Nov. 7, 1950 J. YOXALL 2,529,272

FLARED JAMB FURNACE DOOR FRAME

Filed March 16, 1948

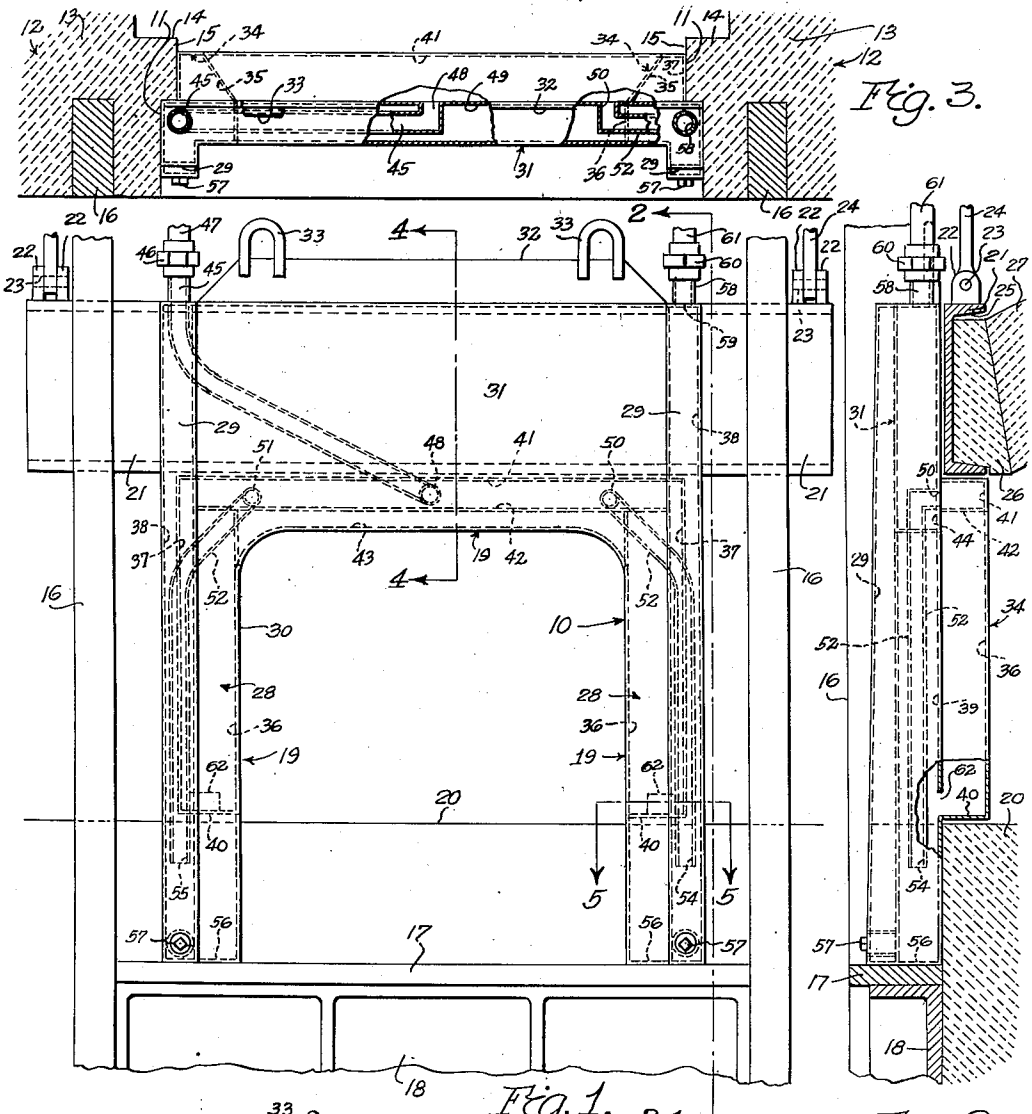


Fig. 1.

Fig. 2.

Fig. 3.

