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DOOR FRAMEWORK FOR OPEN HEARTH FURNACES OR OTHER INDUSTRIAL FURNACES

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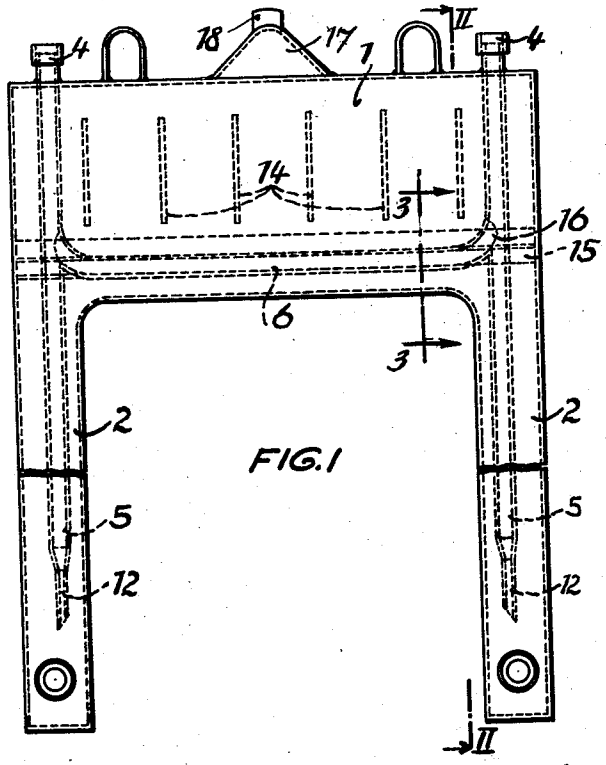


FIG. 1

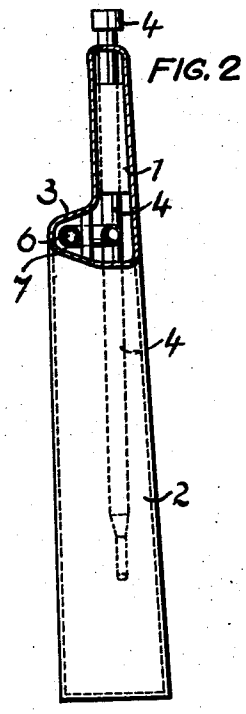


FIG. 2

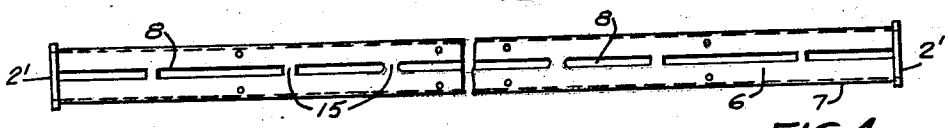


FIG. 4

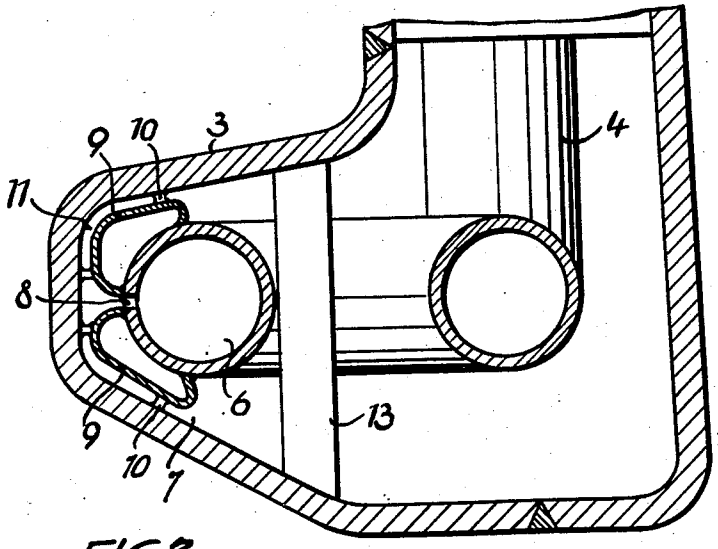


FIG. 3

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DOOR FRAMEWORK FOR OPEN HEARTH FURNACES OR OTHER INDUSTRIAL FURNACES

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The invention relates to door framework with cooling means for open hearth furnaces and other industrial furnaces, and more particularly to such door frames provided with a projection at the side facing the furnace, the projection forming a support, horizontal or inclined, for the ceiling of the furnace made out of refractory brickwork.

