July 7, 1925. 1,544,869

N. D. STEVENS

FURNACE

Filed May 1, 1920 3 Sheets-Sheet 1

Fig.1.

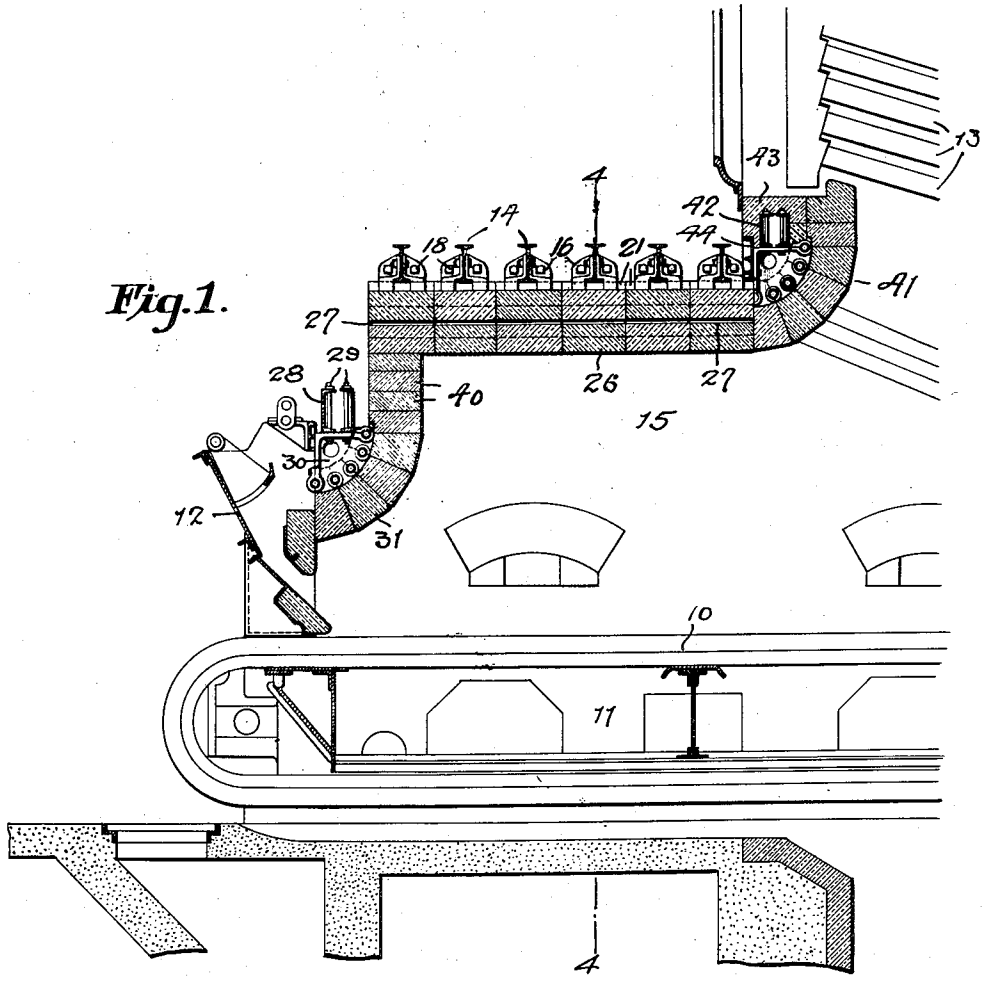
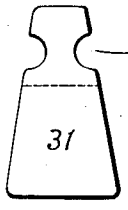


Fig.2.



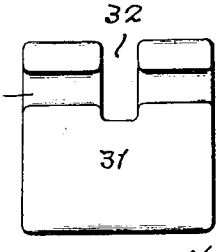


Fig.3.

