

No. 676,606.

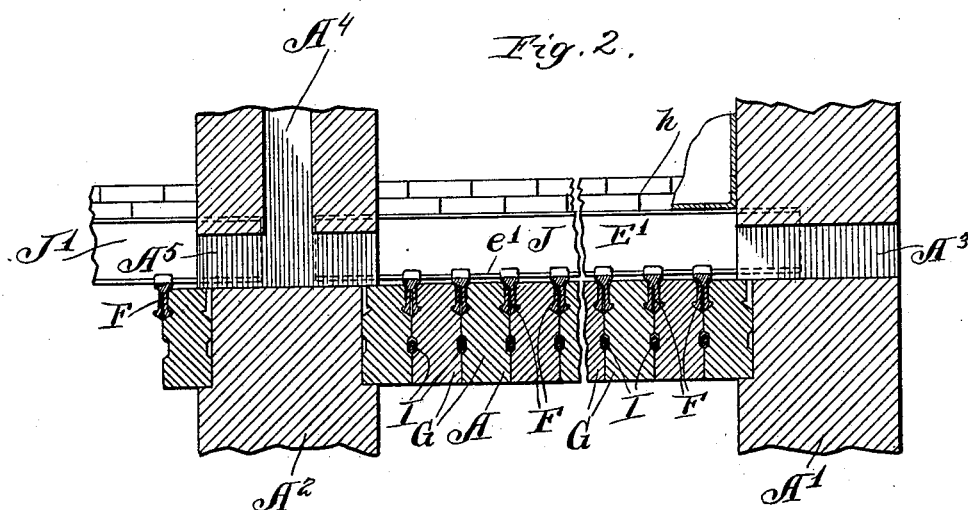
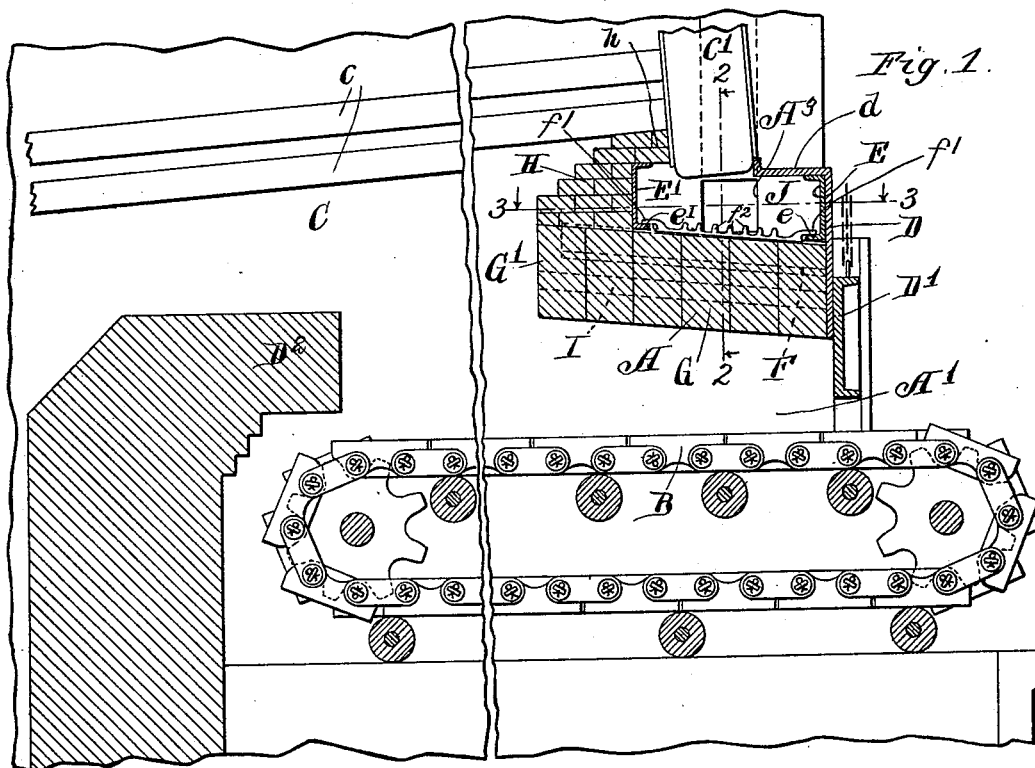
Patented June 18, 1901.

