July 22, 1930. O. A. COLBY 1,770,970

ROTARY HEARTH FURNACE

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Fig. 1.

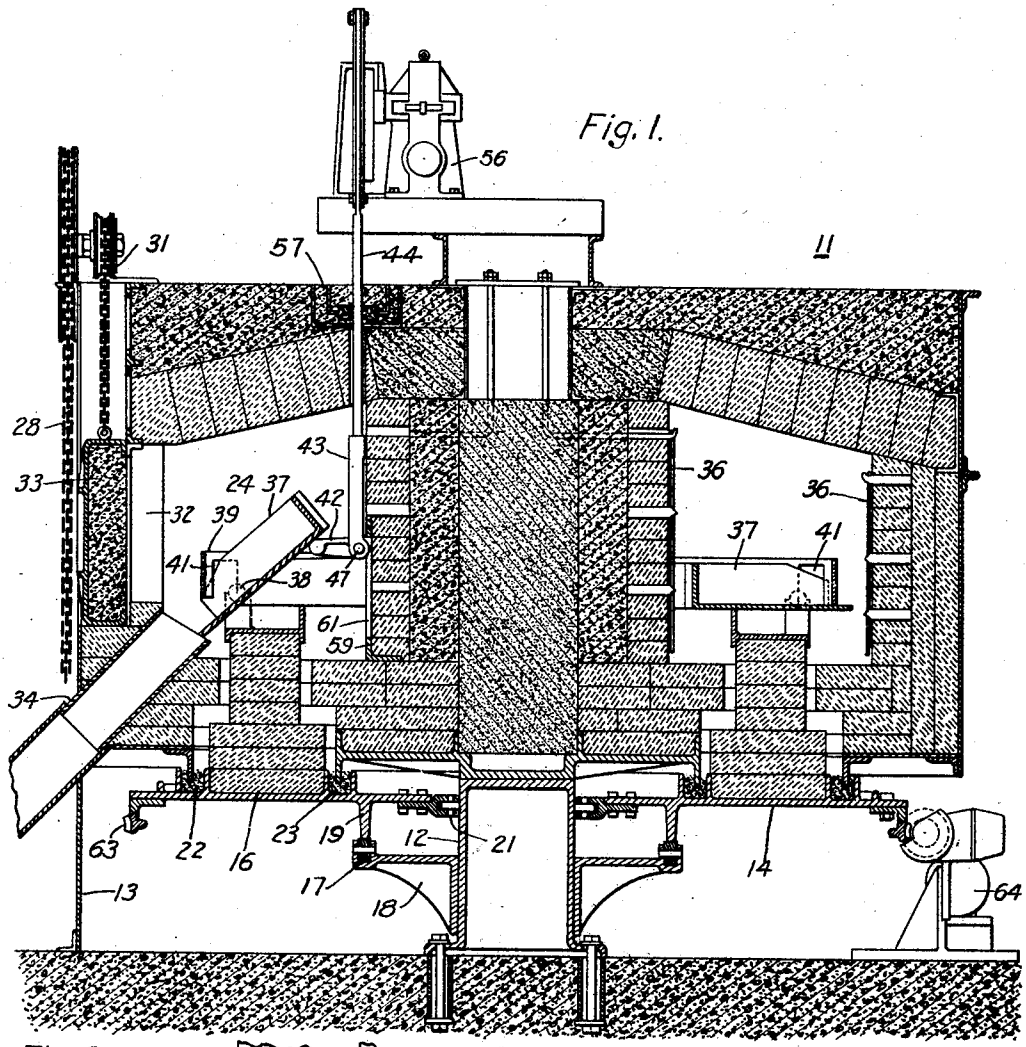


Fig. 2

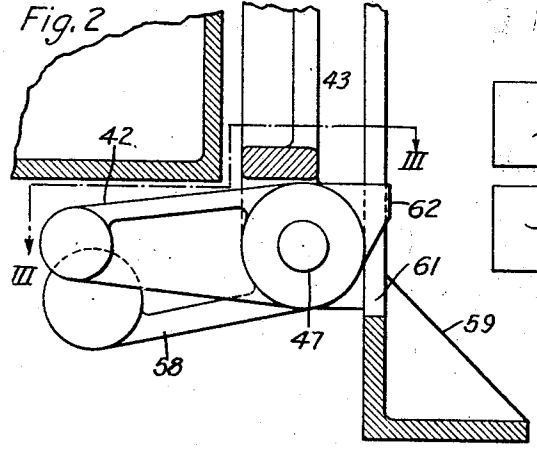
