April 5, 1932. J. L. McFARLAND 1,852,816

FURNACE

Filed April 7, 1931

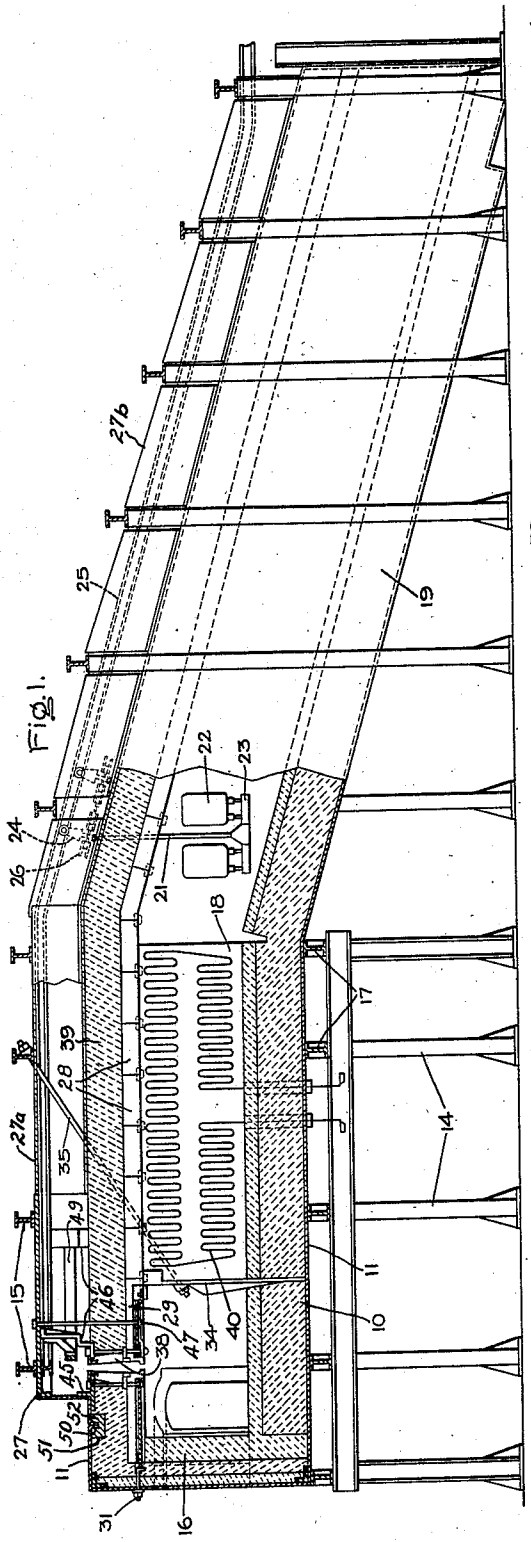

Fig. 1.

