Feb. 6, 1962 H. W. WEBER 3,019,561

FLEXIBLE ANCHOR ARRANGEMENT FOR CASTABLE OR PLASTIC REFRACTORY AND METHOD FOR EMPLOYING THE SAME

Filed March 10, 1958

Fig. 1.

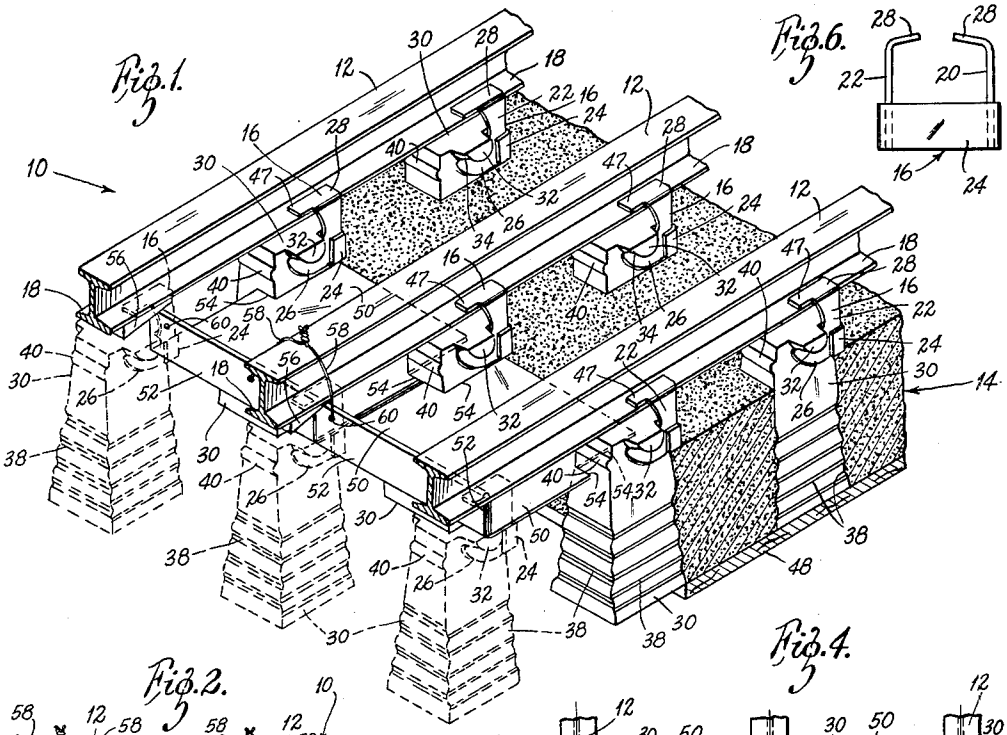


Fig. 6.

Fig. 2.

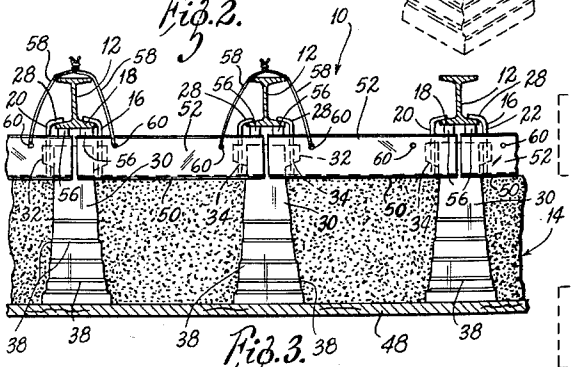


Fig. 4.

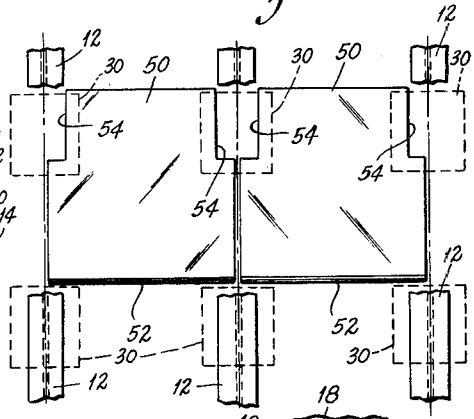


Fig. 3.

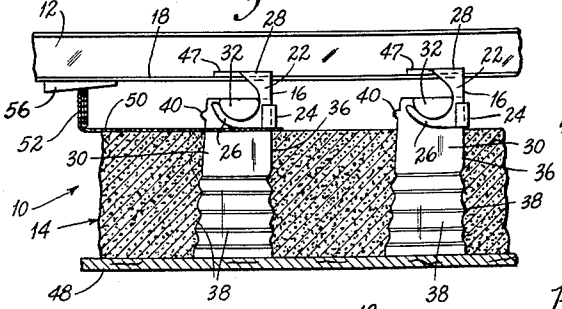


Fig. 7.

