Oct. 18, 1955 S. H. LANYON 2,720,850

TILE SUPPORTING NOSE BRACKET FOR REFRACTORY FURNACE ARCHES

Filed July 16, 1951 4 Sheets-Sheet 1

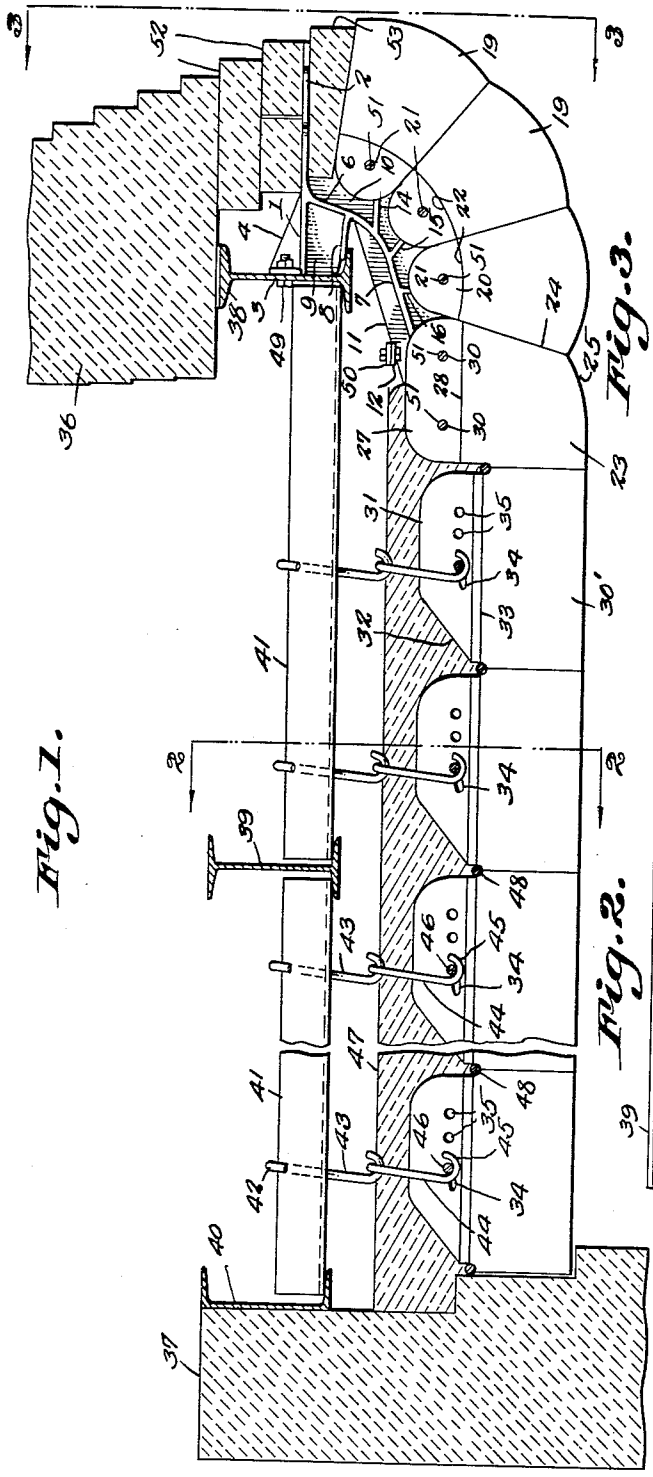


Fig. 1.

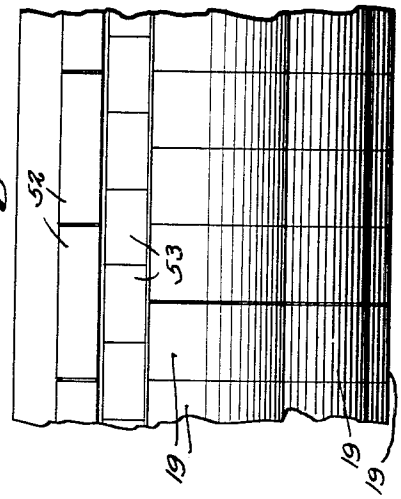


Fig. 3.