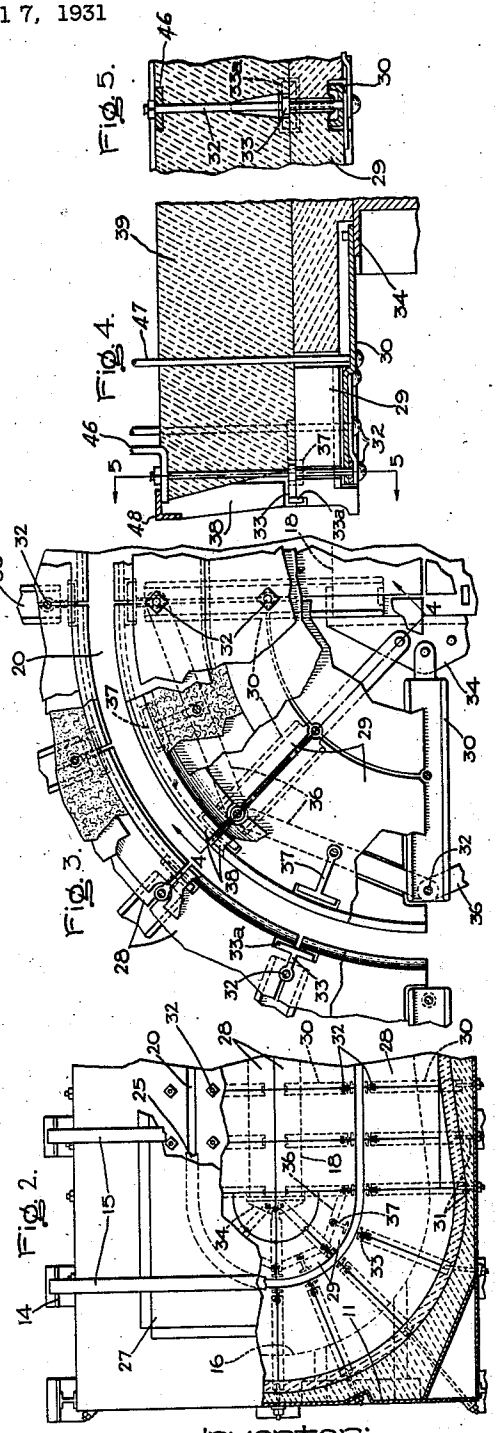

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE

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FURNACE

Application filed April 7, 1931. Serial No. 528,334.

My invention relates to furnaces, more particularly to furnaces provided with a slot or other opening in one of its walls through which a support for the charge extends, and has for its object a simple and reliable construction for the furnace walls, especially the roof wall of the furnace.

My invention is particularly applicable to furnaces of the conveyor type, such as used in baking vitreous enamel, in which a slot opening is provided in the roof for a hanger supporting the charge in the furnace. It has been found that the refractory bricks adjacent the slot have a tendency to become displaced, probably by expansion and contraction during heating and cooling, into the slot space where they obstruct the passage of the hangers. In carrying out my invention I provide specially shaped bricks and mount the bricks so that they are free to expand and contract but are held securely against displacement into the slot opening. It will be understood, however, that my invention has general application in the construction of furnace walls, particularly the roof wall. My invention also comprehends a heat seal between the casing and the furnace refractories.

For a more complete understanding of my invention reference should be had to the accompanying drawings, Fig. 1 of which is a side elevation view partially in section of an electric furnace embodying my invention; Fig. 2 is a fragmentary plan view partly in section of the furnace shown in Fig. 1; Fig. 3 is an enlarged fragmentary sectional view showing details of construction; Fig. 4 is a sectional view taken along the lines 4—4 of Fig. 3 looking in the direction of the arrows; while Fig. 5 is a sectional view taken along the line 5—5 of Fig. 4 looking in the direction of the arrows.

Referring to the drawings, I have shown my invention in one form as applied to a U-shaped continuous conveyor furnace such as used in the baking of vitreous enamel, although it will be understood that my invention has application to various other types of furnaces. A furnace of this general type is described and claimed in the copending application of C. L. Ipsen and James L. McFarland, S. N. 326,833, filed December 18, 1928, and assigned to the same assignee as this invention.

As shown, the furnace comprises heat refractory walls 10 forming an elongated heating chamber, the walls being formed of suitable heat refractory bricks and enclosed in an outer metallic casing 11. The furnace walls are supported on a metallic framework comprising a plurality of vertically arranged I-beams 14 at each side, arranged in pairs having their upper ends connected by horizontal I-beams 15 extending across the top of the furnace. One end of the furnace, as shown in the left-hand end, is closed by a wall 16 and this end is elevated and further supported on horizontal I-beams 17 extending underneath the furnace. This elevated closed end of the furnace serves to entrap the heated air while the opposite lower end remains open for the passage of the articles to be heated into and out of the furnace. In the raised end portion is a central wall 18 made of suitable heat refractory material which divides that portion into two chambers connected together through the passage remaining between the inner end of this wall, i. e., the left-hand end as observed in Fig. 1 of the drawings, and the closed end of the furnace. The articles to be heated may therefore be passed continuously into the furnace along one side of the central wall 18 across the closed end and out past the other side of the wall 18. The inclined portion 19 of the heating chamber serves as a heat exchange chamber whereby heat is given up from the hot articles passing out of the furnace along one side of this chamber to the cold incoming articles on the opposite side of the chamber.