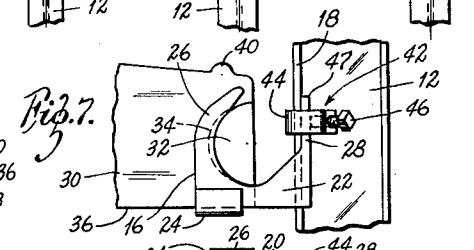


Fig. 5.

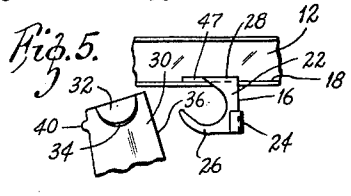
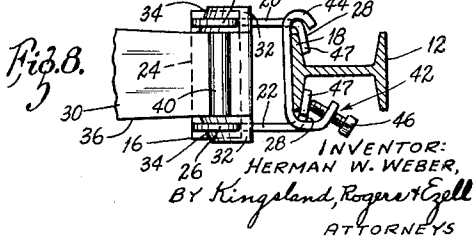


Fig. 8.



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FLEXIBLE ANCHOR ARRANGEMENT FOR CASTABLE OR PLASTIC REFRACTORY AND METHOD FOR EMPLOYING THE SAME

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The present invention relates generally to refractory wall and roof structures, and more particularly to a novel flexible anchor arrangement for walls and roofs constructed for the most part from castable or plastic refractories.

Castable or plastic refractory materials are extensively used for the construction of furnace enclosures and may be used in the hearth, walls or roof. When used in the hearth, such materials present no problem of emplacement or retention, but when used for walls or roofs, it is often desirable to provide support from an external steel structure, rather than depending on gravity for support, as would be the case with ordinary unsupported walls or "sprung" arches. Thus, the present invention contemplates a flexible anchor arrangement by means of which monolithic portions of a refractory wall or roof may be anchored to an appropriate external steel structure.

In brief, the improved arrangement comprises anchors in the form of steel stampings fabricated so as to engage the flanges of a small I-beam and having fingers that engage suitable lugs on a special refractory tile suited for embedment in the castable or plastic refractory forming the major portion of the wall or roof. The anchors are so constructed and mounted as to enable them to shift or flex slightly in at least three directions, and are adapted to engage the special tiles in a manner which permits the inevitable shifting which is necessary to accommodate expansive movements of the refractory furnace lining, while portions of the special tiles are, of course, embedded in the refractory, no part of the steel anchors is thus enclosed.

The invention also contemplates special molding forms comprising movable sections to be used in the emplacement of the castable or plastic refractory to uniform thicknesses. Appropriate locks and wedges are provided for use with the forms for insuring a finished wall of uniform thickness.

It is an object of the present invention, therefore, to provide a novel flexible anchor arrangement suitable for a castable or plastic refractory wall or roof.

It is another object of the invention to provide a novel method or system for anchoring a wall or roof of cast or plastic monolithic construction.

It is another object of the invention to provide a novel flexible anchor arrangement for flexibly supporting a monolithic wall to enable the latter to move in various directions under expansive and contractive forces.

It is another object of the invention to provide a novel flexible anchor arrangement which includes a metal hanger and a refractory tile associated on the ball and socket principle.

It is another object of the invention to provide a novel flexible anchor arrangement employing hangers in the form of fabricated steel stampings.

It is another object of the invention to provide a novel flexible anchor system which employs sectional forms for insuring uniform thickness of cast or rammed plastic refractories.

It is another object of the invention to provide a novel flexible anchor system for castable or plastic refractory material which utilizes relatively inexpensive material formed to relatively simple configuration and being readily assembled and mounted with a minimum of effort and instruction.

The foregoing, along with additional objects and advantages, will be apparent from the following description relating to specific embodiments and illustrations of the invention as depicted in the accompanying drawing, in which:

FIGURE 1 is a fragmentary isometric view showing a partially constructed refractory roof embodying the teachings of the present invention;

FIGURE 2 is a fragmentary vertical section showing the partially constructed roof of FIGURE 1 as viewed from the left foreground;

FIGURE 3 is a fragmentary vertical section illustrating the partially constructed roof of FIGURE 1 as viewed from the right foreground;

FIGURE 4 is a diagrammatic plan view illustrating the use of movable sectional molding forms;

FIGURE 5 is a fragmentary side view illustrating the removable interengagement of the metal hangers and the special tiles associated therewith;

FIGURE 6 is a rear elevation of a removed hanger;

FIGURE 7 is a fragmentary side elevation showing the locked engagement of a metal hanger with an element of the supporting structure; and

FIGURE 8 is a horizontal section showing in top plan form the interconnection illustrated in FIGURE 7.