In order to guarantee the stability of the door frames of open hearth furnaces or the like in spite of the high temperature of the interior of the furnace, hollow door frames are provided. Through the hollow frame a cooling fluid, such as water, is led, which is being circulated through the frame and a recooling arrangement connected therewith. Nowadays, the door frame is used for the production of steam. For this purpose the door frame is connected by means of forward and return pipes with a vessel mounted above the level of the ceiling of the furnace, so that the mixture of hot water and steam, produced in the door frame, is lifted into the vessel, where steam and water separate. Then the water reflows through the return pipe into the frame. This system has proved especially advantageous in the case that steam of a higher pressure is produced.

In case of frames designed for the production of steam, considerable difficulties arose in connection with the cooling of the projection extending into the interior of the furnace and by which the ceiling of the furnace is supported.

It is an essential object of the invention to provide for an improved door frame suitable for open hearth furnaces and the like and which ensures a perfect cooling of the side facing of the door frame and especially of the parts of the frames supporting the ceiling. A further object of the invention is to provide for an improved design of door frames for open hearth furnaces and the like, permitting the production of high pressure steam.

Further objects of the invention may be seen from the following specification.

Briefly stated, the invention mainly consists in the following:

It was found out that the previous defects and deficiencies of the known frames for the production of steam have been due to the fact that the water recirculating into the frames did not flood the parts extending into the interior of the furnace uniformly. Thereupon it is possible that (along some parts of the frame) zones of higher temperatures are formed. The cooling water entering these zones is vaporised and a flowing layer of steam is formed, which causes a heavy wear in the inside of the cooling frame. In principle, the invention provides means to distribute the water recirculating into the frame in such way over the total surface of the projection of the frame extending into the interior of the furnace, that the water floods regularly along the inside of the horizontal or slightly inclined wall of the projection. Thereby, various separate flows of steam in the frame are prevented, and a regular cooling of the most

heated parts of the frame extending into the interior of the furnace is effected.

With the above and other objects of the invention in view we will now describe several preferred embodiments of our invention.

In the drawings:

Fig. 1 represents a front view of a door frame according to the invention for open hearth furnaces and the like;

Fig. 2 represents a section on the line II—II of Fig. 1;

Fig. 3 is a view taken substantially along the line III—III of Fig. 1 looking in the direction of the arrows;

Fig. 4 represents a detailed side elevational view of the projection of the cooled frame, seen from the furnace after taking off the outer wall.

On the drawings the open hearth furnace or the like with which the various embodiments of the frames are connected, are not shown for simplicity sake. The furnace itself can be designed in a known manner. It has several openings by which the interior of the furnace is accessible. These openings are provided with door frames which are suitably connected with the refractory brickwork of the furnace and against which the door, not shown in the drawing, is fitted from outside in a manner as well known to those skilled in the art.

In the embodiment according to Fig. 1 the door frame consists of the arch or lintel 1 and the two legs 2. The frame is made from soft steel or the like and is hollow to receive the cooling fluid.

In the embodiment according to Figs. 1 and 2 the lower part of the frame is wider than the upper part 1, as shown in Fig. 2. Thereby, a wall or lateral hollow projection 3 extending into the interior of the furnace is formed, being slightly inclined and supporting the brickwork of the ceiling of the furnace normally constructed as a vault.

The cooling water is led into the interior of the frame through the two pipes 4, each of which has an end portion 5 extending into the lower part of frame leg 2.

From the pipes 4 is branched a horizontal pipe 6, which, as shown in Figs. 2 and 3, is located within the chamber 7 of the projection 3 so as to extend into the interior of the furnace.

