a number of revolutions of the furnace will strike the inner wall of the same at practically all points in succession and will thus serve to effectively clean the material from the wall. Besides acting to remove the material which may be stuck on the walls it agitates the material since some material is carried up on the inner face of the angles 31 and is dropped back into the bottom of the furnace as these angles or shelves make an angle with the horizontal approximately to the angle of repose of the material, which is probably in the neighborhood of 30 degrees, so that the shelves will discharge their load when about 60 degrees from the vertical position.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a furnace of the character described, a discharge chamber comprising a casing rotatably mounted about a substantially horizontal axis, inlet and outlet valves in said casing, and means adapted to cause said valves to open at different times in the rotation of said casing.

2. In a furnace of the character described, a discharge chamber comprising a casing rotatably mounted about a substantially horizontal axis, inlet and outlet valves in said casing, said valves being mounted on opposite sides of the axis of said casing, and being adapted to open alternatively.

3. In a furnace of the character described, a discharge chamber comprising a casing rotatably mounted about a substantially horizontal axis, inlet and outlet valves in said casing, said valves being mounted on opposite sides of the axis of said casing, and weighted means connected to said valves and adapted to cause the same to open at different times in the rotation of said casing.

4. In a furnace of the character described, a discharge chamber comprising a casing rotatably mounted about a substantially horizontal axis, inlet and outlet valves in said casing, one of said valves being mounted in one end wall and the other in the side of said casing 180° from said first named valve, said valves being normally closed by gravity, and weighted means adapted to successively open said valves at predetermined times in the rotation of said casing.

5. In a furnace of the character described, a discharge chamber comprising a casing rotatably mounted about a substantially horizontal axis, a valve mounted circumferentially in the wall of said casing, and operating means for said valve mounted on the end wall of said casing, said means including a weight and guide means therefor and being adapted to open and close said valves at predetermined intervals.

6. In a furnace of the character described, a discharge chamber comprising a cylindrical casing rotatably mounted about a substantially horizontal axis, said casing having a circumferentially adjustable end wall, a valve mounted circumferentially in the wall of said casing, and operating means for said valve, said means including angularly regulated guides and a weight connected to said valve and movable along said guides, said weight being timed to open and close said valve by the relative position of said end wall and valve.

7. An agitator for a cylindrical furnace chamber comprising a framework disposed longitudinally in said chamber and having a maximum transverse dimension appreciably less than the inside diameter of said chamber, said framework being provided with longitudinally extending angles adapted to swing against the inner wall of said chamber upon rotation of the same.

8. An agitator for a cylindrical furnace chamber comprising a framework disposed longitudinally in said chamber and having a maximum transverse dimension appreciably less than the inside diameter of said chamber, said framework being rectangular in cross section and being adapted to swing periodically about the edges lowermost in said chamber as the latter rotates.

9. An agitator for a cylindrical furnace chamber comprising a framework disposed longitudinally in said chamber and having a maximum transverse dimension appreciably less than the inside diameter of said chamber, said framework having a series of longitudinally extending angles and being adapted to progressively move around the inner wall of said chamber as the latter rotates.

Signed by me, this 9 day of March, 1918.

JOSEPH B. GAFFNEY.