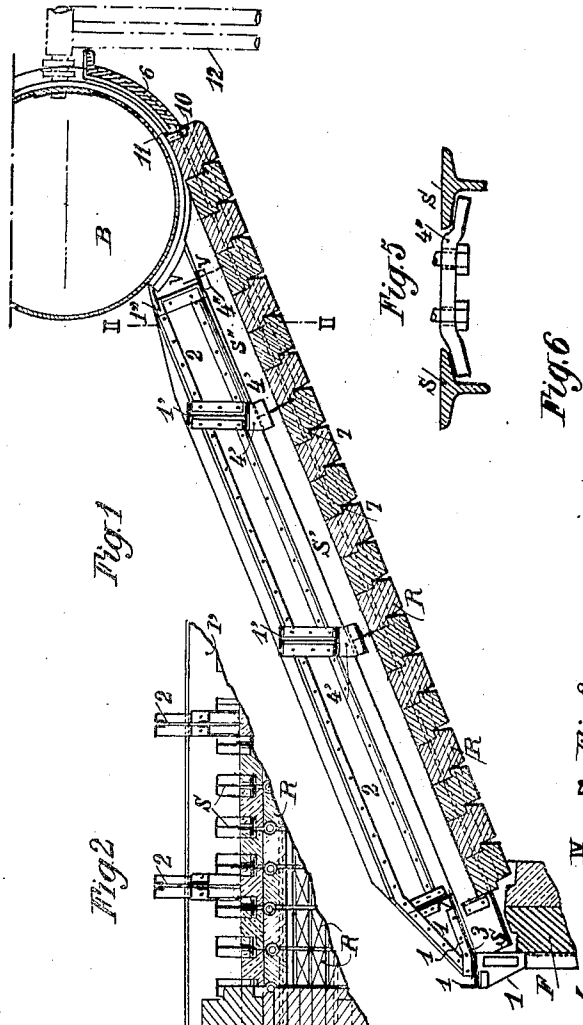
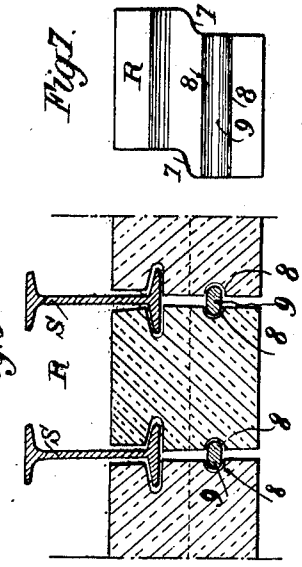
Sept. 11, 1928. 1,683,963