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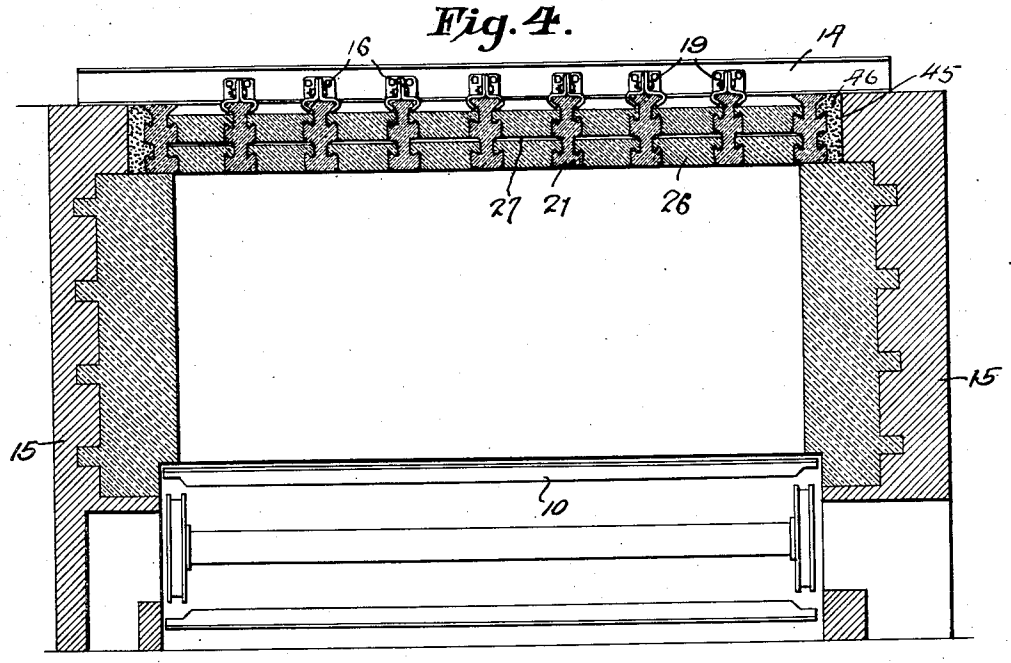
July 7, 1925. 1,544,869

N. D. STEVENS

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Filed May 1, 1920 3 Sheets-Sheet 2

Fig. 4.



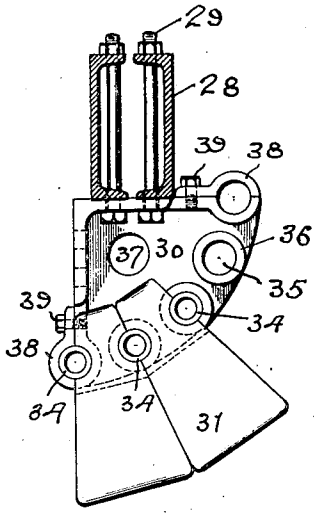


Fig. 5.

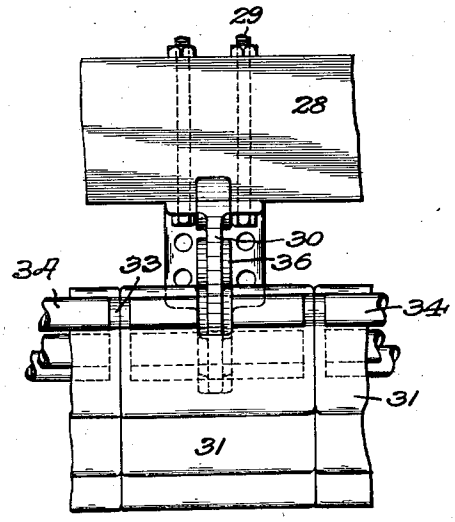


Fig. 6.

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July 7, 1925. 1,544,869

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FURNACE

Filed May 1, 1920 3 Sheets-Sheet 3

Fig. 7.