W. M. GREEN & J. R. GENT.
FIRE ARCH FOR FURNACES.

(No Model.)

(Application filed Apr. 4, 1900.)

2 Sheets—Sheet 1.



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2 Sheets—Sheet 2.

(No Model.)

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Fig. 4.

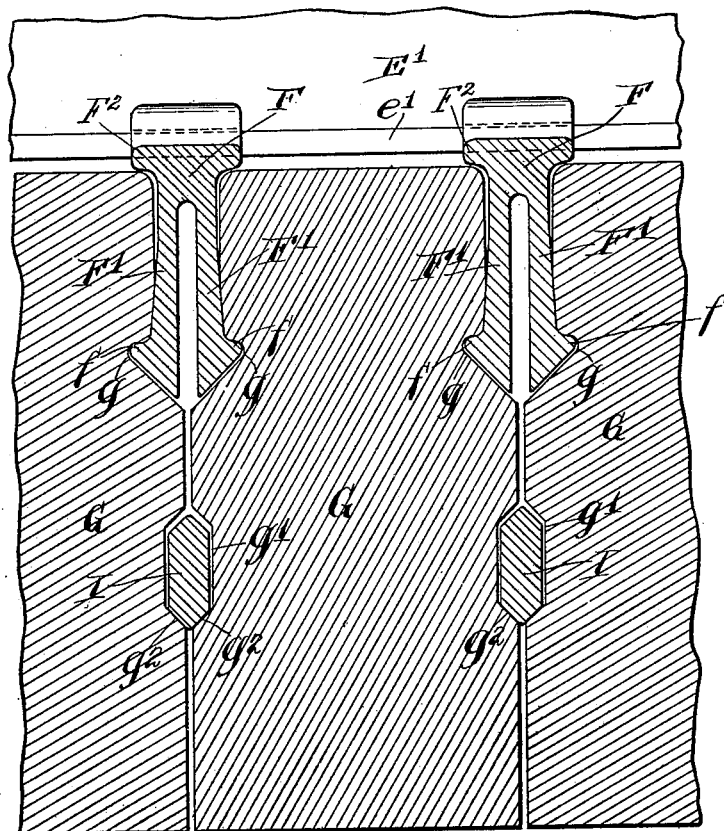
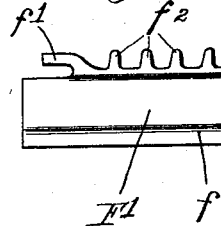


Fig. 5.



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UNITED STATES PATENT OFFICE.

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FIRE-ARCH FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 676,606, dated June 18, 1901.

Application filed April 4, 1900. Serial No. 11,443. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM M. GREEN, a resident of Evanston, and JOHN R. GENT, a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fire-Arches for Furnaces; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in fire-arches for boiler and other furnaces.

The invention relates more especially to the features of construction of the fire-arch itself, to means preventing overheating of the metal supporting parts of the same, and to other details of construction in such structures, as will hereinafter more fully appear.

The invention consists in the matters hereinafter set forth, and pointed out in the appended claims.

In the accompanying drawings, illustrating our invention, Figure 1 is a central vertical longitudinal section of a boiler-furnace, showing the fire-arch embodying our invention and other related parts. Fig. 2 is a vertical transverse section taken through the fire-arch on line 2 2 of Fig. 1. Fig. 3 is a detail plan section taken on line 3 3 of Fig. 1. Fig. 4 is a sectional view, much enlarged, of the parts for supporting the fire-brick illustrated in the sectional view, Fig. 2. Fig. 5 is a detail side view of one of the beams which support the fire-brick.

As illustrated in the said drawings, A indicates a fire-arch, which, as shown, is located over the forward end of a grate B, herein shown as having the form of a traveling or chain grate.

