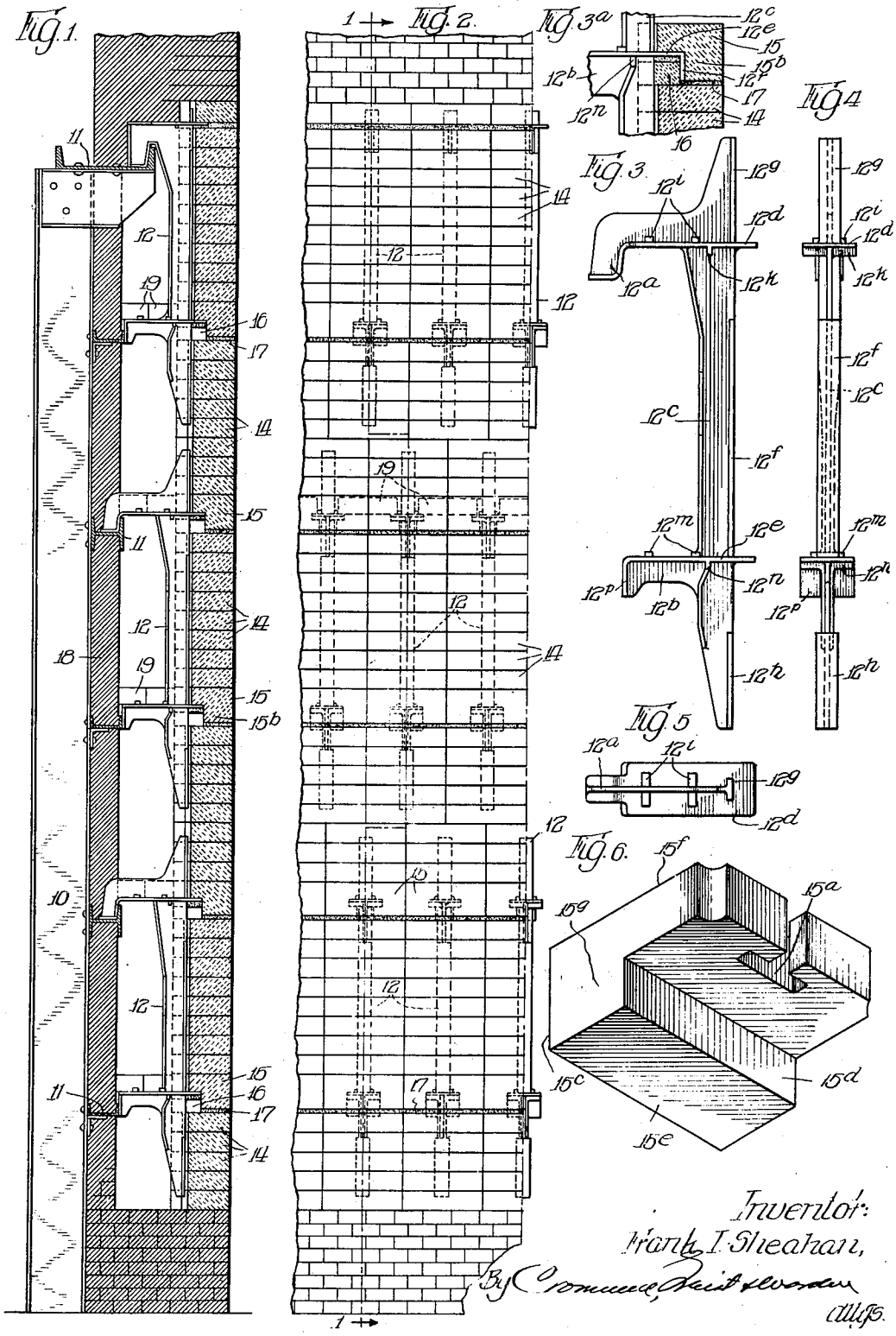
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FURNACE CONSTRUCTION

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FURNACE CONSTRUCTION

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This invention relates to the construction of furnaces, particularly to the construction of furnace walls.

In the construction of furnaces having walls of considerable height, or in locations where it is desired to support a wall portion above an opening or above other portions of the furnace structure which it is desired to maintain free of the weight of the wall, constructions have been designed whereby the wall refractories are carried on a suitable framework and maintained in the desired association to preserve the integrity of the wall as a portion of the furnace chamber.