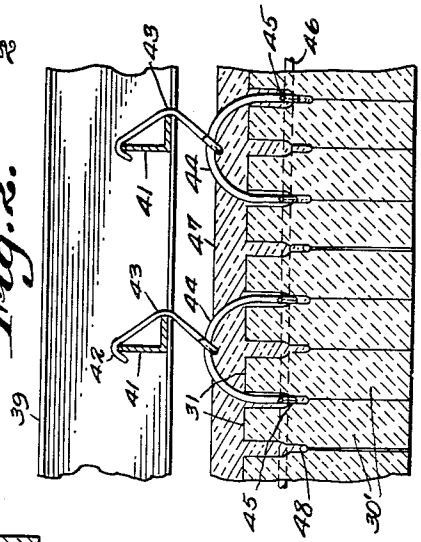


Fig. 2.

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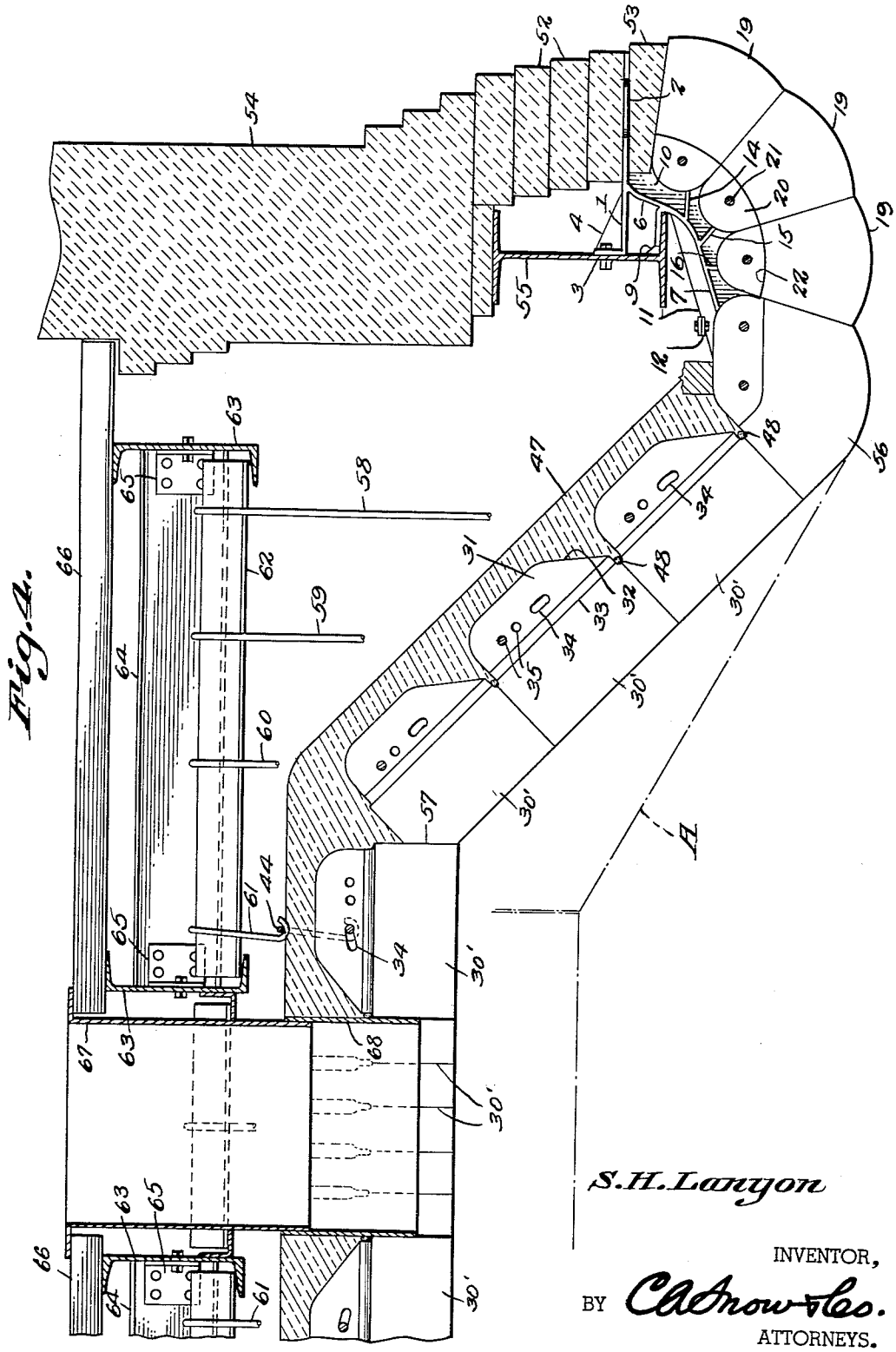