C indicates a boiler located above the furnace, which is herein shown as having the form of a water-tube boiler, provided with tubes *c* and a water-head *c'*, which latter in the instance illustrated is located over the fire-arch.

D indicates the front plate of the furnace, D' the sliding fuel-door thereof, and D² the bridge-wall at the rear end of the grate.

Referring first to the construction of the fire-arch and means by which the same is supported, said parts are constructed as follows: Said fire-arch as a whole is sustained by means of a plurality of transverse girders, supported at their ends in the side walls A' A² of the furnace. Two of such transverse girders E E' are shown in the drawings, of which the forward girder E is shown as located in contact with the front plate D of the furnace, and the rear girder E' is shown as located at some distance rearwardly from the same and at the rear of the water-head *c'* of the boiler. Attached to the lower side of said girders E E' are a plurality of longitudinally-arranged metal beams F F, arranged in parallel relation to each other and parallel with the side walls of the furnace, and therefore at right angles to the main girders E E'. Said girders E E' are provided at their lower edges with flanges *e e'*, by which the beams F F are attached to the said girders. Preferably and as herein shown the said girders are made of channel form and are provided with flanges at their upper as well as at their lower edges; but the said girders may be of any desired form or cross-sectional shape adapted to afford the necessary strength and rigidity and to provide for the attachment of the beams thereto. Said beams F F are provided on their side faces with laterally-extending flanges *ff*, and the arch proper, which is flat, is formed by means of fire-brick G G, which are engaged with the flanges *ff* on the beams F F, each brick being provided at each side with a groove *g*, adapted to engage the adjacent flange on one of the beams F. Said beams F are so connected with or supported from the girders as to be movable or adjustable sidewise or in a direction endwise of the girders, so that said beams may be slid or moved along the girders to bring them at the proper distance apart to receive or engage the fire-brick, it being intended that the arch be assembled by inserting a row of fire-brick, placing a beam against the same, then inserting another row of brick, placing another beam in engagement therewith, and repeating the same operation until the arch is complete. The main parts of the fire-brick are located or extended below the beams F F,

and fire-brick meet at their side faces, so as to form a close or continuous arch and prevent access of heat or products of combustion to the said beams. The said beams F are extended at their rear ends past the rearmost girder E', and the end portions of the beams thus projecting beyond or rearwardly from said transverse girder serve to support a transverse bridge-wall H, which closes the space between the top of the fire-arch and the boiler above the same. As herein shown, the upper part of said wall H is extended forward over and above the rear girder E' into contact with the rear face of the boiler water-head c', as clearly seen in Fig. 1, this construction being employed in order to make close joints between the water-head and the said bridge-wall H.

In order to protect the rear ends of the longitudinal beams F from the action of the fire, the grooves in the fire-brick may be filled by a packing of asbestos or other refracting material. The rearmost fire-brick G' may differ from the others in having the grooves g thereof extended only partly through the thickness of the brick, as shown in the accompanying drawings. When thus constructed, the bricks are made of uniform thickness from top to bottom at their rear faces, so that the side faces of the same in their parts which extend rearwardly beyond the beams come in close contact throughout the entire height or vertical thickness of the arch, and thereby serve to cover and protect the ends of said longitudinal beams. In the accompanying drawings the bridge-wall H is shown as extended rearwardly past the ends of the longitudinal beams, so that its rear surface is flush with the rear surface of the fire-brick G' and the rearwardly-projecting ends of the beams F are completely inclosed by or buried in the mass of brickwork which forms the rear part of the fire-arch and the said bridge-wall.