In the roof wall of the furnace is a U-shaped slot 20 having its two parallel straight portions extending in parallel relation throughout the length of the furnace and its curved portion extending across the closed end. This slot is provided for hangers 21 carrying the material 22 to be heated. These hangers consist of rods made of a suitable heat resisting material such as an alloy of

nickel and chromium which are provided with suitable racks 23 on their lower ends for supporting the material 22. They extend upward through the slot into pivoted engagement with trolleys 24 supported on a track 25, shown as an I-beam mounted directly above the slot 20. It will be understood that there will be a plurality of hangers 21 and trolleys passing along the tracks, they being connected together to form an endless conveyor. For example, the trolleys may be secured to an endless chain 26 provided with suitable driving means whereby the hangers and their loads are passed continuously along the track 25 into and out of the heating chamber. In order to prevent the escape of heat through the slot, it is covered by a channel or cap member 27.

In accordance with my invention I provide a special construction for the refractory bricks and associated supporting parts forming the roof of the furnace. I have shown the roof of the furnace provided with a layer of special heat refractory bricks 28 which form the inner lining of the furnace. As shown in Fig. 2 along the sides of the furnace chamber these bricks are long enough to extend from the side wall of the slot to the outer wall of the furnace. In the middle, i. e., between the parallel lengths of the slot there are two bricks placed end to end. Around the curved portion of the closed end of the furnace tapered bricks 29 are used, as shown in Figs. 2 and 3. These bricks are supported on elongated metallic members 30, engaging their adjacent edges, whereby the bricks are free to expand and contract but are secured against longitudinal movement into the slot.

As shown the supporting members 30 are U-shaped or channel members. For the roof support adjacent the side walls these channel members are secured against endwise displacement by means of bolts 31 (Fig. 2) secured thereto and passing through the walls of the furnace. These bolts together with the brick construction forming the side walls of the furnace support the outer ends of the channel members. Their inner ends are supported by elongated vertical rods or bolts 32 having their upper ends secured directly to the cap member 27 or to supporting brackets in turn secured to the cap member, as will be described in detail hereinafter. Suitable recesses are provided in the adjacent edges of the bricks for these rods, or spacing between the bricks may be great enough to allow for them. Also there are provided anchors 33 for the inner ends of the bricks which are shown probably most clearly in Figs. 3 and 4. These anchors 33 are T-shaped members, having apertures in the ends of their shanks through which the rods 32 extend whereby the anchors are secured with their shanks resting in adjacent bricks. The cross bars 33*a* in the anchors project downward into engagement with the outer ends of the bricks so as to effectively secure the bricks against movement in an inward direction, i. e., into the slot opening.

The supporting means for the bricks forming the portion of the roof between the sides of the U-shaped slot is quite similar to that just described. Along the central wall 18 the inner ends of the channel supporting members 30 are supported on this wall, the outer ends being supported by rods 32 as before. Around the curved portion at the ends of the furnace the supporting members 30 have their inner ends secured to a metallic member 34 so as to extend radially between the tapered or V-shaped bricks 29. The member 34 projects upward from the bottom of the furnace to which it is secured, for example in the brickwork at the bottom, and lies against the inner end of the central wall 18. The upper end of this member is secured by a rod 35 extending obliquely through the roof and secured to one of the horizontal I-beams 15. Bracing links 36 are provided to interconnect the outer ends of the supports 30 around the curved portion, these links being pivotally connected at their ends to the supporting rods 32. Also additional anchor members 37 are provided, these anchor members being pivotally secured to the links 36 at the centers thereof.