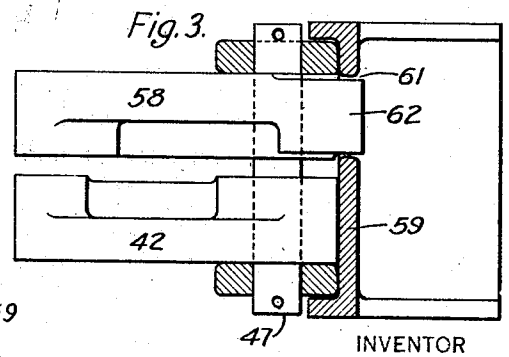


Fig. 3.



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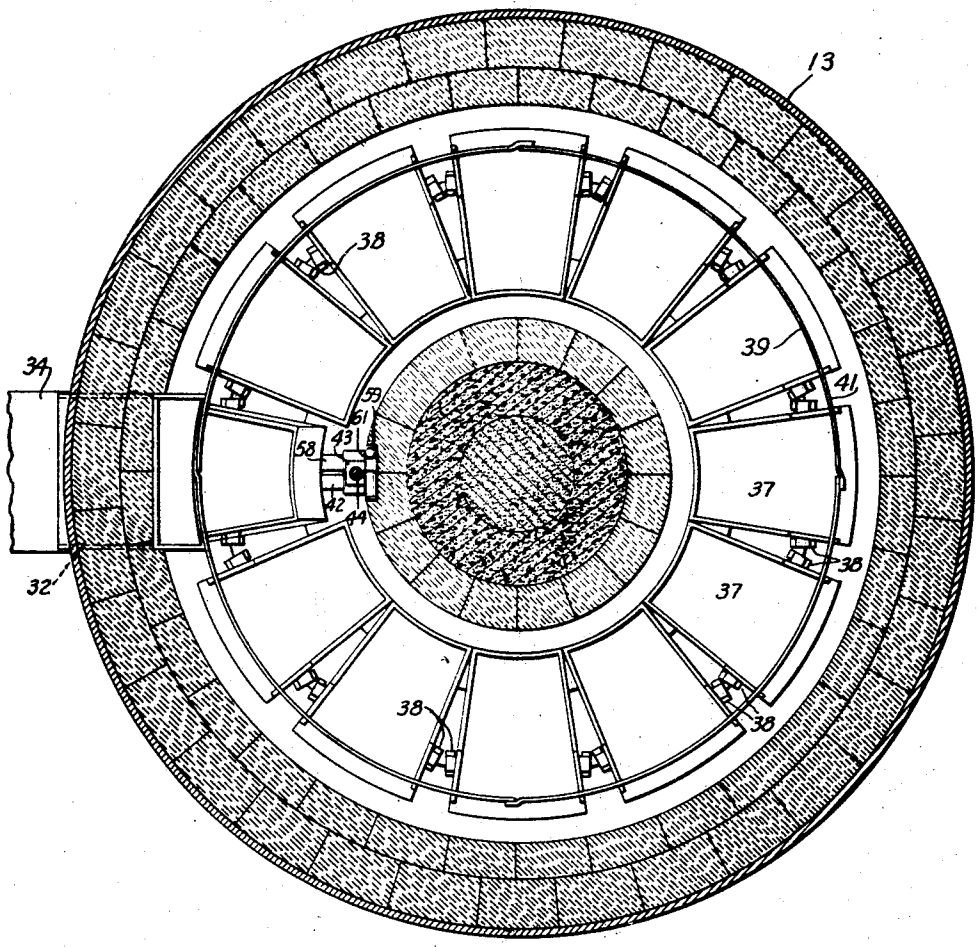
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Fig. 4.