Fig. 4.

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Fig. 5.

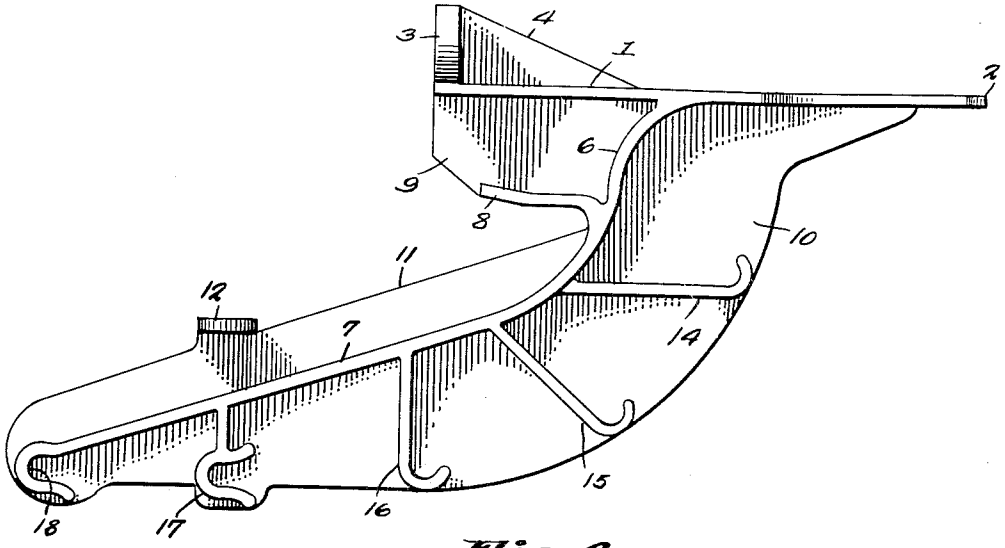
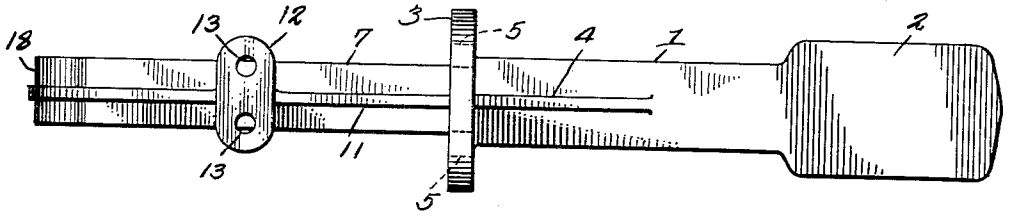


Fig. 6.



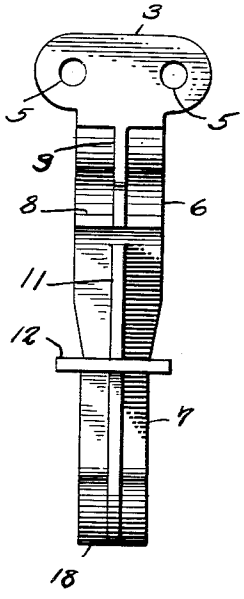


Fig. 7.

