July 7, 1925. 1,544,870

N. D. STEVENS

FURNACE

Filed July 31, 1920 2 Sheets-Sheet 1

Fig. 1.

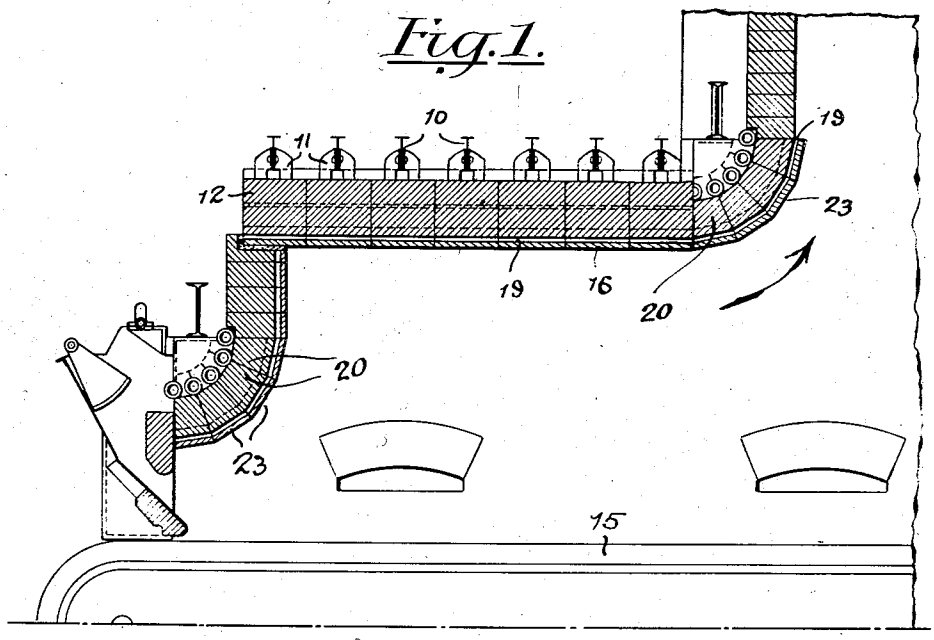
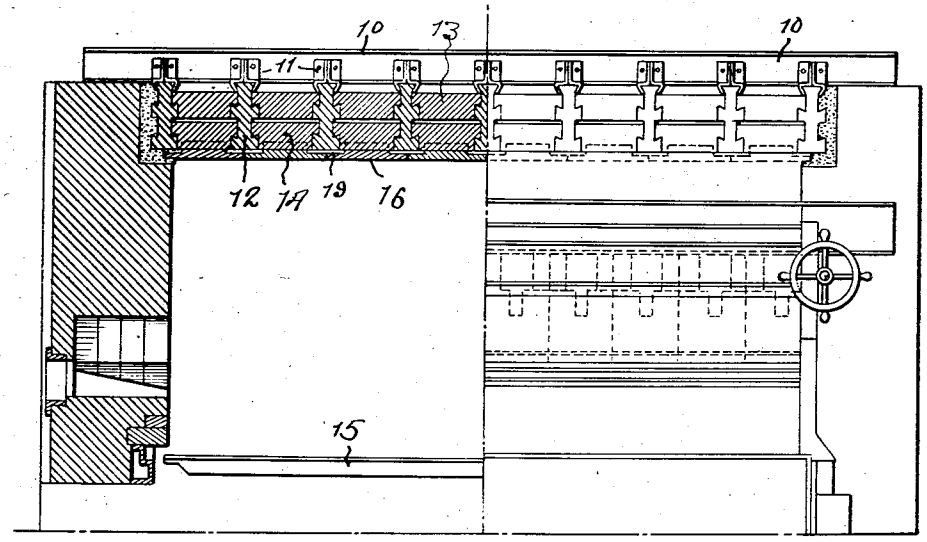


Fig. 2.



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Fig. 4.

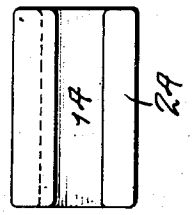


Fig. 5.

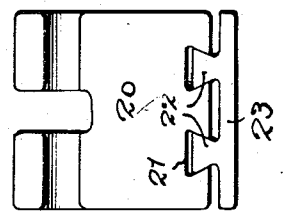


Fig. 3.