Considering the drawing more particularly, and employing reference characters to indicate details illustrated therein, the numeral **10** designates generally a flexible anchor arrangement conforming to the teachings of the present invention. The arrangement **10** as illustrated in FIGURES 1, 2 and 3 of the drawing comprises a plurality of I-beams disposed in parallel arrangement for overall support of a horizontal generally monolithic refractory roof **14**. In supporting the roof **14**, the beams **12** are, of course, mounted horizontally; however, it should be understood that, where a vertical or side wall is to be supported, similar beams may be disposed vertically and a vertical monolithic wall would be anchored thereto.

Referring once more to the arrangement illustrated in FIGURES 1 through 3, each of the beams **12** supports a plurality of hangers **16** spaced longitudinally along respective lower beam flanges **18**. The hangers or cradles **16** are preferably constructed from steel sheet, which may be stamped to appropriate shape and the parts assembled by spot welding. Thus, each cradle **16** comprises a right hand and a left hand hanger element **20** and **22** interconnected by a U-shaped strap **24** as clearly shown in FIGURE 6. The hangers **20** and **22** differ from each other only in being of opposite hand, and each comprises a hook portion **26** shaped as clearly illustrated in FIGURES 5, for example, and a bent over elongated flange portion **28**.

As is apparent from the drawing, each of the cradles **16** supportingly engages a sepcial tile **30**, each of the latter being provided with oppositely extending lugs or bosses **32** for engagement with the parallel hook portions **26** of the cradles **16**. As clearly shown in FIGURES 2 and 5, the bosses **32** have convex surfaces **34** at an inclination to a central vertical plane through the tile **30** and thus provide, in effect, a generally spherical character in respect to the opposed bosses of each tile. Clearly, then, the illustrated engagement of a cradle **16** with a tile **30** is in the general nature of a ball and socket relationship, which permits the tile to move in various directions relative to the associated hanger.

Preferably, the tiles **30** have a tapered configuration, being of generally smaller area at top than at the bottom. However, it will be noted from FIGURE 3 that one side, preferably a back side **36**, is formed so as to be generally

parallel to the longitudinal axis of the tile 30, whereas each of the remaining three sides of the tile 30 are tapered outwardly from top to bottom. Each of the four lateral faces of the tiles 30 is corrugated over its lower area as illustrated at 38 in the drawing. In addition, each of the illustrated tiles 30 is provided with a boss 40 adjacent the top of its forward face, as distinguished from the rear or nontapered face 36. It is obvious from FIGURES 3 and 7 that these bosses 40 would interfere with the cradles 16 if it were attempted to suspend the tiles 30 in reverse position to that illustrated in the drawing.

FIGURES 7 and 8 illustrate the use of a locking assembly 42 for securing the cradle 16 to an I-beam flange 18. The assembly 42 comprises a metal strap member 44 bent to the configuration clearly illustrated in FIGURE 8, and a bolt 46 threadedly engaging the strap 44. The arrangement is clearly such that the assembly 42 may be engaged over the flanges 18 and forwardly extending portions 47 of the hanger flanges 28, being then secured by screwing down on the bolt 46.

The emplacement of the monolithic refractory 14, which may be of cast or plastic type, completes the refractory panel, so that the resulting wall or roof, as the case may be, provides a uniform refractory lining.

The employment of the anchoring arrangement 10 in securing furnace linings is generally apparent from the foregoing description and from the illustrations of the drawing. Thus, with the beams or columns 12 in place, one hanger 16, along with an associated tile 30, is engaged with each of the members 12 to provide a row of spaced anchoring devices. Where the structure being erected is a horizontal roof, this row will be disposed adjacent one end of the roof area, and where the structure is to take the form of a vertical wall, the row of anchoring devices will be located near the bottom or foot of the wall. Also, in the case of a wall, a locking device 42 is preferably associated with each of the cradles 16 to retain the same in place, at least until the wall under construction has been completed up to that point.

With one row of cradles 16 and supported tiles 30 in position, the refractory material 14 may be emplaced so as to embed the tapered portion of the tiles 30 as shown. The build-up of material 14 may continue until a position is reached wherein a second row of cradles 16 and supported tiles 30 may be assembled onto the beams 12. It should be particularly noted that the added cradles 16 and tiles 30 are oriented so as to emplace the vertical, or nontapered side of each tile 30 against the previously emplaced refractory material 14. This avoids the necessity of deforming a generally straight surface on the previously emplaced material more than is necessary to accommodate the corrugations 38 on the back side 36 of the added tile 30. This, incidentally, illustrates the significance of the boss 40 on each tile 30, these bosses serving to eliminate the possibility of the tiles being assembled in backward position. Reversal of the tile and cradle combination would, of course, be immediately evident to the worker and would therefore not be expected to occur.