Now referring to certain novel details of construction in the beams F and the fire-brick which constitute part of our invention, the same embrace the following features: Said beams are provided with deep longitudinal grooves extending upwardly from their lower edges and making the beams of inverted-U shape in cross-sectional form, the beams thus made consisting, in effect, of two laterally-separated side pieces or flanges F' F'', united with each other at the upper parts of the beams and having the flanges f f' on their lower parts. The several brick are slightly narrower than required for completely filling the space between the side walls of the furnace, so that they will be separated by narrow spaces when in place upon the beams. The grooves g of the fire-brick fit or embrace closely the flanges f f' on the lower margins of the side portions F' of the supporting beams, so that the fire-brick are held positively and rigidly in place by their engagement with said beams, but by reason of the

inverted-U-shaped form of the beams giving a capacity for lateral yielding or resiliency to the separated lower edges thereof, and also, by reason of the spaces left between the fire-brick when inserted in position in the fire-arch, said fire-brick are adapted to expand under the action of the heat without coming in actual contact with each other and without being subjected to compressive strain, such as is liable to occur in case the fire-brick are fitted close together or are fitted closely in contact with each other when first inserted in place. By reason of the lower portions of the beams being separated, as described, it is obvious that the said parts of the beams will spring or yield inwardly or toward each other when the fire-brick expand under the action of the heat, thereby maintaining the fire-brick in positive engagement with the said beams, while allowing expansion thereof in the manner described. The side faces of the said beams, above the flanges f, are shown as separated from the adjacent upper parts of the fire-brick by narrow spaces, so that when the fire-brick are put in place they come in contact with the lower portions only of the beams and are free from contact with the upper or non-resilient portions of said beams. It follows that expansion of the upper portion of the fire-brick is permitted without liability of compressive strain coming thereon. In the particular construction of the parts illustrated the spaces referred to are formed by making the side faces of the beams, above said flanges f, inclined or tapered inwardly and by making the side faces of the upper parts of the fire-brick, above the grooves g therein, vertical or parallel with each other. In order to afford tight joints between the brick of a fire-arch thus made or to provide means for closing the joints which are left between the fire-brick to permit expansion in the manner described, the adjacent surfaces of the fire-brick, below the flanges by which they are supported, are provided with horizontal grooves g', arranged opposite each other, so as to form spaces or passages between the bricks, and in said spaces or passages are placed filling-pieces I, which by resting in the bottoms of said passages serve to cover or close the joints between the bricks. As a further improvement the lower surfaces g² of the said grooves g' are inclined or beveled, so as to make the bottoms of the recesses between the brick of V shape, and the filling-pieces I are correspondingly beveled on their lower edges or surfaces. Obviously this construction insures tight joints between the filling-pieces I and the brick, while at the same time permitting the free expansion of the brick without liability of crushing the said filling-pieces, it being of course understood that said filling-pieces are made slightly narrower than the width of the said recesses, so as not to interfere with the free expansion of the brick. Moreover, the inclination of

the oblique lower surfaces of the grooves and of the lower edges of the filling-pieces are such as to permit the inclined surfaces of the brick and filling-pieces to slide freely on each other as the brick expand, thereby avoiding any binding or wedging of the filling-pieces between the brick, which would result in a tendency to crush the filling-pieces in the expansion of the brick.

As an improved means of supporting the beams *FF* upon or sustaining them from the said girders *E E'* said beams are provided with horizontally-extending prongs or fingers *f'*, which extend upwardly from the upper surfaces of the said beams and are directed horizontally, so as to overlap and engage the upper surface of the horizontal flanges *e e'* on the lower edges of the said girders *E E'*, said fingers serving to permit lateral sliding of the beams on the girders to correspond with the thickness of the fire-brick placed between the beams. The said fingers may be made separate from and attached or secured to the said beams; but as herein shown the beams are made of cast metal and the fingers or prongs are made integral therewith. Where the girders are provided with flanges at their lower edges, which project toward each other, as is the case with the flanges *e e'* illustrated, the fingers *f'* on the beams will project or extend toward the ends of the beams, and in this case the beams will be engaged with the girders by placing the beams first in an angular relation to the girders, then lifting the fingers above the flanges on the beams, and then bringing the beams at right angles to the girders, so that the fingers will engage said flanges. When the girders are thus provided with flanges for engagement with the fingers on the beams, no other means for attaching the beams to the girders is required, the arrangement of the flanges *e e'* being such that they are directed oppositely on the two girders, and the corresponding arrangement of the fingers, as described, has the advantage of holding the beams from endwise movement without the employment of any special construction for this purpose.