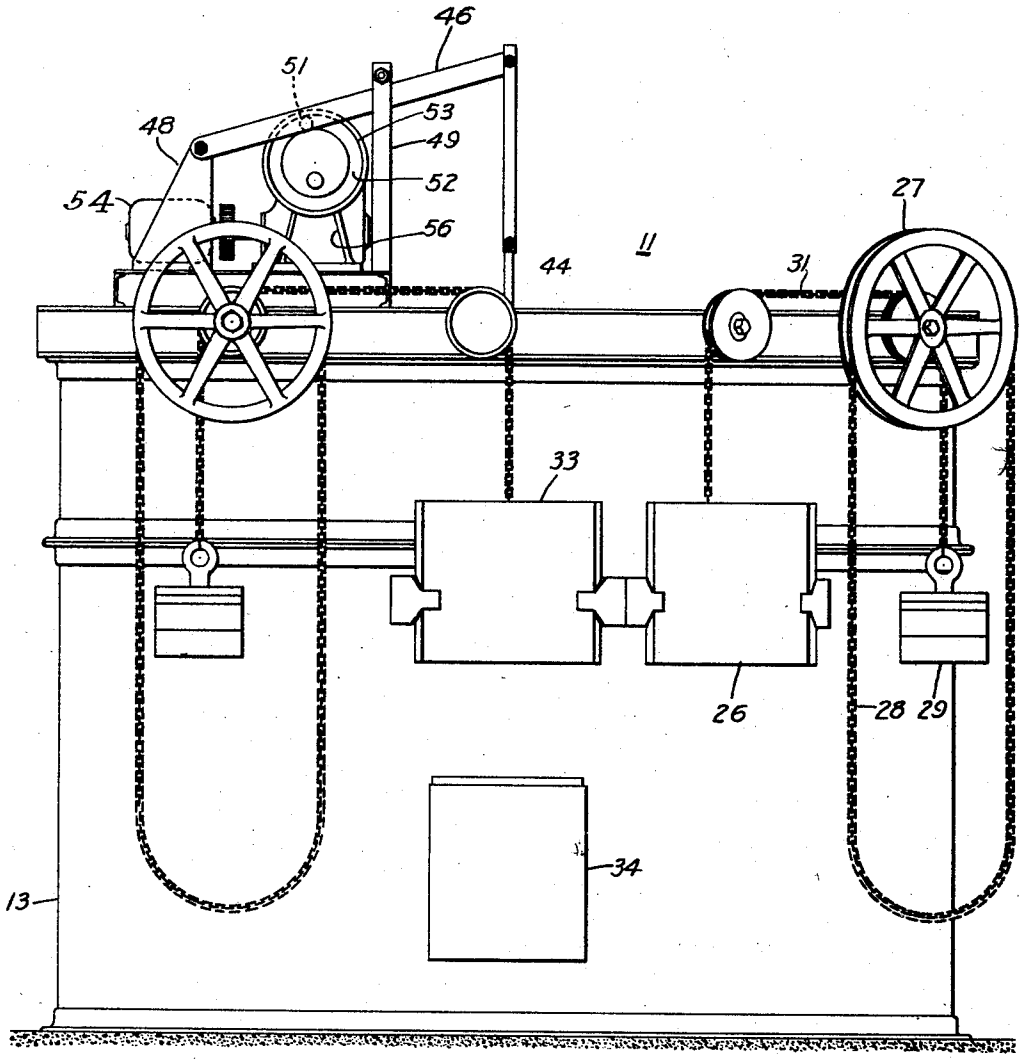
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Fig. 5



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UNITED STATES PATENT OFFICE

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ROTARY-HEARTH FURNACE

Application filed December 7, 1928. Serial No. 324,438.

My invention relates to heat-treating furnaces and more particularly to furnaces of the rotary-hearth type.

In rotary-hearth furnaces embodying a plurality of tiltable trays for normally receiving articles to be heat-treated in the furnace chamber, difficulty has been experienced in dislodging the material from the trays during the tilting movement thereof, because of the tendency of the heated material or the heated objects to adhere to the trays.

One object of my invention is, therefore, to provide means for jarring the trays when they are in their tilted positions to effect dislodgment of the material carried thereby.

In practicing my invention, I provide, in a rotary-hearth furnace, a plurality of tiltable hearth trays mounted upon a rotatable annular hearth structure, means for tilting said trays in sequence, and means directly carried by the tray-tilting mechanism and operative at substantially the limit of the tilting movement of a tray for imparting a sudden blow to the tray to loosen the material carried thereby and ensure the discharge thereof.

This application is a substitute in part for applicant's earlier application, Serial No. 227,455, filed October 20, 1927, which application became abandoned before the present application was filed.