The present invention has to do with a construction wherein the wall is subdivided into sections, each made up of a plurality of refractories, with sections supported independently of one another in the respect that the weight of the refractories in one section is not imposed on refractories in subjacent sections and vertical expansion of the sections is accommodated in such fashion that excessive compressive stresses are not imposed on the refractories. The general object of the invention is the provision of a construction by which this sectional support of the wall is attained in a simple and effective fashion and in which wall refractories are afforded anchorage in such fashion as to hold the wall against bulging and the refractories against displacement from the wall, such as might result from thermal expansion and contraction, operating pressures, pulsations, and the like.

A more particular object is the provision of such a construction in which the wall may be supported collaterally of a supporting frame or frame members by means of hangers or anchoring members so constructed and associated as to afford the wall refractories the requisite support and anchorage with a desired economy of material and uniformity of design in both the hangers and refractories.

Another object is the provision of a construction wherein a single hanger may be utilized to support portions of different sections and to maintain the alignment of refractories in those sections with those in a subjacent section.

Yet another object is the provision of an improved expansion joint construction and of a new and advantageous refractory element for forming the expansion joint.

Yet another object is the provision of an improved hanger for supporting and anchoring the wall refractories.

Other and further objects will be pointed out or indicated hereinafter, or will appear to one skilled in the art on an understanding of the invention or employment of the construction in use.

For aid in properly disclosing the invention, I show in the accompanying drawings forming a part of this specification, certain forms which are illustrative of embodiments of the invention, but it is to be understood that these are presented here by way of example only, and are not to be construed in any fashion calculated to limit the claims short of the true and most comprehensive scope of the invention in the art.

In said drawings

Fig. 1 is a sectional elevation of a portion of a furnace wall taken transversely or through the wall, as along the line 1—1 of Fig. 2;

Fig. 2 is a part inside elevation of a furnace wall;

Fig. 3 is a side elevation of a hanger;

Fig. 3ª is a detail showing a feature of a modified form of hanger with associated refractories;

Fig. 4 is a front elevation of same;

Fig. 5 is a top view of the hanger illustrated in Figs. 3 and 4, and

Fig. 6 is a perspective of an improved seal-forming wall refractory.

Described generally, the invention contemplates a wall construction wherein the wall refractories are carried on hangers or anchoring supports which are in turn mounted on a framework in such fashion that the wall refractories are supported collaterally of the framework to form a wall portion of the combustion chamber.

These hangers are so constructed as to cooperate with refractories in a plurality of

wall sections which are arranged one above another, preferably with intervening expansion joints accommodating vertical expansion of respective sections, the respective hangers having anchoring engagement with refractories in three proximate vertically associated sections, so that a given hanger is effective to maintain the desired alignment of a considerable vertical extent of the wall. Refractories are removable from any section without requiring removal of refractories from any other section, so that localized repairs may be made with facility, and for the expansion joints an improved form of refractories is provided which allows the necessary amount of vertical slippage between sections while maintaining the joint closed. This special joint refractory is so constructed as to admit of its being definitely anchored in place and to facilitate extraction of heat from it by a heat-diffusing member forming a part of the structure, whereby rapid disintegration of the refractories at the expansion joints from excessive heating may be avoided.

A more definite understanding of the invention may be ascertained from the examples shown in the drawings. In the construction here shown, the reference numeral 10 designates a column member, which may be in the form of an I beam, and of which there is a series ranged at suitable intervals along the furnace wall. These are connected at vertically spaced intervals by horizontal members 11, of any suitable form, connected to the column members on the side toward the furnace chamber. Preferably these horizontal members are spaced apart at uniform distances, although this is not essential. Hangers 12, preferably of cast iron, are supported on the members 11, each hanger cooperating with a plurality of said members, being hooked onto the upper one thereof and bearing against the lower one. For this purpose the hanger is provided with a hook-like tension arm 12^a at the top and a compression arm 12^b at the bottom, adapted for engagement with the members 11, and which arms are connected by a body portion 12^c. The hanger is formed with a pair of shelves 12^d and 12^e, the former adjacent its upper end and the latter adjacent its lower end. Lateral flanges 12^f are formed along the body portion extending upwardly from the shelves 12^e and terminating short of the upper shelf, and similar lateral flanges 12^g are formed on an extension which projects upwardly from the upper shelf. Below the shelf 12^e, the hanger is formed with an extension which carries lateral flanges 12^h, which terminate short of that shelf. The shelf portion 12^g is continued as marginal flanges on the sides of compression arm 12^a, and spacing lugs 12^i are arranged on the upper sides of said flanges inward from their margins, for a purpose to be pointed out later. Also stop lugs 12^k are provided depending from the lower sides of the shelf 12^d at a point spaced inwardly from the projected plane of the flanges 12^f. Similar spacing lugs 12^m and stop lugs 12^n are provided on the flanges of the shelf 12^e, which flanges are extended around the end of the arm 12^b to form a foot or rest 12^p for bearing engagement with one of the members 11.

