

Jan. 18, 1938.

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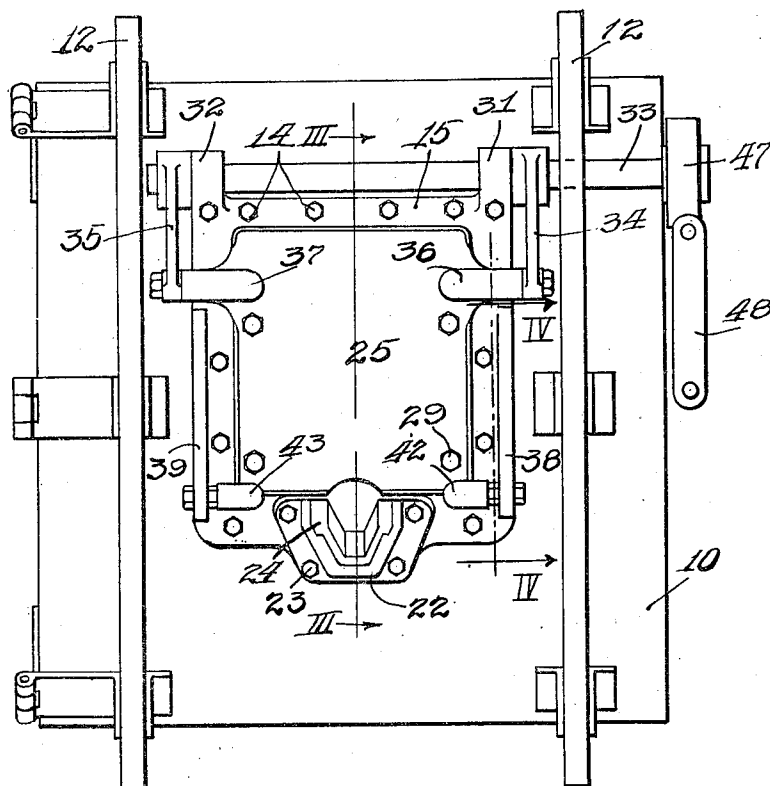
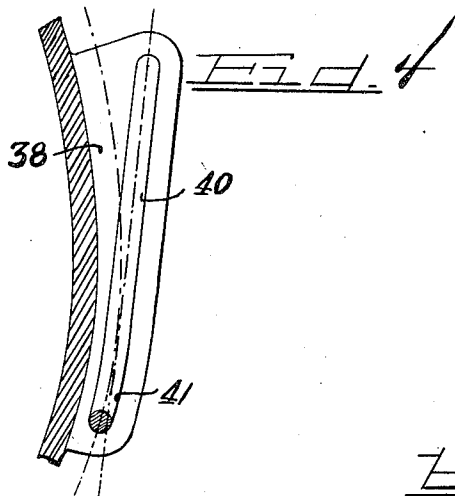
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DOOR AND OPERATING MECHANISM