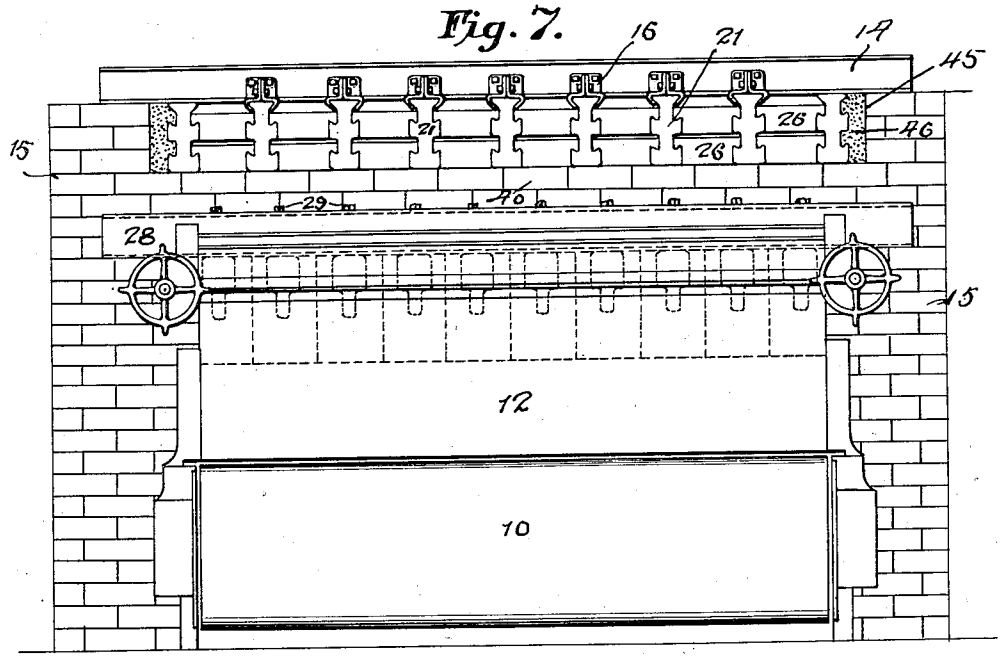


Fig. 8.

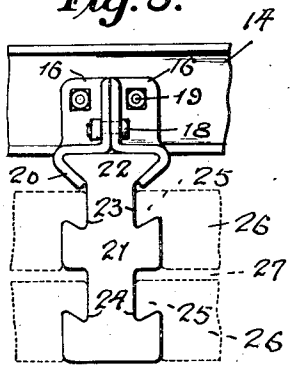
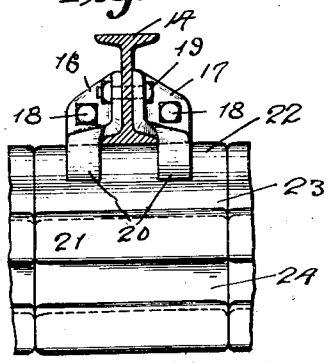


Fig. 9.



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Patented July 7, 1925. 1,544,869

UNITED STATES PATENT OFFICE.

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

FURNACE.

Application filed May 1, 1920. Serial No. 378,328.

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 furnace arches, one object of my invention being to provide a suspension arch in which the metal supports are thoroughly protected against the heat of the furnace by the lining elements of the arch, and are also air cooled so that they readily radiate such heat as is imparted to them through the lining.

Another object is the improvement in the construction of the arch nose and the ignition arch and in the arrangement whereby the wedge-shaped refractories are suspended therein, for the purpose of increasing the effectiveness and serviceability of those portions of the arch and the general efficiency of the furnace.