It will be understood that sufficient space is maintained between the bricks 28 and 29 to allow for expansion and contraction due to changes in temperature. The channel support provides for freedom of expansion and contraction, the bricks being free to slide thereon while the anchor members prevent any movement into the slot opening.

The slot opening is further defined by special upright bricks 38 (Fig. 4) which are set up endwise on the ends of the bricks 28 and 29. These bricks are provided with recesses in their lower adjacent sides for the anchor members 33 (Figs. 4 and 5) and also with recesses for the supporting rods 32. The anchor members, it will be observed, rest on the upper faces of the lower bricks 28 and 29 and have their outer crossbars in engagement with both the outer ends of the bricks 28 or 29 and the outer ends of the upright bricks 38. Suitable recesses are provided for the cross-bars of the anchor members so that the side walls of the slot present smooth surfaces.

On the outside of the bricks 28, 29 and 38 and between the bricks and the outer metallic lining is a layer of suitable heat refractory insulating material 39 preferably in the form of bricks. A similar construction may be used at the bottom of the furnace. Any suitable source of heat may be used. As shown an electric heating resistor 40 is mounted on each side of the central wall 18.

As previously stated, the supporting rods 32 are secured at their upper ends to the top

or cap member 27 either directly or through the medium of supporting members attached to the cap member 27. In the specific construction shown the cap member over the closed end of the furnace, i. e., that portion just above the central wall 18, is in the form of a large cap 27*a* which extends laterally across the furnace from one side to the other. In other words, this portion of the cap member extends over the two sides of the U-shaped groove as well as the base part of the groove, i. e., the left-hand end of the furnace as seen in Fig. 2. At a point substantially above the left-hand end of the central wall 18, as viewed in Fig. 1, this enlarged end portion of the cap member connects with two portions 27*b* extending parallel with each other over the respective sides of the slot to the open end of the furnace. The cap member portions are secured directly to the upper I-beam support 15. They are of substantial construction, preferably of relatively heavy cast iron. On the sides of the slot adjacent the outer walls of the furnace a metallic member 45 is provided, this member being secured in turn to the cap member and forming a support for the upper ends of the rods 32 whereby this part of the roof of the furnace is supported. A similar construction is used for each side of the slot in connection with the two narrow cap member portions 27*b*, the metallic channel supporting members 30 for that portion of the roof wall between the parallel sides of the slot extending across from one slot to the other and having their ends secured to the respective cap members. As a result it will be observed that this central portion of the roof wall between the sides of the slot, that is, the portion to the right of the central wall 18 as viewed in Fig. 2, is suspended on the cross members.

For supporting the central roof section between the slots underneath the enlarged cap portion 27*a* special metallic brackets 46 are provided having their upper ends secured to the cap member and their lower ends forming supports for the upper ends of the rods 32 at this point. The auxiliary supporting rods 47 forming intermediate supports for the channel members around the bend extend directly upward into engagement with the upper wall of the cap member. The auxiliary upright bricks 38 defining the slot opening have their upper ends secured by flange members 48, one on each side of the slot, which flange members are in turn secured to the members 45 or the supporting brackets 46 as the case may be. These flange members furthermore form wearing surfaces for the sides of the slots and prevent injury to the refractories in case the hangers 21 swing from side to side. A curved guard member 49 is provided around the curved portion of the slot against which the trolleys for the hangers bear and whereby the hangers are held centrally in the slot when passing around the bend.

Preferably the metallic parts exposed to high temperatures in the furnace are made of a suitable heat resisting material such as alloy of nickel and chromium or iron, nickel and chromium. This applies especially to the channel supports 30, the links 36 and the rods 32 and 47.

Another feature of my present invention is the provision of a heat seal in the metal casing 11 so as to reduce the escape of heat from the slot opening. I have found that a considerable amount of heat escapes by a conduction through the metal of the casing 11, the casing 11 in effect being a heat radiator. Furthermore, I have found that there is a circulation of air between the casing and the upper layer of bricks whereby the heated gases circulate between the casing and the upper layer of bricks and thus heat a large area of the casing which in turn radiates its heat to the air. Also a certain quantity of the heated gases may escape through crevices in the casing, which may not be gas tight.