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Fig. 8.

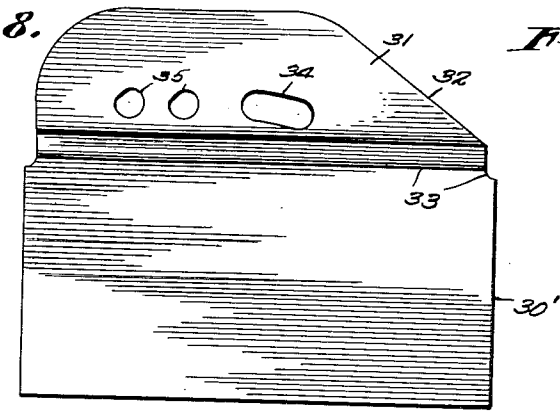


Fig. 9.

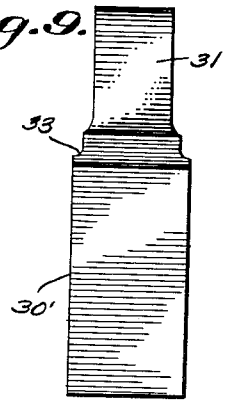


Fig. 10.

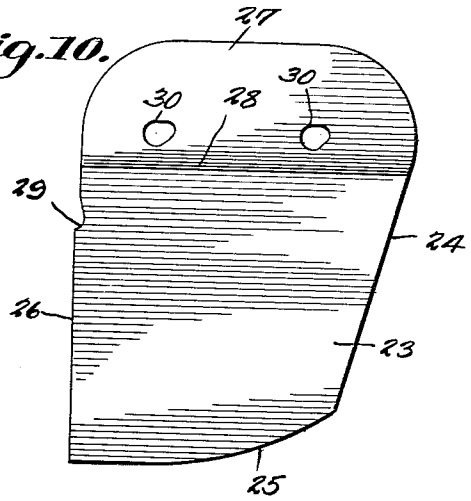


Fig. 11.

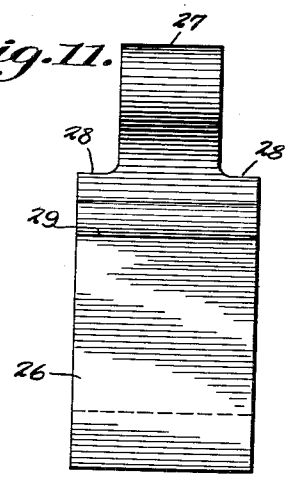


Fig. 12.

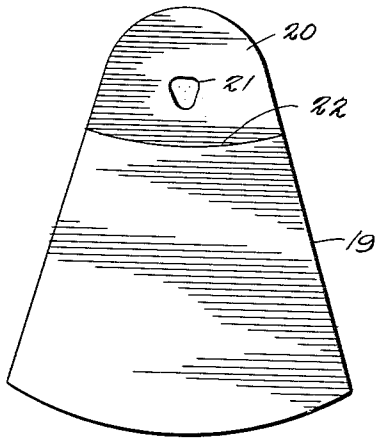
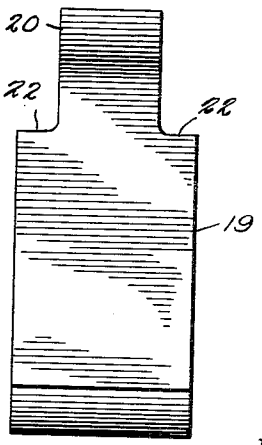


Fig. 13.



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TILE SUPPORTING NOSE BRACKET FOR REFRACTORY FURNACE ARCHES

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Application July 16, 1951, Serial No. 236,882

2 Claims. (Cl. 110—99)

This invention relates to refractory arch construction. More particularly, the invention has reference to suspended refractory arch assemblies used as roofs of industrial furnaces.