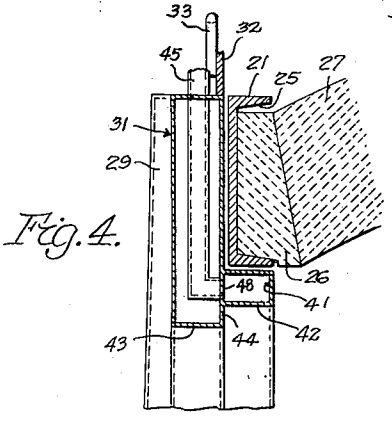


Fig. 4.

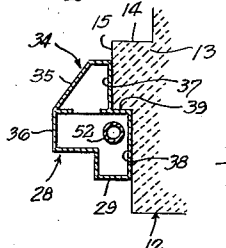


Fig. 5.

Inventor

John Yoxall

By Barthel & Bugbee

Attorneys

Patented Nov. 7, 1950 2,529,272

UNITED STATES PATENT OFFICE

2,529,272

FLARED JAMB FURNACE DOOR FRAME

John Yoxall, Detroit, Mich.

Application March 16, 1948, Serial No. 15,093

3 Claims. (Cl. 122—499)

1

This invention relates to furnace door frames and in particular to water-cooled furnace door frames.

One object of this invention is to provide a hollow water-cooled furnace door frame for industrial furnaces such as open hearth furnaces or the like, wherein a water-cooled flared portion is provided on each side or jamb of the door frame diverging inward at such an angle as to protect the door frame and the adjacent brickwork from damage, particularly that occurring during the withdrawal of charging boxes or other equipment inserted through and withdrawn from the door frame.

Another object is to provide a flared-jamb furnace door frame wherein the inwardly flared portions of the jambs are hollow so as to be water-cooled in a similar manner to the remainder of the door frame.

Another object is to provide a flared-jamb furnace door frame wherein the inwardly-flared portions of the jambs are hollow and are interconnected at their upper ends by a hollow water-cooled extension of the lintel of the door frame, so constructed and arranged as to protect and cool the skew-back channel which extends across the furnace at the upper part of the door frame and which serves to support the arched furnace roof.

In the drawings:

Figure 1 is a front elevation of the front wall of an open hearth furnace showing a furnace door frame equipped with the flared door jambs according to a preferred form of the present invention;

Figure 2 is a vertical section taken along the line 2—2 in Figure 1, showing the flared jamb door frame mainly in side elevation;

Figure 3 is a top plan view, partly in section, of the flared-jamb door frame of the present invention, with the skew-back channel removed to show the parts beneath it;

Figure 4 is a central vertical section through the lintel and skew-back channel of the door frame of Figures 1, 2 and 3, taken along the line 4—4 in Figure 1; and

Figure 5 is a fragmentary horizontal section through one of the flared jambs and adjacent masonry, taken along the line 5—5 in Figure 1.

Water-cooled furnace door frames for industrial furnaces, such as open hearth steel furnaces, are widely used in the steel industry. Such door frames, however, are frequently damaged and their life shortened by collisions between charging boxes and other equipment being withdrawn

2

from the furnace and the jambs or vertical side members of the door frames. Occasionally the door frame is torn bodily away from the adjacent brickwork while the charging box is being removed, causing major repairs to be made to the door frame or requiring complete replacement thereof.

The door frame of the present invention greatly reduces or eliminates such damage due to collisions by providing the door jambs or vertical side members of the door frame with inwardly flared extensions, the walls thereof diverging inward. These extensions, like the main portions of the door frame, are hollow and water-cooled so as to further reduce the destructive effects of heat. The flared jamb portions are interconnected at their upper ends by the hollow horizontal member or lintel extension which projects inward from the lintel of the door frame and serves to cool and protect the skew-back channel which extends across the top of the furnace above the door opening and which serves to support the thrust of the arched furnace roof.

By reason of this construction, when the charging box or other equipment is withdrawn through the door frame and accidentally collides with the flared jamb extensions, it glances off the diverging walls thereof because it hits them at an angle. This construction also prevents the pulling out of the door frame while withdrawing the charging box or other equipment, as the inclined side walls of the flared jamb extensions safely guide and deflect this equipment toward the door opening without providing any abutment surface or shoulder upon which it could gain a hold. At the same time, the hollow water-cooled construction of these flared-jamb extensions further reduces the damage thereto which might be caused by the extreme heat to which these are subjected. The hollow lintel extension extending across the door frame above the tops of the flared jamb extension protects the skew-back channel from such damage.