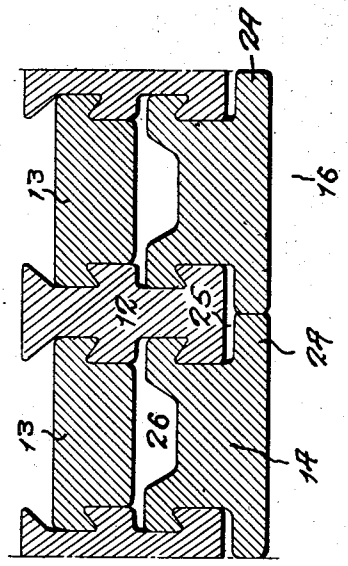
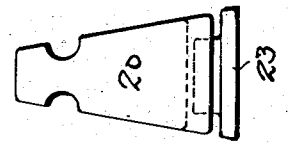


Fig. 6.



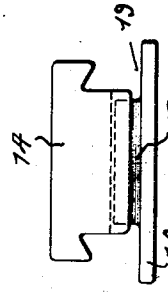
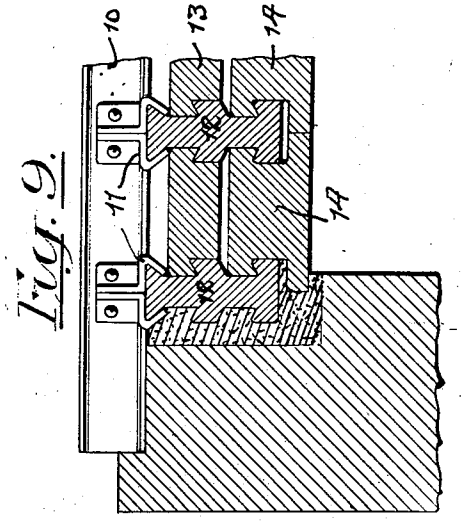


Fig. 7.

Fig. 9.



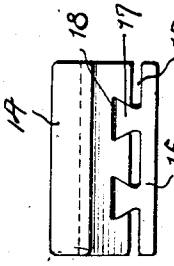


Fig. 8.

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Patented July 7, 1925. 1,544,870

UNITED STATES PATENT OFFICE.

NATHANIEL D. STEVENS, OF WILKES-BARRE, PENNSYLVANIA, ASSIGNOR TO M. H. DETRICK COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

FURNACE.

Application filed July 31, 1920. Serial No. 400,536.

To all whom it may concern:

Be it known that I, NATHANIEL D. STEVENS, a citizen of the United States of America, residing at Wilkes-Barre, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to furnaces, and particularly to the construction of the fire-box walls. Among the objects of my invention may be mentioned especially an improved construction of the lining elements of the fire box to secure greater durability, second, to provide dead air spaces between the lining elements and the main body of the walls, third, to apply these features of improvements particularly to arches of the suspended type of construction.

One of the more specific objects of the invention is the provision of a construction for arches or arch portions of convex arcuate form, such as may be employed in positions where it is desired to change the course or direction of the refractory wall, by virtue of which improved construction such portions of the arch and their supporting members are safeguard against deterioration by the heat and combustion products within the combustion chamber, and the component parts of the structure are rendered accessible and readily interchangeable for purposes of replacement or repair.

Other objects of the invention will be pointed out hereinafter, indicated in the appended claims or obvious to one skilled in the art from the present disclosure.

In the accompanying drawings I have shown one form in which the invention may be embodied, but it is to be understood that the same is here presented for illustrative purposes only, and that it is not to be construed in any fashion such as to limit the invention which I purport to secure, short of its true and most comprehensive scope in the art. In the drawings, which form a part of the specification,

Fig. 1 is a longitudinal section through the fire box of a furnace in which my invention is embodied in one form;

Fig. 2 is a broken front elevation thereof;

Fig. 3 is a detail view in the nature of a section through a portion of an arch including elements of slightly modified construction;

Fig. 4 is a side elevation of one of the filler bricks shown in Fig. 3;

Figs. 5 and 6 are side and end elevations, respectively, of one of the bricks of either of the radial arches;

Figs. 7 and 8 are similar views of certain bricks of the main arch shown in Figs. 1 and 2; and

Fig. 9 is a section through portion of the main arch showing a further modified form of one of the filler bricks.

In its main features the present construction corresponds to that shown in my co-pending application Ser. No. 378,328, filed May 1, 1920, in that the bricks of the main arch are suspended from transverse beams 10 exposed to air cooling and having at suitable intervals clamps 11 which engage the dove-tailed heads of tie bricks 12. Between adjacent rows of tie bricks extend superposed layers of filler bricks 13 and 14. In the construction shown in my previous application, the tie bricks 12 extend the full thickness of the arch, and are consequently exposed at their inner ends to the heat of the fire on the traveling grate 15. Inasmuch as injury to the exposed face of the tie brick lessens the support afforded by it to the intermediate filler bricks 14, I have found it desirable to protect the tie bricks against the direct heat and contact of gases in the fire box.