In conventionally constructed refractory arch assemblies, certain disadvantages exist which it is proposed to eliminate through the present invention. In such conventional assemblies, construction of a refractory arch proceeds with a slowness which is undesirable; thrust and loading pressures are excessive at various locations in the arch, stresses within the arch are created by thermal expansion; skilled workers are required; replacement of individual parts is difficult and costly; metal parts providing integrity to the assembly are too close to the hot face thereof; and, quite commonly, resistance to gas leakage is not developed to as high an extent as is desirable.

The broad object of the present invention is to provide a refractory arch construction in which these disadvantages will be eliminated or materially reduced.

It is proposed to meet this object of the invention by provision of an assembly including a novelly formed tile-supporting bracket adapted for use at selected locations and capable of providing a base for either a dropped-nose or flat arch assembly as desired, and by the further provision of novelly formed tiles capable of use in combination with said brackets to complete construction of the arch, the tiles being so formed as not to require the use of right and left hand units, and being so formed, additionally as to be capable of being laid in a gas-tight, thrustless arrangement.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combination of parts, hereinafter more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

Referring to the drawings:

Figure 1 is a longitudinal section through a flat arch assembly formed in accordance with the present invention.

Fig. 2 is a fragmentary transverse section taken on line 2—2 of Fig. 1.

Fig. 3 is an end elevation as seen from line 3—3 of Fig. 1.

Fig. 4 is a longitudinal section through a dropped-nose arch assembly, an alternative angle to which the arch can be formed being illustrated in chain-dotted lines A.

Fig. 5 is a side elevation of the tile supporting bracket.

Fig. 6 is a top plan view of said bracket.

Fig. 7 is an end elevation of the bracket as viewed from the left of Fig. 5.

Figures 8 and 9 are respectively a side and a front elevation of a refractory block such as is used in the dropped-nose arch of Figures 1 and 4.

Figures 10 and 11 are respectively a side and a front elevation of a thrust block such as is used in the arch constructions of Figure 1.

Figures 12 and 13 are a side and a front elevation of a radial block such as is used in the arch constructions of Figures 1 and 4.

Referring to the drawings in detail, in Figs. 5 through 7 I have illustrated the tile supporting bracket. This is a metal casting and is formed at its upper end with a horizontal shelf **1**, one end of which is widened as at **2**. Upstanding from the other end of the shelf is the vertical attaching flange **3** strengthened by a gusset **4** extending between said flange and the shelf. Spaced openings **5**, adapted to receive bolts of equivalent fastening means, are formed in the attaching flange.

Rigid with the intermediate portion of the shelf **1** and extended downwardly therefrom is the upper portion **6** of a longitudinal rib having an elongated, straight tail portion **7** extending obliquely to and projecting a substantial distance beyond the rear end of the shelf **1**, the rear or inner end of the shelf being that end on which is provided the attaching flange **3**.

Spaced below the inner end of the shelf and extending longitudinally of the shelf, is a tongue **8**. This is integral with the rib and is reinforced by a strengthening web **9** extended between said tongue and the bottom face of the shelf.

Depending from the rib throughout the length of the rib, and disposed upon the longitudinal center line of the rib, is a fin **10**. Upstanding from the rib and also extended along the longitudinal center line of the rib is a back fin **11** integral intermediate its ends with a horizontal lower attaching flange **12** having spaced openings **13**.

I provide means spaced longitudinally of the bottom fin **10** adapted to support, at either or both sides of the bracket, end portions of tile support rods to be described hereinafter. In the present form of the invention, said means constitutes rib members **14**, **15**, **16**, **17** and **18**. These are formed on both sides of the fin **10**, being integral with the rib tail portion **7** at their inner ends, and being extended outwardly from said tail portion toward the bottom edge of the fin **10**. At their outer ends, the respective rib members are of hook-like formation, defining bearing pockets for the ends of said tile supporting rods.

The rib member **14**, as readily seen from Fig. 5, extends horizontally from the longitudinal rib, while the rib member **15** extends downwardly and obliquely from the longitudinal rib. Rib members **16** and **17** extend vertically from the longitudinal rib, while rib member **18** constitutes an extension of the rear end of the longitudinal rib.