In the drawings, Figure 1 is a view, in vertical section, through a rotary-hearth furnace embodying my invention;

Fig. 2 is a detail view of the tray-tilting jarring means, portions of the tray and furnace structure being broken away;

Fig. 3 is a view, in section, taken on the line III—III of Fig. 2;

Fig. 4 is a view, in horizontal section, through a rotary-hearth furnace embodying my invention, and,

Fig. 5 is a view, in side elevation, of a furnace embodying my invention.

Referring more particularly to Fig. 1 of the drawings, I have shown my invention as applied to a rotary-hearth furnace 11 comprising annular side and top walls, built of refractory material in a well-known manner and supported in operative relation upon a central standard 12, and a metallic outer shield 13. The particular details of construction of the furnace walls and top constitute no part of my invention and are, therefore, shown for illustrative purposes only.

An annular opening is formed in the base of the furnace chamber and is substatially sealed by a annular refractory hearth 14 supported upon an annular base plate 16. The hearth structure is supported in its operative position by means of a plurality of rollers 17 that are journalled in brackets 18 with which the standard 12 is provided, the base plate 16 being provided with a flange 19 to rest upon the rollers. A plurality of bearing rollers 21 are carried by the base plate 16 to engage the outer peripheral surface of the standard 12 to maintain the base plate in its horizontal position.

Annular sand troughs 22 and 23 are provided on the plate 16, at the respective edges of the hearth 14, to cooperate with depending annular flanges on the stationary furnace structure to constitute sand seals, in the usual manner.

Access to the furnace chamber 24 may be had through an opening normally covered by a door 26 which is vertically movable by means of a hand-wheel 27 and a chain 28, a counterweight 29 being connected to the door 26 by a chain 31 to facilitate movement of the door.

A discharge opening 32 is normally closed by a vertically movable door 33 that is operated by mechanism substantially like that which is employed to operate the door 26. A discharge chute 34 is provided immediately below the opening 32 to communicate, at its lower end, with a suitable conveyor or a quench tank (not shown).

Any means for heating the furnace chamber may be employed, but I prefer, in the present embodiment, to employ electrical-resistance elements 36 which are mounted upon the side walls of the chamber 24 in any suitable or desired manner and which are connected to a suitable source of electrical energy.

A plurality of tiltable hearth trays 37 are mounted on the upper face of the hearth 14 and are uniformly spaced circumferentially thereof. The trays are severally pivoted at 38 to permit a tilting movement thereof, as shown on the left-hand side of Fig. 1 of the drawings.

The hearth trays are open at their outer ends, means being provided for closing the otherwise open ends, such means being a single annular member 39, preferably made of sheet metal. The annulus 39 is provided with a plurality of peripherally-spaced recesses 41 in its lower edge which are so located as to receive the side walls of the correspondingly spaced trays. That is, the two adjacent side walls of two adjacent peripherally-spaced hearth trays 37 fit into one of the recesses 41, so that the member 39 is supported by all of the hearth trays and, therefore, rotates therewith. The diameter of the annulus 39 is made such that it will rest upon the outer ends of the trays or closely adjacent thereto in order that such outer ends may be closed to normally prevent movement therefrom of material located in the trays during the rotative movement of the hearth and the trays.

Tilting of the hearth trays is effected by means of a bar 42 pivotally mounted upon the lower end of a depending link 43 the upper end of which is connected to a horizontally extending actuating lever 46 by a suitable rod 44. The bar 42 is pivotally mounted on a pivot pin 47 with which the link 43 is provided and is located in a recess in the lower end of the link 43 in such manner that it is prevented from turning in a counter-clockwise direction. The lever 46 is pivotally mounted, at its other end, on a bracket 48 which is mounted on the furnace structure. The lever 46 may move vertically upwardly or downwardly in a guide member 49 which extends vertically upward and is also mounted on the furnace structure.

The lever 46 is moved vertically by means of a cam 53 having a groove 52 which is engaged by a roller 51 secured to the lever intermediate its ends, the cam being driven by an electric motor 54 and suitable speed-reducing gear mechanism 56.

The rod 44 extends through a suitable sand seal or stuffing box 57 mounted in the top of the furnace structure. The operation of the tilting mechanism is such that the tray is in the tilted position shown in the left-hand side of Fig. 1 of the drawings at the limit of the upward movement of the rod 44, and the subsequent downward movement thereof effects the gradual movement of the tray to its normal horizontal position.