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Fig. 1



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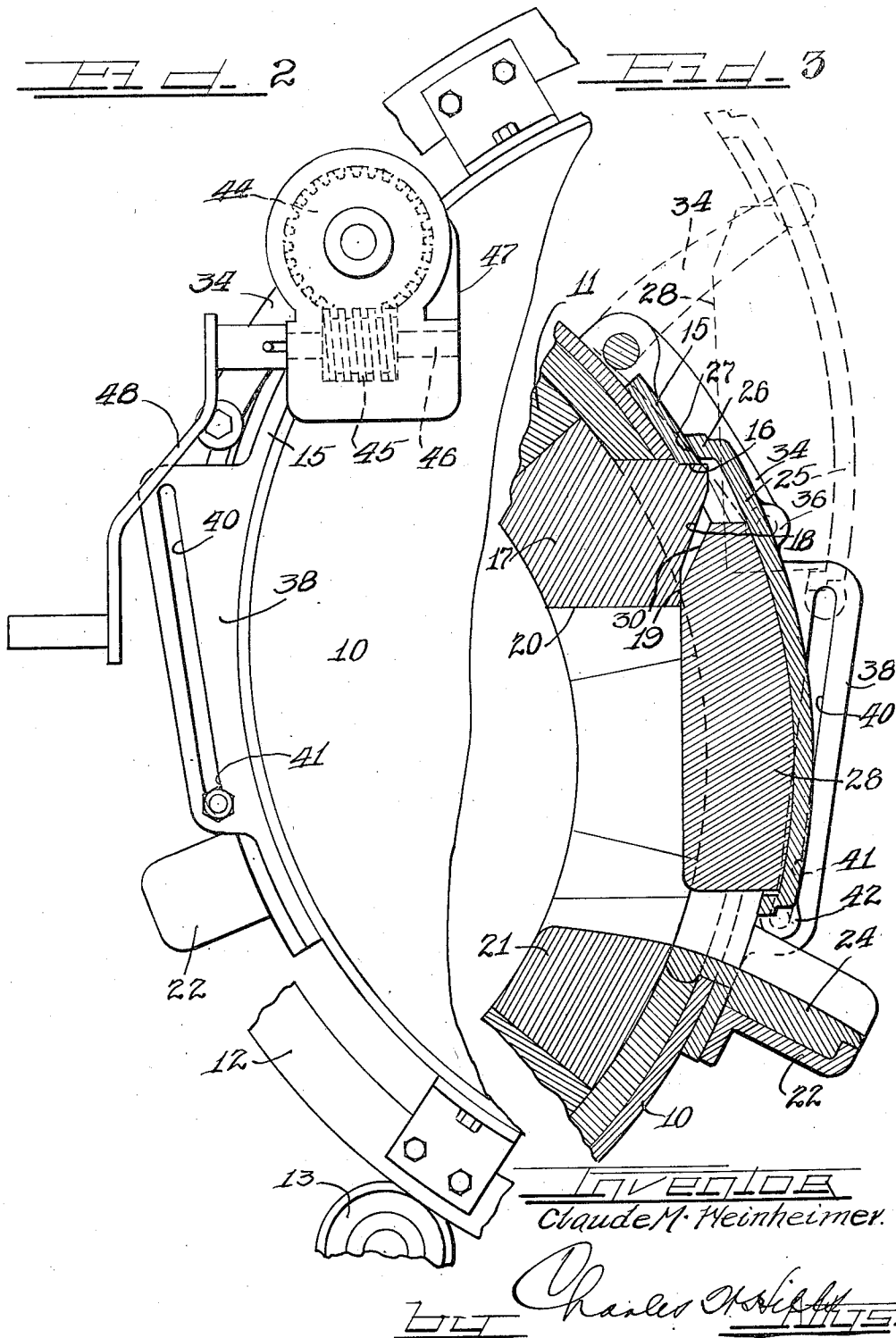
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UNITED STATES PATENT OFFICE

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DOOR AND OPERATING MECHANISM

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2 Claims. (Cl. 110—176)

The present invention relates in general to an improved door construction and is particularly concerned with a novel operating mechanism for opening and closing the door, and although the herein described invention has been found to be particularly adapted for use as a charging door in connection with electric furnaces, it will be apparent that the invention may with equal facility be utilized in connection with other devices.

Heretofore, it has been the general practice in the field of electric furnaces to provide a charging door of the type which is hinged at its upper edge for swinging movement. At most, a door arrangement of this kind was inconvenient and necessitated the use of clamping screws or the like for clamping the door in closed position, which made it very difficult to properly seat the door.

To the end that the difficulties experienced with the usual type of charging doors might be overcome, this invention contemplates a mechanical arrangement for opening the door, wherein the door instead of being swung about one edge is bodily shifted outwardly from its seating position and is at the same time shifted upwardly to one side of the opening, thereby providing unobstructed access to the interior of the furnace. Moreover, with the improved door operating mechanism herein to be described, the mechanism inherently functions to retain the door in any position to which it is moved and prevent movement of the door other than by the actuation of the door operating mechanism. This is particularly advantageous in that when the door is moved to seated position, it is not necessary to have additional clamping means to hold the door in closed position.