The wall refractories 14, which are used throughout the wall excepting at the expansion joints, are of uniform shape and size, and are provided with T-shaped slots disposed at the middle of their outer ends, which slots are adapted to accommodate the flanges, 12^g, 12^f or 12^h when the refractories are slid thereonto from the upper ends of the flanges. Thus the refractories are anchored to the hangers. Special expansion joint refractories 15 are provided, of the form illustrated in Fig. 6, and conforming in peripheral outline to the refractories 14, being provided at the middle of their outer ends with the T-shaped slots 15^a. For substantially one-half its length from the end opposite the slot, this refractory is approximately twice the thickness of the slotted end portion, to form a lap portion 15^b with its end faces 15^c and 15^d parallel, its bottom face 15^e parallel with the top face 15^f and its side faces 15^g parallel and disposed at right angles to its bottom and end faces respectively.

The hangers are arranged in collateral association in series running horizontally, with one series above another, the tension arms being hooked on one of the members 11 and the brace portions 12^p bearing against a lower one of said members. The first few courses at the bottom of the wall are preferably supported on a suitable foundation, and then the courses of refractories 14 below the shelves 12^e of the lowermost series of hangers are slid on to the flanges 12^h from the top, the uppermost of said refractories, as clearly appears in Fig. 1, being inserted without engaging said flanges, but being retained frictionally by contact with refractories 14 already in place and retained against inward movement by the web of the hanger. Then short length refractories 16 are put in place with their outer ends abutting the stops 12^n of the hangers, forming a course across and covering only part of the length of the refractories 14 on which they rest. A single joint refractory 15 is then slid onto the flanges 12^f of each of the lowermost hangers, after a layer 17 of a suitable compressible refractory material, such as asbestos mixed with fire clay, has been laid on the short length refractories and the subjacent refractories 14. When the thinner portion of the refractories 15 is resting on the shelf 12^e, the lap portion 15^b extends down across the inner margin of that shelf

and in overlapping contact with the short length refractories 16 and rests upon the layer of compressible material 17. Then the tier of refractories is built up on the hanger 12 by sliding refractories 14 one after another down on the flanges 12^f, the uppermost of said refractories below the shelf 12^d being retained by friction, as above described, with its slotted ends straddling the web of the hanger. Short length refractories are then placed on this uppermost refractory 14, as above described. A layer of compressible material then being placed, as above described, another of the joint refractories 15 is slit onto the flanges 12^g and positioned on the shelf 12^d with its lap portion extending down across the inner margin of said shelf and in overlapping contact with the short length refractories, as above described. Refractories 14 are then slid onto the flanges 12^g in sufficient number to span the height of the portion of the hanger above the refractory 15 on which they are supported. The wall having been built to this level on the lowermost series of hangers, the next higher series of hangers is put in position, and the wall thus built on up by repetition of the operations above described. Thus, it will be seen, each hanger affords independent support for refractories of two sections, and in addition to affording anchorage for refractories in the two sections supported on it, each hanger also affords anchorage for some of the refractories in a subjacent section. While I have shown the vertical tiers of refractories arranged in staggered or broken-joint association with respect to the tiers above and below them, it is obvious that the hangers may be arranged in vertical alignment so that the tiers will align vertically throughout the height of the wall. However, with either arrangement, the hangers in one horizontal series are shiftable along the supporting members 11 independently of the hangers in subjacent and superjacent series, so that any relative disposal of the different series may be made, to accommodate wall openings, lack of uniformity in the width of the refractories or other contingencies. As is evident from an examination of Fig. 2, the construction provides an arrangement wherein a section having its refractories anchored to hangers of one horizontal series is alternated with a section having its refractories anchored to the hangers in two series. Thus, with only two series of hangers, refractories of five independently supported sections may be anchored against displacement out of the plane of the wall.

Thermal expansion of the refractories in one section is accommodated by the expansin joints without subjecting the refractories of subjacent or superjacent sections to the expansion pressure, while the free slippage of the lap portions of the joint refractories on the short length refractories allows for vertical expansion and contraction of the sections without opening the joints between them and permitting the access of incandescent gases to the hangers. The form of the joint refractories 15 is important in safeguarding them against rapid destruction by slagging. It will be observed that by virtue of its form, each of these joint refractories 15 has a substantial area of contact with the hanger on which it is supported, said contact being with the shelf and also with the parts of the hanger engaged in the slot 15^a. As will be seen in Fig. 1, the hangers have surface portions of susbtantial area exposed to air outside the refractory wall. These portions are effective to diffuse heat into the air, thus exercising a continuous cooling effect on the refractories 15 as well as the refractories 14, due to the rapid conduction of heat from the refractories to the hangers afforded by their liberal areas of contact. Thus the joint refractories are safeguarded against heating to the point where they would be rapidly destroyed by slagging. It will be appreciated that this protection of the joint refractories from rapid destruction is of particular importance where such refractories are relied upon to protect the shelves and hangers from the flame and incandescent gases of the furnace. For increasing the heat drainage from the joint refractories, the hanger shelves may be formed with depending ledges 12^r along their end margins, said ledges contacting the lap portions 15^b for part of the latters' width. With this arrangement the corners of the refractories 16 may be notched out to accommodate the ledges 12^r and permit the refractories 16 to contact the lap portions 15^b between the ledges.