As shown in Figs. 1, 2, 7 and 8, I employ for this purpose a tile 16, preferably of some material capable of resisting very high heat, such as carborundum, and secure this tile to the filler brick 14 by means of dove-tailed ribs 17 on the tile which fit into corresponding channels 18 formed in the fire-box face of filler brick 14. Where material such as carborundum is used as a facing or veneer tile, certain complications arise from the fact that this material is a good conductor of heat, and consequently would transmit to the tie brick substantially all the heat received by the facing tile, unless the brick were protected therefrom in some way. An effective arrangement for protecting the tie brick is a dead air space 19 afforded by making the ribs 17 on the tile of sufficient height to hold the tile spaced from the fire-box face of the tie brick a slight distance. Inasmuch as the

tiles 16 are arranged edge to edge, and the ribs 17 extend lengthwise of the fire box, a series of channels 19 is afforded extending the full length of the fire box and opening at the boiler end of the box in the direction of the flow of the products of combustion. The latter therefore exert a suction effect in a direction to draw a current of cooling air in through the channels between the carborundum tile 16 and the filler bricks 14, which serves to protect the latter as well as the tie brick 12 from heat injury. It is to be observed that the facing tile 16 and 23 are independently supported, each on individual tile. Accordingly, the facing tile do not interfere with the relative movement of the other tile incident to contraction and expansion, nor are they subjected to stresses incident to the expansion and contraction of the other tile such as would tend to injure them.

The construction of the facing tile for the radial arches at the hopper end and boiler end of the fire box is illustrated in enlarged view in Figs. 5 and 6. The same characteristics of construction are employed. The segmental bricks 20 have in like manner undercut channels 21 in the fire-box faces thereof to receive the dove-tailed ribs 22 on the inner face of the tile 23. The latter are slightly wider than the tile in order that their margins may meet and thus afford a continuous protection at the inner surfaces of the radial arches.

In Figs. 3 and 4, I have shown a still further modification in that the filler brick 14^a at the fire-box face of the main arch is made slightly thicker and is provided with flanges 24 at its opposite margins of such extent that those of adjacent bricks meet on the downward extension of the midline of the tie brick 12, and thus protect the fire-box face of the latter against heat injury. These flanges are preferably slightly spaced from the fire-box end of the tie brick 12, so as to afford a dead air space 25 between the flanges and the protected face of the tie brick.

I have also shown the filler brick slightly modified in the face thereof adjacent the outer brick 13 by depressing the outer face of the brick 14^a to afford a channel 26, which thus gives a greater dead air space between the bricks 13 and 14^a than provided in my prior construction.

In Fig. 9 the construction is substantially the same as that just described with respect to Figs. 3 and 4, except that the filler brick 14^b is not provided with a protective veneer tile 16, or with the channel 26. A construction of this type is satisfactory where the heat of the furnace does not run very high. In the illustrative embodiments shown and in any modifications thereof the tile 12 and 20 may be regarded as suspension tile while the tile supported on them and providing the fire resisting surface, such as the tile 14^a, 14^b, 16 and 23, may be termed the facing tile.

The advantage of the construction shown will be readily recognized when it is recalled that the fusion point of clay brick is approximately 3300° F., and that a safe working temperature should not exceed 3000° F. Where the furnace is used to burn soft coal and powdered fuel, etc., the temperature in the fire chamber is often above the safe working point of the fire brick. The carborundum tile 16, however, will withstand a temperature as high as 4200° F., thus raising the safe working temperature in the furnace approximately 1000°. The construction employed for this purpose is simple and effective. The air circulation through the channels 19 is not sufficient to appreciably lessen the heat transmitted to the boiler, while on the other hand it is sufficient to protect the arch construction. These features are of particular importance in the radial or convex portions of the arch, as in such parts where the course of the combustion gas is changed, there is the greatest tendency for the refractories to spall under the combined influence of the extreme heat and the errosive action of the products of combustion. My invention provides a construction for these portions of the arch which is effective to fully protect the metallic supporting members and to safeguard the refractories, while permitting them the necessary freedom of relative movement to accommodate expansion and contraction and rendering the other parts accessible for replacement or repair.