A further object of the invention resides in the provision of operating means which is so constructed that during the seating operation, the door will be simultaneously moved toward its seat and at the same time transversely to the seat, whereby a wiping engagement is attained.

It is a still further object to provide a door operating mechanism having its parts so arranged that pressure will be applied against the door in its seating direction, when the door is moved into engagement with its seat.

In accordance with the general features of the invention, it is proposed to provide an opening in a wall structure, in this instance a charging opening in the shell of the furnace, and a door for opening and closing the opening. The door is suspended adjacent its upper margin from a pair of spaced arms which are carried on a rotatable shaft, the outer ends of these arms being pivotally connected to the door proper. This shaft is arranged to be rotated through a worm and wheel, the worm being actuatable by means of a suitable crank. The spaced arms are of

such length that when they are rotated, the upper margin of the door is carried outwardly and upwardly in an arcuate path.

The lower margin of the door is guided by means of spaced members having longitudinally extending slots therein, these slots being disposed at an angle. Cooperatively associated with the slots are lugs which are carried by the door. As the upper margin of the door is carried outwardly and upwardly in an arcuate movement, the lower margin is, therefore, guided so that its movement is rectilinear except for a small portion of its movement at the seating position of the door. The lower end of the guide slots are slightly curved so that as the door is brought into seating position, its movement will be toward its seat.

It will be observed that due to the inclination of the guide slots, components of pressure will be set up to act in a direction toward the door seat, whereby the door is forced under pressure into its seating position. Moreover, this arrangement causes the door to seat with a wiping engagement.

Other objects and features of this invention will more fully appear from the following detailed description taken in connection with the accompanying drawings which illustrate a single embodiment thereon, and in which:

Figure 1 is a view in elevation of a furnace equipped with a door mechanism which embodies the features of the herein described invention.

Figure 2 is an enlarged fragmentary end view of the furnace shell showing the cooperative relationship of the parts of the door and operating mechanism;

Figure 3 is an enlarged fragmentary sectional view through the furnace shell and door to show the open and closed position of the door relative to the charging opening, taken substantially on line III—III of Figure 1, and

Figure 4 is an enlarged fragmentary sectional view showing details of the guiding means for the lower edge of the door, taken substantially on line IV—IV of Figure 1.

As shown on the drawings:

In the illustrated embodiment, the present invention is shown as being applied to an electric furnace, which in this case is of the rocking type, and comprises a shell structure 10 defining a melting chamber. The shell structure is substantially cylindrical in shape and is lined with suitable refractory material which is generally indicated at 11. Rails 12—12 are suitably supported at the respective ends of the furnace shell and are adapted to cooperate with roller supports 13, as shown in Figure 2, whereby the furnace may be rocked about a horizontal axis. Secured to the shell 10, as by bolts 14, is a

substantially rectangular frame structure 15 of suitable metallic material.

The frame 15 defines an opening 16 for the charging of the furnace. This opening at the top of the door is lined with a lintel tile 17 that has a rearwardly inclined forward face portion 18 terminating at a lower marginal edge in a portion 19, this portion being normal to the inner surface 20 of the tile which cooperates with the associated portions of the lining to form an opening through the furnace lining into the melting chamber.

At the lower portion of the charging opening, there is disposed a sill tile 21 which cooperates in forming the charging opening.

For pouring the molten metal from the furnace without the necessity of having to open the charging door, there is provided a spout 22 of metallic material which is secured as by bolts 23 to the lower portion of the frame 15. This spout in actual use is lined with a material such as clay 24, which protects the metallic spout from the molten metal.

The charging opening is closed by a door 25 which is of plate-like construction and provided at its periphery with a deflected flange 26 which not only strengthens the plate but also defines an abutment surface 27 for abutting the frame structure 15.

The rear side of the plate 25 is protected from the heat of the furnace by means of a block 28 of refractory material which is secured to the plate by means of a plurality of bolts 29.