It is to be understood, of course, that suitable control means for the motor 54 will be provided in order that the trays may be tilted in sequence as they are brought into operative relation to the chute 34 by the rotative movement of the hearth and the trays.

A second bar 58 is pivotally mounted on the pivot pin 47 and is so designed that the outer end thereof is located somewhat below the outer end of the bar 42 during the larger portion of the movement of the link 43. A metal frame 59, which is located in the inner wall of the furnace structure, has a vertical slot 61 for receiving a rearwardly-extending portion 62 of the bar 58. The slot 61 is of such length that the upper surface of the rearwardly-extending portion 62 will strike its upper wall at substantially the upper limit of travel of the rod 44 in order that the bar 58 may be given a sudden movement in a clockwise direction to strike the lower surface of the tray adjacent to its inner end and thus jar the same.

An annular rack 63 is provided on the plate 16 to effect rotary movement of the hearth by the cooperation therewith of a motor-driven speed-reducing gear mechanism 64 of any suitable or desired kind.

Assuming that the rotation of the hearth has been stopped by any suitable means and that one of the hearth trays 37 is in alignment with the discharge chute 34, the tray-tilting motor is energized to raise the rod 44 sufficiently, through the operation of the intervening mechanism, to cause the bar 42 to engage the bottom of the particular tray in alignment with the chute and tilt it upon its bearings 38.

During the upward movement of the rod 44, the outer portion of the pivoted bar 58 is out of engagement with the tray 37, but, as the rod 44 approaches the limit of its upward movement, the extension 62 of the hook strikes the stop constituted by the upper wall of the slot 61 and swings the outer portion of the bar 58 into sudden engagement with the bottom of the tray 37. In view of the different lengths of the lever arm of the extension 62 and that of the other portion of the bar 58 from the pivot pin 47, the tray will be forcibly jarred by this action, and any heated material mounted on the tray will be loosened therefrom to slide down the discharge chute 34 to either a conveyor or a quench tank.

My invention thus provides a means pivotally mounted on a tray-tilting means for jarring the tray when at substantially the upper end of its vertical movement to effect loosening of the material thereon. The jarring means is carried directly by, and is pivotally mounted on, the tray-tilting means.

While I have illustrated and described my

invention as applied to a rotary-hearth furnace of a particular design, it is obvious it is applicable to furnaces of other types wherein the material-supporting trays are tiltable to effect the discharge of material therefrom.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. In a heat-treating furnace, the combination with a plurality of hearth trays movable through said furnace, and movable means for tilting said trays successively to effect the discharge of material therefrom, of means pivoted directly on said movable tilting means and normally out of engagement with a tray during the tilting movement thereof, and means including an abutment on a wall of said furnace adapted to be engaged by said pivoted means to move it into sudden engagement with the tray being tilted at substantially the end of its tilting movement to effect jarring thereof.

2. In a furnace, the combination with a pivoted hearth tray and means for effecting the tilting thereof, of means for jarring said tray during the tilting movement thereof to effect the dislodgment therefrom of material carried thereby, said means comprising a bar pivoted to said tilting means and normally out of engagement with said tray and means in the path of movement of said tilting means for swinging said bar into engagement with said tray.

3. In a furnace, the combination with a pivoted hearth tray and means for effecting the tilting thereof, of means for jarring said tray during the tilting movement thereof to effect the dislodgment therefrom of material carried thereby, said last-mentioned means comprising a bar pivoted intermediate the ends thereof to said tilting means and normally out of engagement with said tray and means secured to said furnace wall in the path of movement of the portion of said pivoted bar remote from said tray for bringing said bar into sudden engagement with said tray.

4. In an annular heat-treating furnace, the combination with an annular support, a plurality of hearth trays on said support having open outer ends, means for moving the support and trays in said furnace and means for tilting upwardly the inner ends of said trays in sequence, of a single means comprising an annular strip of relatively thin material supported by all of said trays adjacent to their outer ends for closing the outer ends of the trays during their annular movement only, and means for jarring a tray at substantially the end of its tilting movement to effect movement of material located on said tray outwardly therefrom under said annular strip, said jarring means embodying a lever pivoted on the tray-tilting means, and means in said furnace to cause it to operatively engage a tray at substantially the end of its tilting movement only.

In testimony whereof, I have hereunto subscribed my name this 27 day of November 1928.

ORA A. COLBY.