As a result, it may be noted that the bearing pockets are so arranged relative to each other as to be disposed in a horizontal alignment at the tail portion of the bracket (see the rib members **17** and **18**). This horizontal series of bearing pockets merges into a curvilinear series at the head portion of the bracket (pockets **14**, **15** and **16**).

Referring to Figs. 12 and 13, there is here illustrated one of the arch tiles used with the above-described bracket. These may be termed radial tiles or blocks. Each of these is of tapered configuration when viewed in side elevation as in Fig. 12, and has a convex (as shown) or circular bottom face, which may be termed the hot face of the block when said blocks are mounted in a refractory arch such as shown in Fig. 1 or in Fig. 4. In this connection, the converging faces of the radial blocks are at angles of approximately 33 degrees to each other, for a reason to be made apparent hereinafter.

At their upper ends, the radial blocks **19** are formed with reduced upper extensions **20** formed with openings

21, the openings 21 being preferably formed noncircularly, so as to allow latitude for limited transverse movement of the tile supporting rods.

The provision of the reduced upper extensions 20 defines side shoulders 22, and these are curved circumferentially from the apex of the angle enclosing the converging faces of the blocks.

Another form of block illustrated, and used in the improved assembly, is a thrust block 23 illustrated in Figs. 10 and 11. This block has one face 24 inclined from the vertical and adapted to contact an adjacent radial block in the manner illustrated in Fig. 1. The thrust block shown also has a partially curved bottom face 25.

Opposite the inclined face 24 is provided a vertical face 26. At the upper end of the block, the block is reduced as at 27, defining horizontal shoulders 28. A transverse groove 29, for a purpose to be made apparent, is formed in the vertical face 26, slightly below the shoulders 28.

At the reduced upper portion 27 of the thrust block is provided a pair of spaced openings 30 which, like the opening 21 of the radial block, are of non-circular formation. In both blocks, the openings are so formed as to eliminate any sharp corners therein, it having been found that this minimizes the possibility of cracking due to mechanical or thermal stresses existing during manufacture or service.

In Figs. 8 and 9 I have illustrated a tile shape in which the body 30 of the block is of rectangular, flat-faced configuration, said rectangular body being formed with the upper extension 31 of reduced width and may have one end obliquely cut away as at 32. A groove 33 extends fully around the block, at different heights at the base of the reduced upper extension.

A plurality of perforations 34 and 35 respectively is provided in the block of Fig. 8, the perforation 34 being of slot-like appearance, and the perforations 35 being so formed as to receive tile supporting rods while allowing a limited amount of lateral play in said rods.

The bracket which has been illustrated and described and the several tiles of blocks, are capable of assembly in various arrangements, to produce refractory arches of desired design. One such arrangement is illustrated in Fig. 1. This arrangement shows a flat refractory arch having a radial nose. The blocks and bracket are assembled in this instance between masonry supporting walls, curtain wall 36 and front wall 37 respectively. Supported immediately below the wall 36 is a conventional suspension beam, 38. Other beams 39 and 40 are spaced from and extend parallel to the beam 38; 36, 39 and 40 are adequately supported by outside means.

A plurality of transverse supporting members 41 may be formed from angle iron material, as seen in Fig. 2, and have their ends supported upon the spaced beams. There is no necessity of the ends of the cross members 41 being welded or otherwise rigidly secured to the supporting beams, and they may simply rest thereupon, without detracting from the efficiency, strength or immobility of the completed assembly.

At spaced intervals, supporting hooks designed to prevent angles 41 overturning are suspended from the cross members 41, said hooks having hook ends 42 at their upper ends, and having angular bodies 43 as seen in Fig. 2. Hook ends are also formed at the lower ends of the support hooks, these engaging the medial portions of approximately semi-circular bridles 44, of heat resisting metal, the lower ends of which are formed as hooks 45 supporting each rod 46 which passes through the perforations of all the flat-faced or rectangular blocks 30' which constitute an independently arch unit.

Covering the blocks 30' is insulation 47 of any desired type, and sealing the joints of adjacent units assembled of blocks 30' against gas leakage are asbestos ropes 48 disposed only in the inter-unit groove 33 of the blocks.