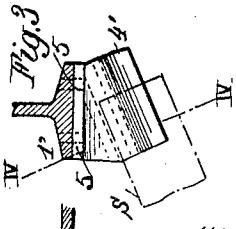
C. DUQUENNE

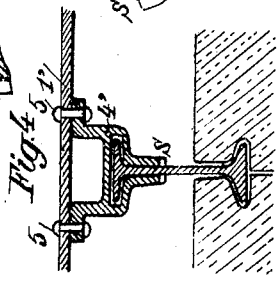
FURNACE ARCH

Filed April 14, 1924 2 Sheets-Sheet 1









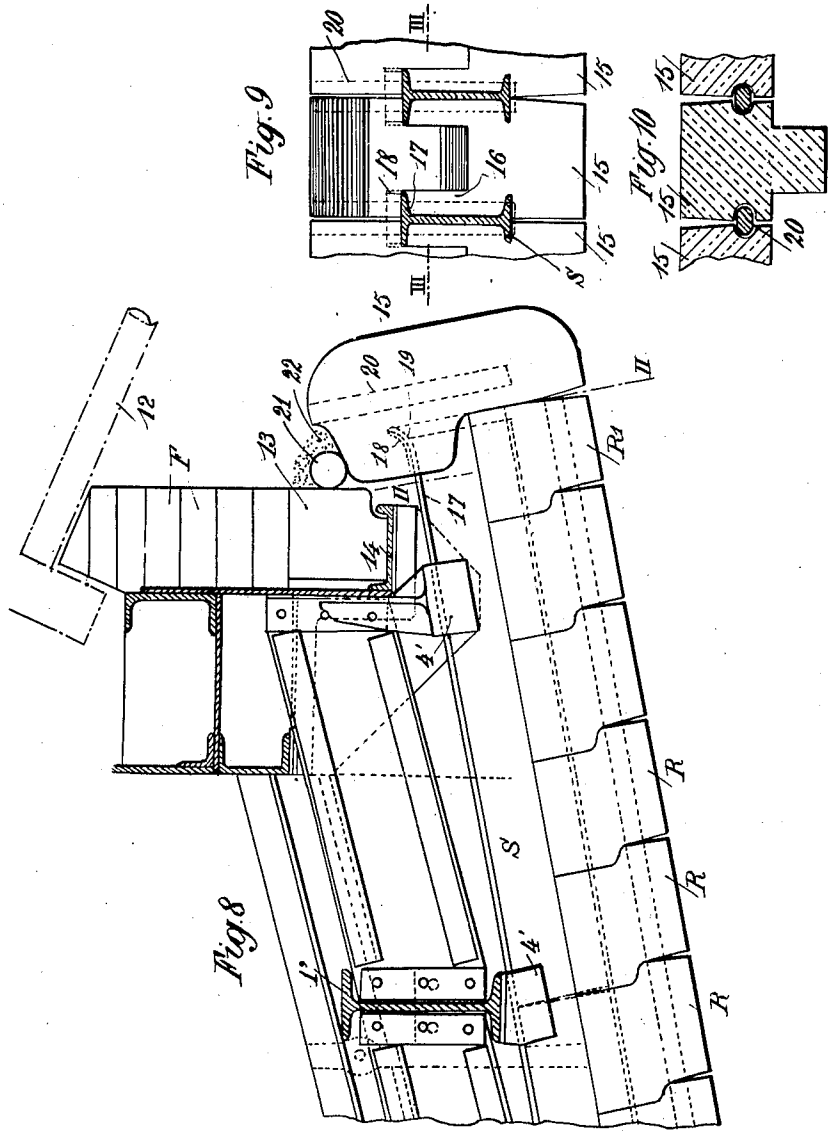
Inventor
Camille Duquenne
By Cushman, Darby & Cushman
Attys

Sept. 11, 1928. 1,683,963

C. DUQUENNE

FURNACE ARCH

Filed April 14, 1924 2 Sheets-Sheet 2



Inventor
Camille Duquenne
By Cushman, Darby & Cushman
Attys

Patented Sept. 11, 1928. 1,683,963

UNITED STATES PATENT OFFICE.

CAMILLE DUQUENNE, OF PARIS, FRANCE.

FURNACE ARCH.

Application filed April 14, 1924, Serial No. 706,543, and in France April 27, 1923.

My invention has for its object the construction of flat walls which may have a large surface and may occupy a horizontal or slightly inclined position said walls being adapted to withstand high temperatures at their lower parts whereby they may be employed as roofs or arches for boiler furnaces or the like, and chiefly for combustion chambers burning slack coal; said roofs consist of hard refractory blocks which will withstand a high heat and are made in a special shape, said blocks being suspended from a suitable metallic structure.

A suspended roof according to the invention consists essentially of a metallic structure to which are secured suitable section iron members—preferably I-irons—by their upper flanges, said members being in parallel position, with the proper spacing; the lower flanges of said members serve for the suspension of the refractory blocks which are so constructed as to be hung from the said flanges with a sufficient play to render them loosely slidable thereupon. Another special feature of the invention consists in attaching the suspension beams to the main structure, not in a direct and permanent manner, but through the intermediary of hangers whose shape is such that the upper flange of the suspension beam, which is laid in the hanger, may be freely slidable therein, so that the suspension beams will be allowed a free movement of expansion. On the other hand, the suspension beams are formed in sections, of 1.00–1.20 m. length, and are disposed in said hangers at suitable distances apart, so as to reduce the vertical deflection of the said beams due to the differences in expansion caused by differences in temperature between their upper and lower flanges.

Another feature of the invention relates to the shape of the refractory blocks, this being such that any two adjacent blocks, in the lengthwise as well as in the transverse direction, will have between them a certain play which increases from the top part near the suspension members to the bottom part forming the surface of the arch; this provides for expansion depending upon the temperature. For the joints between the adjacent blocks, the latter are preferably given a suitable shape to provide for the proper fitting or overlapping of the said blocks in a given row, i. e. in the transverse direction and perpendicular to the axis of the suspension beams, each lateral face of the block having therein a suitable channel or groove, parallel to the axis of said beams, wherein is inserted a rod of baked refractory material which thus occupies the oppositely situated channels of any two adjacent rows of blocks.

According to the said invention I further provide at the ends of the said suspension beams, suitable end blocks which are properly suspended, the shape of said blocks being such as to ensure in a constant manner the joint which is formed on the one hand with the rearwardly situated blocks and on the other hand with the front wall of the furnace, irrespectively of all movements caused by differences in expansion.