The pipe 6 is provided with a slit or elongated transverse opening 8 extending the whole length of the arch 1. The said slit or slot 8 is open to the wall of the chamber 7 facing the interior of the furnace. The water flowing out of the pipe 6 is thus distributed regularly over the total width of chamber 7. Preferably pipe 6 is provided with guiding curved spaced members 9 having spaced connecting straps 10 which may be welded to the inner wall of the chamber 7 so as to be supported thereby. The water leaving the slit 8 is thus forced to flow in the comparatively narrow space 11 along the inner wall of chamber 7, partly upwards and partly downwards, so that the water necessarily overflows the total inner surface of chamber 7 of the frame.

The pipes 4 at their lower ends are provided with nozzles 12 which are designed in such manner that part of the water entering through the pipes 4 flows into the horizontal pipe 6 and from there along through the slit 8 upon the inner wall of chamber 7 of the frame.

In case high pressure steam shall be produced in the door frame, chamber 7 can be provided with reinforcing fins 13. Furthermore, the arch or lintel 1 of the door frame can be provided with reinforcing walls 14, e.g. by welding, connecting the opposite walls of arch 1.

The slit transverse opening 8 provided for in pipe 6 can be interrupted by narrow bridges 15 (Fig. 4) in order to avoid the pipe 6 from gaping. The bridges 15 are designed in such way that they are of no essential in-

fluence on the regular distribution of the entering water along the total length of chamber 7 of the frame.

The ends of pipe 6, as indicated at 15', are lengthened beyond the branches leading to pipes 4 and closed by suitable and removable covers 2'. After removing the covers, cleaning tools or the like can be inserted.

The mixture of water and steam being produced during operation within the door frame is drained off through the dome 17 approximately in the middle of the horizontal part 1 of the cooled frame. The dome 17 is connected with the pipe 18.

The pipes 4 and 18 are connected with a closed vessel located above the ceiling of the furnace, not shown in the drawings, the pipes 4 communicating with the lower part of the vessel and the pipes 18 with the upper part of same. In this vessel the steam water mixture flowing upward through pipe 18 is separated into water and steam. The steam can be drawn off the vessel for further use. The water flows through pipe 4 branching off from the bottom of the vessel back to the door frame. Several door frames can be connected as described with the vessel mentioned for the separation of steam and water.

Having now particularly described said ascertained nature of the invention and in what manner the same is to be performed, without however confining the invention to the embodiments shown and described, we declare that what we claim is:

1. A liquid-cooled door frame for open hearth furnaces and the like, including a metal body having a hollow arch and spaced hollow depending legs, said arch having a hollow lateral projection forming a transversely disposed cooling chamber extending into the furnace, means for circulating cooling liquid through said arch and the legs of the body, said means including liquid supply pipes extending into said legs and having a transverse branch connection in said cooling chamber, said branch connection being spaced from the rear wall of said chamber and having at least one elongated transversely disposed liquid discharging slot coextensive in length therewith, said slot facing the rear wall of said chamber, and guiding means between said branch connection and the rear wall of the chamber, said guiding means being positioned on opposite sides of said slot and spaced from the inner wall of the chamber to provide restricted passages for receiving the liquid as it issues from said slot so as to increase the velocity of flow of the liquid along that portion of the door frame wall subjected to the highest degree of heat.

2. A liquid-cooled door frame, as called for in claim 1, in which the arch of said body has laterally spaced longitudinally disposed vertical partitions.

3. A liquid-cooled door frame for open hearth furnaces and the like, including a metal body having a hollow arch and spaced hollow depending legs, said arch having a hollow projection forming a transversely disposed cooling chamber having a vertical wall and arranged to extend into the furnace, means for circulating cooling liquid through said arch and said legs of the body, said means including liquid supply pipes extending into said legs and having a transverse branch connection extending through said chamber and coextensive in length therewith, said branch connection being spaced from said vertical wall of said chamber and having an elongated slot extending the length thereof and facing said vertical wall of said chamber, and guiding means positioned between said branch connection and said vertical wall, said guiding means including curved plate members extending outwardly in opposite directions from the slot to form restricted channels with the inner wall of the cooling chamber so as to direct the liquid in opposite directions as it issues from said elongated slot in order to insure cooling the body over the area thereof subjected to the greatest heat of the furnace, and for providing means for controlling the steam generated in said chamber from having any detrimental effect on the door frame, and means for withdrawing the liquid and steam from the body.

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