In assembly of a flat refractory arch such as seen in Fig. 1, the first step would be to mount the brackets upon the supporting beam 38. Wide flange beams are preferred; but I-beams, channel, angle, T-beams, single in multiple or combined, may be used if desired. A plurality of brackets formed as illustrated in Fig. 5, is mounted upon said beam, at intervals spaced longitudinally of the beam. The brackets are secured to the beam by means of bolts 49 passing through the beam and through the openings 5 of the top attaching flange of each bracket.

When so secured to the beam, the bracket will have its tongue 8 supported upon the bottom flange of the beam as readily seen in Fig. 1.

If found desirable to rigidify the several brackets in relation to each other, a spacer bar 50 (or angle) may be provided, overlying the tail portions of the brackets, and secured to the several brackets by means of bolts passed through the spacer bar and through the openings 13 of the bottom attaching flanges 12 of the brackets. This spacer bar 50 may be supported by attachment to beam 38.

After the brackets have been secured to the beam in this manner, the thrust blocks 23 are put into place. The thrust blocks are suspended from and are fixed in position by the insertion of rods 51 through the perforations 30 of the thrust blocks. The thrust blocks, when strung upon the rods 51, are cemented together in two-tile units which will assemble within the center-to-center dimension of the adjacent brackets, with the ends of the supporting rods 51 being received in the pockets of the rib members 17 and 18 of the respective brackets. Cement, or resilient expansion joints, are provided at the vertical joints at the center of the brackets.

The radial blocks are now assembled to the brackets. As a first step, the radial blocks are pre-cemented reversed in pairs, to make up a unit, after which a single supporting rod 51 is inserted through the perforations of the units. The lowermost radial block units are first mounted upon the brackets, these being the radial units adjacent to the thrust block units 23 and contacting the inclined edges 24 of said thrust blocks. The ends of the single support rod 51 of the lowermost series of radial blocks are positioned in the pockets of the rib members 16. Higher series of radial blocks are similarly positioned in the rib members 15 and 14 respectively.

A wedge block 53, of a conventional fire brick shape, is positioned upon the uppermost series of radial blocks, under the top shelf of the bracket. Other fire bricks 52 are supported upon the top shelves of the brackets, filling the space between said top shelves and the bottom of the masonry 36 carried on support 38.

Considering the relative formation and arrangement of the radial blocks and thrust blocks when mounted in position, it is believed appropriate to note that the conventional wedge brick 53 has a horizontal top face, and has an included angle of approximately 6 degrees and 20 minutes. As previously noted herein, each radial block has an included angle of 33 degrees. Therefore, the radial center line of the lowermost radial block which passes through its center of gravity, as block is symmetrical on this plane, is 1 degree and 10 minutes above verticality. This assures a pressure due to gravity across the joint between the lowest radial block and the thrust block 23 adjacent thereto. As a result, the assembly of three radial blocks and the wedge brick above will, by their unbalanced weight, produce a force tending to cause the thrust blocks to pivot on that supporting rod 51 passing through the right hand perforation 30 of the thrust block when the thrust block is viewed as in Fig. 1. Such rotation is stopped by the vertical immovability of rod 51 in left hand perforation 30.

In other existing similar assemblies this force is either absorbed by the blocks of the adjacent flat portion of the arch assembly, or by an anchored metal thrust

plate, which must necessarily extend close to the hot face of the tile. Such thrust plates are soon burned out and are known to be highly undesirable.

In the present assembly, however, the thrust blocks, by their weight, resist displacement in such a way as to reduce the gravity load on the tail end of the brackets at pockets **16**.

In Fig. 4, I have illustrated a dropped-nose refractory arch assembled by means of my universal bracket and specially shaped blocks.

In this instance a masonry curtain wall **54** is illustrated, below which is fixedly mounted in any suitable manner the supporting beam **55**. A plurality of fire bricks **52** are disposed between the top shelves of the brackets that are secured to the supporting beam, and fill the space between said shelves and the curtain wall.