Various modifications in detail of construction will occur to those dealing with the problem, which do not depart from what I claim as my invention.

What I claim is—

1. In a furnace arch, a metal suspension beam wholly exposed for air cooling, spaced refractory tie blocks directly suspended therefrom, filler refractories engaged between said tie blocks and supported thereby, and means associated with said filler blocks for protecting the fire box ends of said tie blocks against heat injury.

2. In a furnace arch, a metal suspension beam wholly exposed for air cooling, spaced refractory tie blocks directly suspended therefrom, filler refractories engaged between said tie blocks and supported thereby, and means associated with said filler blocks for protecting the fire box ends of said tie blocks against heat injury, said means being air spaced from the fire box ends of the tie blocks.

3. In a furnace arch, a metal suspension beam wholly exposed for air cooling, spaced refractory tie blocks directly suspended

therefrom, filler refractories engaged between said tie blocks and supported thereby, and means carried by said filler blocks for protecting the fire box ends of said tie blocks against heat injury.

4. In a furnace arch, a metal suspension beam wholly exposed for air cooling, spaced refractory tie blocks directly suspended therefrom, filler refractories engaged between said tie blocks and supported thereby, and means carried by said filler blocks and air spaced from the fire box ends of the tie blocks to protect the latter against heat injury.

5. In a furnace arch, an exposed suspension member, arch refractories hung therefrom, spaced layers of arch brick engaging said refractories and supported thereby, the faces of the bricks of one layer opposed to the faces of the adjacent layer being recessed to afford an enlarged air space between the said layers.

6. A furnace arch construction comprising in combination metallic supporting members, wedge-shaped channelled suspension tile supported thereon with their side faces in contact and their end faces in angular relationship, and facing tile engaged in the channels of the suspension tile in covering relationship to their lower end and cooperating to form a continuous refractory wall of arcuate contour.

7. In a furnace fire box, an arch comprising fire brick, in combination with a tile veneer secured to the fire-box face of said brick and spaced therefrom to form a channel, said channel having an unobstructed opening at one end in the direction of the travel of the products of combustion from the fire box and at its other end to a cooling air intake.

8. In a fire-box chamber, a suspended arch forming the roof of the chamber, side walls having expansion chambers into which the ends of said roof enter, together with a protective tile facing for said arch, the tiles entering said expansion chamber at opposite sides of the fire box, together with material in said expansion chambers serving to pack the latter against air leakage.

9. In furnace arch construction, in combination, metallic supporting members, suspension tile individually suspended thereon, and surface tile supported on the suspension tile severally and cooperating to provide a continuous refractory surface for the furnace arch.

10. In furnace arch construction, in combination, metallic supporting members, wedge-shaped suspension tile supported thereon, said suspension tile having end faces in angular relationship, surface tile supported on the suspension tile and associated to form a continuous arcuate refractory surface, portions of said surface tile being spaced from the supporting tile to afford air conducting channels following the contour of the arch surface.

11. In furnace arch construction, in combination, metallic supporting members, wedge-shaped suspension tile supported thereon in angular relationship, and surface tile supported on the suspension tile severally, said surface tile being arranged to form a continuous refractory surface on the arch.

12. In furnace construction, in combination, a plurality of arch supporting bars disposed in substantially horizontal relationship, a plurality of tile supporting members associated with said arch supporting bars, said tile supporting members having tile engaging portions arranged in arcuate relationship, suspension tile suspended from said arch supporting bars and said tile supporting members, and refractories supported on said suspension tile and covering their end faces, said refractories being associated to form a substantially horizontal arch portion supported by the arch bars and a contiguous convex arcuate arch portion supported by the tile supporting members.

13. In furnace arch construction, in combination, associated supporting members having arcuately arranged tile engaging portions, suspension tile supported thereon, and refractories suspended on the suspension tile and covering their end faces, said refractories being associated to form a convex arcuate portion of the furnace chamber.

14. In furnace arch construction, in combination, metallic supporting members, wedge-shaped suspension tile supported thereon, and refractories suspended on the suspension tile with their outer surfaces associated to form a convex heat resisting arch.

15. In furnace arch construction, in combination, a plurality of associated supporting members having tile engaging portions, wedge-shaped suspension tile retained by said tile engaging portions, said suspension tile being provided with channels extending intermediate their converging sides, and refractories engaged in said channels and suspended from said suspension tile in association to form a convex heat resisting arch portion between the suspension tile and the furnace chamber.

In testimony whereof I have signed my name to this specification.

NATHANIEL D. STEVENS.