The appended drawings show by way of example an embodiment of the invention. In Figs. 1 to 7 the arrangement relates to an inclined roof or crown of a furnace for a multitubular boiler, disposed between the front wall of the furnace F and the lower cylindrical recipient B of the boiler. Fig. 1 is a longitudinal section, i. e. parallel to the suspension members and from front to rear of the furnace. Fig. 2 is a vertical cross-section on the line II—II of Fig. 1. Figs. 3 and 4 are respectively a side view on a larger scale of the hanger for the suspension beams, and a section of said hanger on the line IV—IV Fig. 3. Fig. 5 shows a detail on a larger scale and in section on the line V—V, Fig. 1, illustrating the manner in which the suspension beams are supported at the rear end. Figs. 6 and 7 are views on a larger scale showing the refractory blocks, said views being respectively a section perpendicular to the suspension members and a side view of one of the blocks. Figs. 8, 9 and 10 relate to a modification, employed for furnace roofs for Babcock boilers, with mechanical stoking, and illustrate an arrangement of refractory blocks at the end of the series, providing for the joint between the preceding blocks and the front wall of the furnace. Fig. 8 shows at a larger scale a detail of the connection of the furnace arch to the boiler. Fig. 9 is a section on line II—II of Fig. 8, and Fig. 10 is a section on line III—III of Fig. 9.

In Figs. 1 to 7, the structural frame, supported by the lateral uprights of the boiler, consists of transverse girders one of which, 1, of a very rigid construction and comprising various section iron members riveted together, is mounted along the front wall of the furnace; the other girders 1′, 1″, consisting of strong section iron members, are disposed

in variable number according to the length of the furnace roof, and are secured together by the longitudinal girders 2.

The transverse girders comprise suitable means for attaching the longitudinal I-irons from which the fire brick pieces are suspended. As concerns the front girder 1, the suspension members S are simply riveted or bolted thereto at 3; as to the other transverse girders, the suspension members must be mounted so that they may slide freely under the effects of expansion; to this end the beams 1′ have riveted at 5 below their lower flange the hangers 4′ made of cast steel and having a special form for the insertion of the upper flange of the said suspension members S. Since the beam 1″ is in the inclined position and is perpendicular to the suspension members, the latter may be mounted thereon in a simple manner by the use of an iron member 4″ with curved ends which is riveted to the beam 1″, Fig. 5.

In this manner the said suspension members which are divided into various sections of 1 to 1.2 metre length are loosely suspended from the main structure. The first members S, at their forward ends which withstand the entire thrust due to the inclination of the roof, are riveted or bolted at 3 as observed, and the ends of the said members, as well as those of the succeeding members, are simply inserted into the hangers 4′ or suspended from the flat iron member 4″. In this manner the members S S′ S″ which are situated in alignment will come into contact with each other at the ends, while at the same time they are enabled to slide in their supports in order to provide for the longitudinal expansion, and to assume their natural deflection due to the difference of temperature between the flanges, without causing stresses upon their supports. The juxtaposed ends of the said members are cut at a slight angle, Fig. 1, so that the space will increase towards the bottom.

The distance between centres of the members S corresponds to the transversal dimension of a fire-brick piece, to which is added the requisite play for the expansion of the said piece.

The blocks of fire-brick R, Figs. 6 and 7, are given a suitable shape whereby they may be fitted by their lateral grooves upon the members S; the said blocks are mounted by sliding them into place from the rear part of the roof, before the mounting of the plates 6 covering the recipient B. The joints between the said blocks in the transverse direction have the form shown at 7. The grooves 8 of semi-circular section are formed in the lateral faces of the blocks, and a corresponding fire brick member 9 is inserted into the two opposite grooves; it being coextensive with the series of blocks in each case. The wall of the blocks exposed to the action of the fire is the one which will expand the most; on the other hand, it is important that the lower edges of the several blocks which are more fragile since they are exposed to the greatest heat, shall not come into contact with each other and shall not be obliged to support the effects of expansion and for this reason the play at each of the four sides of the block is increased towards the lower part. In the transverse direction, the distance between the suspension members S is so calculated that the two rows of juxtaposed blocks will have the proper spacing for the expansion, the joint being formed by the member 9.

Expansion can thus take place freely in the transverse direction between two rows of blocks as well as in the lengthwise direction from front to rear, the members S sliding in their hangers and the blocks R upon the members S. The rear end 10 of the roof is entirely free; it supports the lower edge of the plates protecting the cylindrical recipient which follows the movement of expansion, the same being simply secured at 11 to the members S and bearing at the other end upon the boiler tubes 12.

The top of the roof or arch is not to be covered with any layer of a refractory or insulating nature, and the roof is constructed to withstand very high temperatures; the joints which are constituted on the above-mentioned principle will be quite sufficient; the slight admission of cold air which may take place by reason of the draught has the advantage of cooling the framing and the said blocks, which offers a great advantage as regards their duration; this small admission of air will offer no inconvenience, since it takes place in the combustion chamber itself in which the proportions of fuel and comburant can be regulated in consequence.