In the accompanying drawings—

Fig. 1 is a longitudinal section through a portion of a furnace of the travelling grate type, to which my invention is applied in one form;

Figs. 2 and 3 are enlarged end and face views of a brick of the type used on the radial arches;

Fig. 4 is a transverse section through the main arch on the line 4—4, Fig. 1;

Fig. 5 is a detail in the nature of a transverse section of one of the radial arches, with parts removed;

Fig. 6 is a detail in the nature of a partial elevation of the same;

Fig. 7 is a front elevation of the furnace shown in Fig. 1;

Figs. 8 and 9 are, respectively, front and side elevations, drawn to a larger scale, of the brick suspension of the main arch.

While the present arch construction may be applied to furnaces of various types, I have here illustrated the invention in connection with a large furnace employing a travelling grate 10, through which the draft is passed from a wind box 11, and to which fuel is fed from the hopper 12, the products of combustion passing upward to the water tubes 13 of the boiler. Furnaces of this type generate great heat, and considerable difficulty is experienced in keeping the furnace lining in proper condition. While the main furnace arch has been commonly supported by metal elements, the latter have been so arranged as to be more or less embedded in the fire-brick lining, with the result that the heat of the latter is imparted to the metal, and the metal support so weakened that the dropping of the furnace arch through the failure of these supports is a not infrequent occurrence. The present construction is so designed that the metal elements by which the arch is suspended are completely exposed to air cooling, with the result that they rapidly radiate the heat imparted thereto, and are thus maintained in good condition without danger of their failure as a result of the heat to which they are subjected.

The main furnace arch is suspended from a series of transverse I beams 14 resting upon the brick work 15 forming the sides of the furnace. Engaging the lower flanges of the beams are pairs of clamps 16 and 17, the elements of each pair being united by bolts 18, and the respective pairs being secured together and to the I beam by bolts 19 piercing the web of the latter. The clamps support the tie bricks 21, which have undercut heads 22 adapted to be engaged by the claws 20 of the clamps. Each side of the brick is provided with a pair of channels 23 and 24, adapted to receive the supporting marginal flanges 25 of intermediate filler bricks 26, which extend between adjacent tie bricks. The filler bricks 26 are of such thickness that they afford between them a dead air space 27 which assists in protecting the upper layer of bricks and the superposed metal work from the heat of the furnace chamber. As is obvious from the drawings, the supporting beams 14, and the clamps 16 and 17 spaced along each beam, are entirely exposed to the surrounding atmosphere and are thus free to radiate such heat as may be imparted thereto.

The radial arch at the ignition end of the furnace adjacent the hopper 12 is supported by a transverse beam, here shown as comprising two oppositely faced channels 28, through the flanges of which pass the hanger bolts 29 by which segmental plates 30 are supported beneath the beams. A series of

these segmental plates is spaced along the beam 28 and serves to support the bricks 31 which form a radial ignition arch. These bricks, drawn to a larger scale in Figs. 2 and 3, are wedge shaped, and at their norrow ends are slotted at 32 to receive the web of the segmental plates 30, and are grooved at 33 on their opposite faces, the grooves cutting the slots 32. To support the bricks 31 short lengths of pipe 34 are passed through the holes 35 formed near the inner peripheral margins of the segmental plates 30 and are engaged by the grooves 33 of adjacent bricks 31, the latter being thus suspended by the plates 30. I prefer to provide bosses 36 surrounding each hole 35 in order to snugly engage the sides of the slots 32 in the bricks, while at the same time spacing the webs of the segmental plates 30 from the sides of the slots so as to permit air to pass into the slot and thus to afford a free circulation around the portion of the plate 30 which enters the slot 32. Furthermore, while solid bars could be used instead of pipes 34, it is obvious that by making these supporting pieces in pipe form, air is free to pass therethrough and thus to take up the heat of these pipes. In order to facilitate the circulation of air between adjacent webs of the segmental plates 30, they may be perforated as at 37, or otherwise apertured. While it is possible to cast flanges of sufficient size to permit the formation of holes 35 therein at the edges of the plates 30, it is simpler to shape these pieces as a half round and complete the marginal holes by supplemental flange pieces 38 secured in position by bolts 39.