Referring to the drawings in detail, Figures 1 and 2 show a furnace door frame generally designated 10 according to a preferred form of the invention as applied to an archless doorway opening 11 of an open hearth furnace, generally designated 12. The doorway or door opening 11 is formed between a pair of laterally-spaced piers or jamb walls 13 of refractory masonry, which have inwardly-stepped portions 14 forming a reduced width opening 15 (Figure 3). The piers 13 are strengthened by vertical members 16 embedded in the masonry piers 13. The piers 13 are

interconnected by a foreplate or sill 17 of steel or other suitable material which rests upon the usual breastplate 18.

The opening 19 in the doorway 10 is optionally closed for a portion of its height by a refractory masonry forewall 20 which serves as a dam to raise the level of the contents of the furnace to a greater height than the level of the door sill 17 and thereby increase the capacity of the furnace 12. Extending across the top of the door opening 15 is the usual steel skew-back channel 21, each end of which is provided with spaced ears 22 carrying pivot pins 23 to which supporting rods 24 are pivotally attached. The skew-back channel 21 has its channel portion 25 facing rearwardly toward the interior of the furnace (Figure 2) and serves to receive skew blocks 26 of refractory material which in turn support the arched furnace roof 27 along its front edge.

The door frame 10 of the present invention is fabricated from sheet or plate steel with welded joints which are fluid tight. The door frame 10 includes hollow vertical jamb portions 28 having hollow rib portions 29 extending forward therefrom at the outer edges thereof. The rib portions 29 are substantially at right angles to the main jamb portions 28 so as to guide the furnace door (not shown) in its vertical sliding movement for opening and closing the door frame opening 30. The door frame jamb portions 28 are interconnected by a horizontal lintel portion 31 extending over the door frame opening 30 and forming the upper boundary thereof. Like the jamb portions 28, the lintel portion 31 is hollow for water cooling purposes. Welded to the upper edge of the lintel portion 31 is a plate 32 which has welded thereto a pair of eyes 33 by which the door frame 10 may be handled, as by an overhead travelling crane.

Extending inward from the jamb portions 28 are hollow flared jamb extensions 34 having inner side walls 35 inclined relatively to the jamb side wall 36 so as to diverge inwardly therefrom (Figure 5) toward the inner jamb extension wall 36. The outer walls 37 of the jamb extensions 34 are set inwardly from the outer walls 38 of the main jamb portions 28, leaving a stepped portion or rear wall 39 between the walls 37 and 28. The jamb extensions 34 commence at a height above the door sill or foreplate 17 approximately at the level of the top of the forewall 20, with which its bottom wall 40 approximately coincides (Figure 2). The upper ends of the jamb extensions 34 are interconnected by a hollow lintel extension 41 which extends across the door opening immediately below the bottom edge of the skew-back channel 21. The bottom wall 42 of the lintel extension 41 is stepped above the bottom wall 43 of the lintel portion 31 (Figure 4) with a vertical wall 44 therebetween.

In order to cool the various internal spaces within the door frame 10, a water inlet pipe 45 is provided at the upper left-hand end of the lintel portion 31, and is connected at the coupling 46 to a pipe 47 leading to a source of cooling water. The inlet pipe 45 extends downward through the lintel portion 31 to a port 48 in the forward wall 49 of the lintel extension 41. From side ports 50 and 51 in the forward wall 49 of the lintel extension 41 the pipes 52 and 53 extend downward within the jamb portions 28 and have their lower ends 54 and 55 (Figure 1) terminating a short distance above the bottom wall 56 thereof. Clean-out plugs 57 are provided at the lower ends

of the hollow rib portions 29. In order to carry away the heated water and steam, an outlet pipe 58 (Figure 1) leads upward from a port 59 at the top of the lintel portion 31 and is connected as by the coupling 60 to a pipe 61 which leads to a point of disposal or to cooling apparatus.