In this instance another form of thrust block is used, this being designated **56**. Essentially, this form of thrust block is the same as the thrust block illustrated in Figs. 10 and 11, except that instead of a vertical face **26**, another inclined face is provided, to give an upward inclination to the series of blocks **30** extending from contact with the thrust block.

In any event, the thrust blocks **56** are strung upon supporting rods, and secured to the universal brackets by positioning of the rod ends in the pockets of the rib members **17** and **18** of the brackets. Radial blocks **19** are assembled in the manner described above, and suspended from and between the universal brackets, after which a wedge fire brick **53** is put in place.

The pre-assembled units of flat faced rectangular blocks **30** are now suspended in proper position, and provide an arch face extending upwardly at an angle of 45 degrees in the present instance. Through the provision of a different type of thrust block **56**, the angle of said arch face can be lowered as shown by chain-dotted lines A, or any other angle. The uppermost blocks **30'** are cut away as at **57**, at the point of intersection with the horizontal portion of the arch.

With reference to the suspension of the blocks **30'** in proper position, support hooks **58**, **59**, **60** and **61** of different selected lengths are used, the upper ends thereof engaging over spaced cross members **62** supported at opposite ends upon supporting beams **63**. The supporting beams **63** can be rigidly connected by braces **64**, angle clips **65** being used to effect the connections between the beams and cross braces.

Supported upon the beams **63** are angle irons **66** supporting the fuel chute **67** and **68**.

In both assemblies, the blocks **30'** are assembled in multi-block units of four blocks each, the blocks of each unit being pre-cemented with air-setting refractory cement. Thereafter, they are handled and installed as multi-block units. However, adjacent units are dry-laid, that is they are not cemented together. This defines open joints inter-unit crossing through the length and breadth of the assembly. These open inter-unit joints are filled with strands of asbestos rope which are tamped into the continuous grooves defined by the side-by-side block arrangement in each of the units.

It is believed worthy of note that the grooves in the block ends are slightly higher than the grooves in the sides, thus to secure gas-tight joints throughout, including

the points where the asbestos ropes cross at right angles. The ropes are a substantial distance away from the hot faces of the blocks, and therefore will not deteriorate from being exposed to destructive temperatures.

All pre-cemented units, as previously noted, are installed without the use of cement or plastic joint filler. Rather, they are merely suspended in aligned rows, and the transverse and longitudinal joints between the units caulked with asbestos rope. The possibility of spelled blocks which might otherwise rise due to expansion pressure is thus obviated, since the joints between units include an open space extending fully around each unit below the asbestos caulking which is resilient.

Another important characteristic of the invention is also believed worthy of note, in that any unit can be removed or replaced quickly and at minimum expense for labor and parts, and also without the use of mortar or any other wet filler. Since the units are not interlocked or tongue-and-grooved, they do not depend upon each other for support and any unit can therefore be removed individually and replaced without cutting. This replacement of units can be accomplished by utilizing unskilled labor working from the outside of the furnace, even while the furnace is too hot to enter.

Having thus described the invention, what is claimed is:

1. A nose bracket for supporting refractory roofs comprising a one-piece casting including a main fin, ribs extending laterally and disposed longitudinally of the main fin, a back fin mounted on and above said ribs, a horizontal top shelf formed integral with one end of said main fin, said top shelf extending a substantial distance forwardly beyond the front edge of said main fin and rearwardly over a portion of said main fin, providing a support, rod supports extending from the rib at one side of the main fin, terminating in hooks disposed adjacent to the edge of the main fin, providing a series of spaced pockets for receiving tile supporting rods.

2. A nose bracket for supporting refractory roofs comprising a wide flat body having side faces disposed vertically, lateral ribs extending longitudinally of the side faces of the body, a wide horizontal shelf formed integral with one end of said body, spaced rod supporting ribs extending laterally from the side faces of the body, upwardly curved hooks formed at the ends of said supporting ribs adjacent to one edge of said body in which refractory brick supporting rods are adapted to be positioned for supporting refractory bricks mounted on said rods.

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