In order to reduce this heat loss I provide a flange in the casing near the furnace opening, which flange is turned downward and embedded in powdered heat insulating material, whereby the circulation of the hot gases between the casing and bricks is effectively prevented. As indicated in Fig. 1 the casing is broken at a point near the slot opening, the adjacent edges being turned downward in abutting relation as indicated by the reference numeral 50 so as to lie in a groove or depression 51 provided in the brickwork of the furnace. This groove, or depression, is filled with powdered heat refractory insulating material 52 which thoroughly embeds the down-turned ends of the casing. The two abutting ends are preferably tightly joined together as by welding although this is not absolutely necessary since the rigidity imparted by the down-turned edge or flange serves to hold these portions of the casing in position. It will be observed that this joint in the casing prevents the circulation of heated air underneath the casing since the powdered insulating material forms a gas-tight seal around the flange 50 formed by the downturned edges. This seal obviously has wide application around furnace openings.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made and I, therefore, contemplate by the amended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A furnace comprising heat refractory walls forming a heating chamber, one of said

walls being provided with a slot opening, a plurality of heat refractory bricks defining said slot, elongated members extending transversely to said slot slidably supporting said bricks, supporting means for said elongated members, and means for preventing movement of said bricks on said elongated members into said slot opening.

2. A furnace comprising heat refractory walls forming a heating chamber, one of said walls being provided with a slot, a plurality of bricks defining said slot, elongated members supporting said bricks at the junction thereof, a plurality of rods supporting said elongated members and anchor members for preventing movement of said bricks on said elongated members into said slot opening.

3. A furnace comprising heat refractory walls forming a heating chamber, one of said walls being provided with a slot, a plurality of bricks defining said slot, elongated members supporting said bricks at the junction thereof, a plurality of rods supporting said elongated members and anchor members secured to said rods embracing the ends of said bricks adjacent said slot.

4. A furnace comprising heat refractory walls forming a heating chamber provided with a curved slot in its roof, said roof being provided with a plurality of wedge-shaped members defining said slot, channel shaped members supporting said wedge-shaped members at the junction thereof and a plurality of heat refractory rods supporting said channel members.

5. A furnace comprising heat refractory walls forming a curved heating chamber, the roof wall of said chamber being provided with a slot, heat refractory brick members forming said roof, radially extending channel members supporting said refractory members at their adjacent edges, connections between the inner ends of said channel members and said framework, heat resisting rods securing said channels and anchor members secured to said rods embracing the inner ends of said tapered members.

6. A furnace comprising heat refractory walls forming a heating chamber provided with an opening in its roof, a cap member covering said opening, supporting means for said roof secured to said cap member, and supporting means for said cap member.

7. A furnace comprising heat refractory walls forming a heating chamber provided with a curved slot opening in its roof, a cap member covering said opening, metallic supporting rods for said roof secured to said cap member, and supporting means for said cap member.

8. A furnace comprising heat refractory walls forming a heating chamber, one of said walls being provided with an external recess, an outer metallic casing provided with a portion extending into said recess, and powdered heat refractory material in said recess embedding said portion so as to prevent the circulation of heated gases between said casing and said wall.

9. A furnace comprising heat refractory walls forming a heating chamber, one of said walls being provided with an opening and with an external recess adjacent said opening, an outer metallic casing provided with a flange portion extending into said recess and powdered heat refractory material in said recess embedding said flange.

10. A furnace comprising heat refractory walls forming a heating chamber, one of said walls being provided with an opening and with an external recess adjacent said opening, an outer metallic casing extending from said opening and provided with a flange portion extending into said recess and powdered heat refractory material in said recess embedding said flange so as to prevent the circulation of currents of heated gasses between said casing and said wall.

In witness whereof I have hereunto set my hand.

JAMES L. McFARLAND.