In the operation of the invention, cooling water passes downward through the pipe 45 into the interior of the horizontal lintel extension 41, cooling this element, which is at an extremely hot portion of the furnace, and thereby protecting the bottom of the skew back channel 21 from deterioration under this intense heat. From the lintel extension 41, the cooling water passes outward through the ports 50 and 51 downward through the pipes 52 and 53 and out through the lower ends 54 and 55. The water rises upward through the hollow jambs 28 and a portion of it enters the port 62 at the lower end of the jamb extension 34 (Figure 2) to cool the latter. The heated water or steam generated as the water flows upward through the jamb extensions 34 passes into the lintel extension 41 from the top openings in the jamb extensions 34, joining the water supplied directly thereto from the pipe 45. This water, as previously stated, is discharged downwardly through the pipes 52 and 53 into the hollow jambs 28. The water continues to rise in the jambs 28 and flows into the interior of the horizontal lintel portion 31 whence the mixed water and steam flow out through the outlet port 59 and pipe 58 into the pipe 61 which carries them away.

When the charging box or other equipment is inserted through the door opening 30 into the interior of the furnace and is thereafter withdrawn, it causes no damage to the furnace door 10 because if it collides with the inclined walls 35 of the jamb extensions 34, it does so at an oblique angle. As a consequence, it glances off these inclined or flared walls 35, which deflect it toward the opening 30 as it is withdrawn. In actual tests, of a full-size embodiment of this door front, it has been found that the door front of the present invention far outlasts the conventional door front, even outlasting the masonry such as the arched roof 27. It was further found that the door frame of the present invention greatly extended the life of the masonry piers 13, which previously had had to be renewed at frequent intervals. As a result, therefore, the door frame of the present invention has a greatly prolonged life over conventional door frames and therefore results in a great saving in labor and materials, as well as a substantial lowering of the time period during which the furnace is shut down for repairs or overhaul.

What I claim is:

1. In a hollow liquid-cooled furnace door frame and skew back channel cooler, hollow jamb portions forming sides of the frame, a hollow lintel portion forming a top of the frame, hollow elongated flared jamb extensions extending upwardly along and projecting inwardly from said jamb portions toward the furnace chamber, a partition between each jamb portion and its respective jamb extension dividing the same into separate liquid channels, cooling liquid inlet and outlet conduits connected to said portions and communicating with said jamb extensions, and a hollow lintel extension extending between the tops of said jamb extensions and having liquid passageways communicating therewith, said

lintel extension extending inwardly toward the furnace chamber from said lintel portion.

2. In a hollow liquid-cooled furnace door frame and skew back channel cooler, hollow jamb portions forming sides of the frame, a hollow lintel portion forming a top of the frame, hollow elongated flared jamb extensions extending upwardly along and projecting inwardly from said jamb portions toward the furnace chamber, a partition between each jamb portion and its respective jamb extension dividing the same into separate liquid channels, cooling liquid inlet and outlet conduits connected to said portions and communicating with said jamb extensions, and a hollow lintel extension extending between the tops of said jamb extensions and having passageways communicating therewith, said lintel extension extending inwardly toward the furnace chamber from said lintel portion, said liquid inlet conduit being connected to said lintel extension and the lower portions of said jamb extensions being connected to and communicating with said jamb portions.

3. In a hollow liquid-cooled furnace door frame, hollow jamb portions forming sides of the frame, a hollow lintel portion forming a top of the frame, hollow elongated flared jamb extensions extending upwardly along and projecting inwardly from said jamb portions toward the furnace chamber, a partition between each jamb portion and its respective jamb extension dividing the same into separate liquid channels, and cooling liquid inlet and outlet conduits connected to certain of said portions, said jamb extensions near their lower ends having liquid inlet ports opening into said jamb portions and near their upper ends having liquid outlet ports.

JOHN YOXALL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
530,539	Leyson	Dec. 11, 1894
737,937	Kenely	Sept. 1, 1903
1,391,197	Law	Sept. 20, 1921
1,407,708	Thornton	Feb. 28, 1922
1,605,566	Rosenberg	Nov. 2, 1926
1,935,853	McAfoos	Nov. 21, 1933
2,246,403	McDonnell	June 17, 1941
2,427,547	Bulmer	Sept. 16, 1947