As a means of keeping cool or from becoming unduly heated the metal girders and beams or other metal parts of a fire-arch a construction is provided as follows: Over the fire-arch is formed an air space or chamber *J*, which communicates at its ends, through suitable openings or passages in the side walls of the furnace, with the outer air, whereby an air-current may pass through said chamber and in contact with said metal parts, so as to absorb the heat from said metal parts and keep the same from being overheated. In the particular embodiment of our invention herein illustrated said air-chamber is made as follows: The front plate *D* of the furnace is provided at its upper edge with an inwardly-extending part or flange *d*, which reaches to and comes in contact with the wa-

ter-head *c'* of the boiler, so that said part *d* of the front plate, the said water-head, and the overhanging part *h* of the bridge-wall *H* together constitute a top or covering extending between the upper margins of the girders *E E'* and forming with said girders and the fire-arch below the same the said air space or chamber *J*, which extends between the side walls *A' A²* of the furnace over the top of the arch. In one of the said side walls *A'* is provided a passage or opening *A³*, which communicates with the outer air and opens at its inner end into the said space or chamber *J*, while in the side wall *A²*, which in the instance illustrated constitutes the partition or dividing-wall between two furnaces, is located an upright flue or passage *A⁴*, the lower end of which is connected with the chamber *J'* by means of a horizontal passage *A⁵*. The top or upper end of said flue *A⁴* may open into the outer air or into the open space above the furnace, or said flue may be connected with a stack or chimney. When the wall *A²* constitutes a partition-wall between two furnaces, the vertical passage *A⁴* will be connected at its lower end by another passage *A⁵* with a chamber *J'*, located over the fire-arch of a second or adjacent furnace. It will be understood from the construction described that inasmuch as the wall *A²* is heated to a considerable extent by heat from the furnace the air within the said flue *A⁴*, as well as that in the chamber *J'*, will tend to rise, thereby producing an upward draft through said flue *A⁴*, with a result of drawing the cooler outside air constantly inward through the opening *A³* and through the air-chamber *J'* to the said flue *A⁴*. The constant current of air thus induced through the air-chamber *J'*, passing over the top of the fire-arch, will obviously tend to absorb and carry away the heat from the metal supports of said arch, and thereby avoid excessive heating thereof. The cooling effect produced by the air also particularly prevents excessive heating of the lower edges of the girders *E E'* and the beams *F*, which are directly in contact with the fire-brick. The provision described for securing a constant flow of cool or cold air over the fire-arch and the metal parts supporting the same is of very great importance, as it has been found in practice that in fire-arches as heretofore constructed, owing to the high heat to which the said fire-arch is subjected, the metal beams supporting the arch are liable to rapid deterioration and are likely to require frequent renewal.

As a further improvement and in order to facilitate the cooling of the beams *F* the latter are provided at their upper edges with enlargements or heads *F²* and also with upwardly-projecting prongs, teeth, or ribs *f²*, which are preferably arranged transversely to the beams, so as to interfere as little as possible with the flow of air through the air-chamber *J*. Said heads *F'* and the teeth or

ribs f^2 seem to give a large area of surface exposed to the air, and thereby insure a much more rapid cooling of the beams than would occur if the relatively narrow upper edges of the beams proper were exposed to the air within the chamber.

We claim as our invention—

1. A fire-arch for furnaces comprising a plurality of transverse girders which rest at their ends on the side walls of the furnace, beams attached to the lower edges of the said girders and extending beneath the same, said beams being provided with lateral flanges, and fire-brick provided with lateral grooves in their side faces near their upper surfaces, adapted to engage said flanges of the beams, said fire-brick being suspended from said beams with their upper surfaces below and free from contact with said girders.

2. A fire-arch for furnaces comprising beams of inverted-U shape provided with lateral flanges, and fire-bricks provided in their side faces with grooves to engage said flanges on said longitudinal beams, the side faces of the said fire-bricks being separated from each other to permit expansion of the same, and means for closing the joints between the bricks below the beams to prevent access of products of combustion to said beams constructed to maintain closed the spaces between said faces while permitting contraction and expansion of the bricks.