Obviously, the said arrangement is given solely by way of example; the construction of the framing must evidently be adapted for each particular use; the shape of the refractory blocks and the form of their attaching means may be varied within wide limits without departing from the spirit of the invention.

Figs. 8 to 10 illustrate a modification adapted for a furnace roof for a Babcock boiler with mechanically operated grate, and showing more particularly a configuration and a method by which the fire brick blocks occupying the end position are suspended from the ends of the supporting beams in order to provide for the movements due to the differences in expansion, while at the same time affording the joint with the preceding fire brick block and with the front wall. F is the front wall situated below the tubes 12 and resting for example upon a set of fire brick blocks 13 mounted upon a frame 14 and forming at the front part a wall with a plane and rectilinear face. In this case the furnace roof is terminated by the end blocks 15 which

have the special form shown in Figs. 8 and 9; at each side is a cut-out portion 16 co-operating with the flange 17 of the suspension member S; the inner end 16 of the said cut-out portion co-operates with a suitable end portion 18, serving to attach the same to the upwardly curved end of the flange 17. At the lower part, the block 15 comes into contact with the last block R_1 of the regular roof series. In this manner, according to the differences in the expansion of the member S and the set of blocks R, the end block 15 may pivot on its point of suspension 19. The joint between adjacent blocks is obtained by means of the fire brick bars 20 in the same manner as shown in Fig. 3 for the roof blocks, allowing a sufficient play to prevent all efforts between the blocks and the fire brick cylinders, whatever may be the movement of the blocks.

The joint between the said portion and the front wall should provide for the movements of the end of the roof without bringing any efforts upon the fire brick parts which are fragile when heated. For this purpose, the joint between the end blocks 15 and the blocks of the front wall 13 are formed by a set of fire brick cylinders 21, adjusted for an exact fit, which are adapted to roll by their own weight into the angle of the joint; to this may be added a refractory joint-filling substance in the state of dry powder. Obviously, when in the cold state a sufficient play must be allowed between the blocks 13 and 15 which shall prevent all contact between the said blocks.

The general arrangement as set forth will provide for the easy and rapid upkeep of the roof or crown. The parts which are the most exposed and the most subject to wear are the end blocks 15; but as they are simply hung from their points of suspension 19 and as the sections of the joint cylinders 21 are free to move, the said blocks can be replaced in a few minutes.

Claims:

1. A roof for furnaces having a metal framework, a plurality of supports carried thereby and arranged in longitudinal alignment inclined from front to rear of the furnace, the said framework comprising transverse members to which the supports are secured, a plurality of successive sections of aligned beams having flanges adapted to engage said supports, the ends of two consecutive sections of said beams resting in contiguity in a common intermediate support and bearing against each other at their upper part, the ends of said beams being cut on a bevel permitting a play between them towards the bottom, said beams being provided with lower flanges and refractory blocks suspended from said lower flanges between successive rows thereof, the faces of said blocks being bevelled to permit increasing play toward their lower ends.

2. In a roof for furnaces, a metal framework, a plurality of supports suspended therefrom, successive aligned sections of flanged beams carried by said supports, a plurality of refractory blocks suspended from said beams, and pivoted end blocks loosely suspended from the ends of said beams, whereby said end blocks may pivot upon their point of suspension in accordance with expansion and contraction of the beams and adjacent blocks, said end blocks bearing at one face upon the last refractory block of the roof with the joint between the end block and the fixed wall of the furnace being formed by cylindrical sections of refractory material adapted to roll loosely in the angle of the joint between said wall and block.

3. In a roof for furnaces, a metal framework, a plurality of aligned supports secured to said framework, flanged beams fitting in said supports, said beams being sectional and loosely engaging said supports by their upper flanges, whereby the sections are held in alignment, contiguous edges of said sections being bevelled to permit independent bending of said sections under expansion and contraction, refractory blocks loosely suspended from said beams by the lower flanges thereof whereby such lower portions of beams may have free access of air, said blocks having their front and rear faces bevelled, whereby said blocks may move longitudinally with respect to each other under stress, the amount of such play increasing toward the bottom of said blocks.

4. In a roof for furnaces, a metallic framework, a plurality of aligned supports secured thereto, a plurality of sectional aligned members freely engaging in said supports, blocks carried by said members and end blocks bearing on said blocks and pivoted to said members, the said sectional members being bevelled to allow of free independent bending thereof and said blocks being bevelled so that play between them shall increase toward their lower ends, the said end blocks being adapted to turn on their pivots under stresses produced by said beams or blocks, and the joint between the end block and the fixed wall of the furnace being formed by cylindrical sections of refractory material adapted to roll loosely in the angle of the joint between such wall and the pivoted end block.

In testimony whereof I have hereunto set my hand.

CAMILLE DUQUENNE.