Referring to Figure 3, it will be observed that the upper edge of this block is beveled as shown at 30, whereby as will later be evidenced, as the door starts to move to open position, its upper edge may readily clear the lintel tile.

Referring to Figure 1, it will be noted that the upper portion of the frame 15 is extended to define a pair of spaced bearing members 31 and 32, within which there is rotatably supported a shaft 33. Outwardly disposed of these bearing members and fixedly secured to the shaft 33 is a pair of arms 34 and 35.

The free or outer end of the arms 34 and 35 are pivotally connected to laterally extending lugs 36 and 37 which are integrally formed with the door plate 25.

Disposed on either side of the plate 25 is a pair of side plate members 38 and 39 which are integrally formed with the frame 15 and extend outwardly therefrom. The members 38 and 39 are respectively provided with elongated slots 40 which are rectilinear except for an inwardly curved portion 41 at the lower ends.

The lower edge of the plate 25 is guided by virtue of laterally extended lugs 42 and 43 which are slidably supported in the aligned slots 40 of the plate members 38 and 39. The shaft 13 at one end projects past the associated end of the furnace shell and is fixedly secured to a worm wheel 44 which meshes with a worm 45 on a right angularly disposed shaft 46, the worm wheel, worm and short shaft 46 being disposed within a housing 47 which may be welded or otherwise secured to the end portion of the furnace shell.

The shaft 46 projects at one end from the housing 47 and is adapted to removably receive an operating crank 48 by means of which the worm and wheel may be actuated to open and close the charging door.

Since the drive through the worm and wheel

cannot be reversed, the worm will lock the worm wheel against movement other than by the crank 48 and the charging door will be held in any position to which it is moved. The arms 34 and 35 are of sufficient length that when they are swung in the arc of a circle, the upper end of the charging door is carried clear of the lintel and at the initial starting of the opening operation, the curved portion 41 of the slot 40 causes the door to move outwardly of the charging opening, after which the lower edge of the door has rectilinear motion. The open position of the door is shown in dotted lines in Figure 3.

In moving the door to closed position, the door is seated in the closed position with a sliding movement. Due to the curved portion 41 of the slot, the door is forced inwardly under pressure to its seating position and as the door is seated, the downward movement of the door causes the door to seat with wiping engagement. The worm and wheel operate to maintain the door in seated position and it is not necessary as in the prior art devices to have special clamping devices, etc. to clamp the door in closed position.

From the foregoing description, it will be apparent that the herein described invention provides an improved door and operating means therefor, which is especially applicable for use in connection with a furnace; a door which in the open position is entirely clear of the opening and is held against movement from that position by means other than the operating mechanism, whereby the door will remain in any position to which it is moved; a door which is forcefully seated with wiping engagement and a door which does not necessitate the use of special clamps, etc. for securing it in closed position. Now, it is of course to be understood that although I have described in detail a preferred embodiment of my invention, the invention is not to be thus limited but only insofar as defined by the scope and spirit of the appended claims.

I claim as my invention:

1. In combination, a door frame defining an opening, a shaft rotatably mounted above said door, a vertically swingable arm carried by said shaft and having its outer end pivotally connected to the door adjacent its upper edge, whereby the upper edge of the door is moved outwardly and upwardly away from said opening in an arcuate path, and inclined slot guide means for the lower edge of the door for causing it to initially move outwardly and upwardly in a curved path and thereafter in a straight line path.
2. In combination, a door frame defining an opening, a shaft rotatably mounted above said door, a vertically swingable arm carried by said shaft and having its outer end pivotally connected to the door adjacent its upper edge, whereby the upper edge of the door is moved outwardly and upwardly away from said opening in an arcuate path, inclined slot guide means for the lower edge of the door for causing it to initially move outwardly and upwardly in a curved path and thereafter in a straight line path, and a worm and wheel drive for rotating said shaft to open and close said door and maintain the same in any adjusted position, all of said elements being associated and mounted for unitary movement.

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