The front wall bricks 40 of the furnace chamber are supported upon the radial ignition arch and protect the beam 28 from the heat of the furnace chamber. It is obvious that the beam 28, the segmental plates 30, and the supporting tubes 34, are all freely open to air cooling, in spite of the fact that portion of the metal lies within the area of the brick work of the ignition arch.

The radial arch 41 at the inner end of the construction is similar to that of the ignition arch, and is suspended by the segmental plates 30 from the beam 42, upon which the brick work 43 of the furnace front rests. It is possible, however, to pass a current of air between the channels 42, and this draft carries off the heat radiated from the plates 30 and the beam. Moreover, the plates 30 are secured, not only to the beam 42, but also to the bracket beam 44 which may be apertured to afford an air inlet and outlet to the area in question, as well as itself radiating to the atmosphere the heat which it receives from the suspension segments 30 of the arch.

In addition to the advantages of construction obtained by the complete air cooling of all metal parts of the arch, the construction is such that repairs may be very readily made. In the main arch it is necessary to disturb only that area of the furnace roof that actually requires repairing, and these repairs are readily made by loosening the clamps which engage the heads of the tie bricks, so that one or more of these may be replaced without disturbing those of the adjacent beam 14. Moreover, by reason of the dead air space 27 between the superposed layers of brick 26 which form the main arch of the furnace, the failure of the lower layer of bricks does not necessitate stoppage of the furnace operation, since the upper layer still suffices to protect the air cooled metal work of the arch. Again, by reason of the manner in which the fire-brick 26 are supported on the tie bricks 21, there is little likelihood of leakage or escape of gases through the joints, since the leakage gases are compelled to follow a serpentine and obstructed course before they escape through the roof and come in contact with the supporting metal.

While the main feature of my invention thus relates to the arch construction and support, I call attention also to the expansion chambers 45, loosely filled with asbestos packing 46, at the opposite sides of the arch. These chambers, which are provided at the sides of the radial arches as well as at the sides of the main arch, take care of the expansion and contraction of the brickwork under varying temperature conditions, without injury to the arch.

It is obvious that various modifications in details of the construction and form of parts may be made without departing from what I claim as my invention. My underlying thought is to provide an arch suspension of such character that the metal parts are exposed throughout to air cooling, and thus minimize the danger of failure of the arch through heat injury.

I claim—

1. In a furnace arch, parallel hanger beams, refractory tie blocks supported therefrom, the connections between said blocks and said beams being entirely external of the former, refractory filler blocks supported on the tie blocks on respective beams, the joints between said filler blocks and their supporting tie blocks being tortuous to afford surface contact and break the joint, and the joints between the refractories on adjacent beams lying between the beams, so that the latter are out of the course of gases leaking through said joints.

2. In a furnace arch, a series of air cooled hanger beams, said beams having courses of refractories suspended therefrom, and comprising spaced tie blocks hung from the beams, and intermediate filler blocks engaged between and supported by said tie blocks, the joints between said tie and filler

blocks being of interengaging rib and recess type and serving to protect the beams from the fire box heat, while the vertical joints between adjacent courses lie between adjacent beams so that the latter are protected from the heat of gases of combustion leaking through said joints.

3. In a furnace arch, a series of air cooled hanger beams, each beam having a course of refractories suspended therefrom, and comprising spaced tie blocks hung from the beam, and a plurality of vertically spaced filler blocks engaged between and supported by adjacent tie blocks, the joints between the tie and filler blocks being of the interengaging rib and recess type, and serving to protect the beam from the fire box heat, while the joints between adjacent courses lie between adjacent beams so that the latter are protected from the heat of gases of combustion leaking through said joints.

4. In a furnace, a fire-box arch comprising exposed air-cooled suspension beams, refractory tie blocks suspended therefrom, and vertically spaced layers of filler blocks engaged between adjacent tie blocks and supported by the latter to form channels communicating with blocks on different beams.