3. A fire-arch for furnaces, comprising beams of inverted-U shape provided with lateral flanges, and fire-brick provided with grooves to engage the flanges on said longitudinal beams, said fire-brick being separated from each other and from the upper parts of the beams by spaces permitting expansion and contraction thereof.

4. A fire-arch for furnaces, comprising beams and provided with lateral flanges, and fire-brick provided with grooves to engage the flanges on said longitudinal beams, said fire-brick being provided in their adjacent faces below the beams with grooves forming recesses between the same, and filling pieces or keys inserted in said recesses.

5. A fire-arch for furnaces, comprising beams provided with lateral flanges, and fire-brick provided with grooves to engage said flanges and having in their adjacent faces below said beams opposite grooves forming recesses between the brick and filling pieces or keys inserted in said recesses, the lower surfaces of said recesses being V-shaped or inclined, and the lower edges of said filling-pieces being of corresponding shape.

6. A fire-arch for furnaces, comprising longitudinal beams of inverted-U shape in cross-sectional form and provided on their lower parts with lateral flanges, and fire-brick provided with grooves to engage the said flanges, said fire-brick being also provided on their adjacent faces with horizontal grooves, forming recesses or passages between the adjacent

surfaces of the fire-brick and keys or filling-pieces inserted in said recesses.

7. A fire-arch for furnaces comprising girders provided with flanges at their lower edges, beams located below the girders and extending transversely thereto, said beams being provided with lateral flanges, and fire-brick provided in the upper part of their side faces with grooves to engage said flanges on the beams, said beams being provided on their upper edges with arms or fingers which project upwardly therefrom and engage the flanges on said girders.

8. A brick for a fire-arch provided in its upper part with lateral grooves for engagement with a supporting-beam, and in its side faces below said grooves with other grooves to form recesses for filling-pieces.

9. A furnace provided with a fire-arch, comprising transverse girders extending between the said walls of the furnace, longitudinal beams attached to said girders, fire-brick supported by said beams, the said girders and beams forming the bottom of an air-chamber located over said arch, and air inlet and exit passages in the side walls of the furnace communicating with the said air-chamber.

10. A furnace provided with a fire-arch, an air-chamber extending between the side walls of the furnace over said fire-arch, an air-inlet passage in one of said side walls, and an exit-passage in the other side wall, said exit-passage being connected with said air-chamber and extending from the said exit-passage upwardly through said side wall.

11. A furnace provided with two side walls, a fire-arch consisting of two girders extending between said side walls, beams attached to said girders, and fire-brick supported on said beams, one of said side walls being provided with an air-inlet opening extending therethrough into said air-chamber, and the other of said walls being provided with a vertical air-exit passage connected at its lower end by a lateral opening with the said air-chamber.

12. A fire-arch comprising girders, transverse beams located below and supported upon said girders, and fire-brick having interlocking engagement with said beams below the upper edges thereof, said beams being provided at their upper edges with heads or enlarged parts affording extended surfaces for contact with the air.

13. A furnace, comprising a fire-arch and an air-space above the same which is in communication with the outer air, said fire-arch embracing fire-brick and supporting-beams provided at their upper edges with enlarged parts or heads affording extended surfaces for contact with the air within the said chamber.

14. A fire-arch comprising girders, transverse beams supported on said girders, and fire-brick having lateral engagement with said beams below the upper edges thereof,

said beams being provided at their upper edges with enlarged parts or heads on which are formed teeth or ribs.

15. A beam for supporting fire-brick in a
5 fire-arch having at its upper edge a wide or flat head having upwardly-projecting transverse ribs or teeth.

In testimony that we claim the foregoing

as our invention we affix our signatures, in presence of two witnesses, this 22d day of 10 March, A. D. 1900.

WILLIAM M. GREEN.
JOHN R. GENT.

Witnesses:

C. W. HILLS,
C. CLARENCE POOLE.