The foregoing process of adding a row of cradle and tile combinations and then an additional section of the castable or plastic refractory 14 is continued until the roof or wall is completed. In the case of a wall, the locking devices 42 may be left in place if desired, but are preferably removed in order to provide less restriction to expansive movement of the finished wall.

In many instances, and particularly with castable refractories, it is advantageous to provide forms for supporting the monolithic mixture until it has set up, and also for insuring a uniform thickness in the wall or roof. In the illustration of FIGURES 1 through 3, a lower molding form of wood, such as plywood sheeting, is shown and designated generally by the numeral 48. Inasmuch as this form 48 is provided at the free surface of the wall under construction, it may be supported in any conventional manner. In providing forms for the opposite surface of the wall lining, however, consideration must be given to the interfering anchoring structure, namely, the beams 12, the cradles 16, and the tiles 30. Thus, form plates 50, constructed of sheet metal to a plan shape shown best in FIGURE 4 and having an upturned flange 52 shown in section in FIGURE 3, are arranged as clearly illustrated in the foregoing figures along with FIGURES 1 and 2. The plates 50 have notches 54 for interfit with the upper portions of the tiles 30 and are disposed at a level immediately beneath the hooked portions 26 of the cradles 16. With the position of the plates 50 thus established, a wedge 56 of wood or other suitable material is inserted between the free edge of the flange 52 and the adjacent flange 18 of the associated I-beam 12 so as to keep the plate 50 parallel to the beams 12. Wires 58 inserted through holes 60 in the flanges 52 are then brought up over the beams 12 and twisted so as temporarily to retain the form plates 50 in position as shown in FIGURE 1. After the material 40 has been emplaced between the forms 48 and the plates 50, the latter, as well as the former, may be removed and positioned in a manner similar to that above described at a new location so as to continue construction of the wall.

It will be apparent that a wall construction as above described will be flexibly supported so that it may shift in any direction under the influence of the forces which occur in the heating and cooling of furnaces. The desired flexibility is attained both by virtue of the ball and socket principle employed in the engagement of the cradles 16 with the tiles 30, and in the flexibility of the cradles 16 themselves. The cradles 16, being constructed from steel stampings, are light in weight and are inherently flexible, yet are amply strong to sustain the loads to which they are subjected. It will be noted particularly that the cradles 16 are not buried in the refractory and hence are not overly susceptible to the weakening influence of a hot wall.

Clearly, there has been provided a flexible anchor arrangement for castable or plastic refractories, along with a method for employing the same, which fulfills the objects and advantages sought therefor.

It is to be understood that the foregoing description and drawing have been given by way of illustration and example. It is further to be understood that changes in the form of the elements, rearrangement of parts, and the substitution of equivalent elements, all of which will be apparent to those skilled in the art, are contemplated as being within the scope of the present invention, which is limited only by the claims which follow.

What is claimed is:

1. In a refractory wall, a monolithic refractory panel having a plurality of preformed refractory tiles embedded therein and extending beyond one major surface thereof, the extended portions of the tiles each provided with oppositely extending bosses, an individual metal hanger movably engaging each of said tiles, each hanger including a pair of parallel hook-shaped spaced apart elements in supporting engagement with said bosses, said parallel hook-shaped elements being spaced apart a distance greater than the width of the supported tile thereby accommodating lateral movement of the tile, the oppositely extending bosses on the tiles being formed with convex surfaces inclined upwardly and outwardly of the tile body, said boss surfaces being in engagement with the spaced apart hanger elements in substantially a ball and socket type of arrangement, and a plurality of parallel flanged structural members each in supporting engagement with a plurality of said hangers.

2. A suspended refractory monolithic roof construction for furnaces comprising a plurality of supporting beams having lower outwardly extending horizontal flanges, a plurality of metal hangers suspended from said horizontal flanges and being movable laterally of said beams, each hanger including spaced parallel depending

cradle arms, a precast elongated refractory tile suspended from each hanger including opposed bosses at the upper end resting in said spaced cradle arms, the bosses of each tile being formed with convex surfaces inclined upwardly and outwardly of the tile body permitting expansion and contraction of said roof construction, said cradle arms being spaced apart a distance greater than the width of the tile thereby accommodating lateral movement of the tile and a monolithic refractory mass about and between said tiles supported thereby to complete the refractory roof, said refractory mass being below said bosses and supporting cradle arms.

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