5. In a furnace, a fire box arch comprising a series of transverse air cooled suspension beams, said beams having courses of interlocking refractories suspended below them, certain of said refractories being vertically spaced to afford an air chamber, the chambers of adjacent courses being aligned and constituting an air cooling passage extending transversely of the beams.

6. In a furnace, a fire-box arch comprising an air-cooled suspension beam, a metallic segment secured below the latter, a group of refractory bricks slotted to straddle said segment and grooved at right angles to the slots, together with metallic members engaging said segment and lying in the grooves of adjacent blocks to support the latter from the segment.

7. In a furnace, a fire-box arch comprising an air-cooled suspension beam, a metallic segment secured below the latter, a group of refractory bricks slotted to straddle said segment and grooved at right angles to the slots, together with tubes engaging said segment and lying in the grooves of adjacent blocks to support the latter from the segment.

8. In a furnace, a fire-box arch comprising an air-cooled suspension beam, a metallic segment secured below the latter, a group of refractory blocks slotted to straddle said segment, members passing through the segment and engaging said blocks to support the latter from the segment, and stud means to engage the sides of the slots and space the segment therefrom to permit air cooling thereof.

9. A furnace arch comprising a series of independently supported courses of refractories, a suspension beam supporting each course and having its connections therewith entirely external of the refractories, said courses including spaced tie blocks hung from the beams and filler blocks intermediate and supported on the tie blocks, the courses on the several beams co-operating to form a continuous heat resisting roof and admitting of the removal of a single course independently of adjacent courses.

10. In a furnace arch construction, the combination of supporting beams, refractory suspension tile supported on each beam in spaced relationship, refractories mounted on the suspension tile on the respective beams, the refractories and suspension tile on the several beams being associated to form a continuous refractory arch structure, and connecting members engaging the suspension tile outside the arch, whereby they are secured to the beams.

11. In a furnace arch construction, the combination of supporting beams, refractory suspension tile mounted thereon in spaced relationship, an upper course of refractories mounted on said suspension tile and cooperating therewith to form a heat resisting wall, and a lower course of refractories supported on said suspension tile and cooperating therewith to form a lower heat resisting wall portion spaced apart through portions of its area from the upper heat resisting wall.

12. In furnace construction, the combination with a roof arch, of an arch nose construction comprising supporting brackets disposed collaterally along the margin of the roof arch, suspension members supported on said brackets at different elevations and projecting laterally beyond the opposite sides thereof, and wedge-shaped tile suspended on the suspension members in courses terminating at the margin of the roof arch.

13. Furnace arch construction comprising a beam extending transversely of the furnace chamber, supporting brackets depending therefrom in collateral relationship, said brackets having apertures at different elevations, suspension members secured in said apertures, and wedge-shaped tile retained by said suspension members to form a convex arch nose.

14. In furnace construction, the combination of beams extending transversely over the furnace chamber, refractories suspended from said beams to form a furnace roof arch, collaterally arranged brackets depending from a beam along the margin of the roof arch, securing devices detachably fastened to each of said brackets at different elevations, and a plurality of wedge-shaped refractories retained on each of the brackets

by the securing devices, said wedge-shaped refractories being associated to form a convex nose at the end of the roof arch.

15. In furnace construction, the combination of beams supported to bridge the furnace chamber from side to side, refractories suspended from said beams in courses running transversely of the furnace to form a top arch, brackets supported by one of the beams along a margin of the top arch, securing devices removably secured to each of the brackets at different elevations, and a plurality of wedge-shaped refractories retained on each of the brackets by said securing devices, said wedge-shaped refractories being arranged in upwardly running courses and with their converging faces in contact so that their outer end faces form a convex arch portion in association with the top arch.

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

NATHANIEL DICKINSON STEVENS.