On the members 11 exteriorly of the refractory wall, an outer or sheathing wall 18 may be supported, the refractory wall being spaced therefrom to afford an air space in which the hanger arms and the portions projecting from the refractories are exposed. This air space forms a chamber for the circulation of air to cool the hangers and refractories and to thus provide pre-heated air for the combustion chamber. If it is desired to subdivide this air chamber into horizontal lanes, such may be accomplished by placing partition members 19, such as tiles, on the flanges of the arms 12^a and 12^b of the hangers, said tiles spanning the distance between juxtaposed hangers and abutting the lugs 12^l and 12^m, and extending from the wall 18 to the outer side of the refractory wall. The lugs 12^l and 12^m keep these refractories spaced away from the webs of the hangers so as to allow free access of air to the latter, for the cooling effect.

Replacement of refractories may be made in any section or in any tier of a section by

withdrawing the uppermost refractory 14 which, it is observed, is not anchored to the hanger, and removing such of the subjacent refractories of the tier as may be necessary, by sliding them up the anchoring flanges until they clear the tops thereof, and then drawing them inwardly, and then putting the replacement refractories in place. At the top of the repaired tier, the short length refractories may be temporarily supported in position behind the lap portion 15^b by a trowel or on small blocks which are dislodged when the uppermost refractory 14 is slid into place, the stop lugs 12^k and 12^n preventing the outward displacement of the short length refractories incident to such operation.

What I claim is:

1. In furnace wall construction, in combination, frame members, hangers supported thereon and arranged in series disposed one above another, refractories supported on the hangers to form a sectional wall spaced laterally from the frame members, hangers in respective series supporting independently two vertically adjacent sections and having anchoring engagement with refractories in said sections and with refractories in a third section subjacent thereto.

2. A furnace wall structure as specified in Claim 1 and wherein refractories are removable and replaceable in respective sections independently of those in other sections.

3. A furnace wall structure as specified in claim 1 and wherein hangers in different series have anchoring engagement with refractories in the same section.

4. In furnace wall structure, in combination, a frame portion, a hanger supported thereon, vertically spaced shelves on the hanger, refractories supported on the shelves in vertical association and having anchoring engagement with the hanger to form a furnace wall portion spaced laterally from the frame portion, and refractories supported independently of the hanger but having anchoring engagement with the hanger below the lower shelf to retain them in alignment with those supported on the shelves.

5. In furnace wall structure, in combination, a hanger having vertically spaced shelves and anchoring flanges, center slotted refractories supported on the shelves and having anchoring engagement with said flanges, one of said slotted refractories having a lap portion depending across the margin of a shelf and across the inner face portion of a refractory below the shelf.

6. In a furnace wall structure, in combination, a hanger having vertically spaced shelves and tile retaining portions below and above the shelves, and slotted refractories arranged in a vertical tier below and above each of the shelves and having anchoring portions slidable into said flanges at the top of the latter, the shelves supporting vertically juxtaposed sections of the tier independently.

7. A furnace wall hanger comprising a metallic member having a bar-like body portion and shelves spaced apart longitudinally of the body portion and disposed substantially perpendicularly thereto, the body portion having aligned tile anchoring flanges disposed both above and below and intermediate the shelves and a support engaging arm extending laterally from the body portion for connection to a supporting member.

8. In a furnace wall structure, in combination, a structural frame, a metallic hanger mounted thereon and supported laterally thereof, a shelf on the hanger, a wall refractory resting on the shelf and having a lap portion depending across the inner margin of the shelf and below the same, said refractory having anchoring engagement with the hanger, and the hanger having a portion extending clear of the refractory and exposed to air to conduct and disperse heat from the refractory.

9. A furnace wall structure comprising, in combination, a structural frame, a hanger having a body portion extending collaterally of the frame portion and vertically spaced arms extending from the body portion and supported on the frame portion, vertically spaced shelves on the body portion, tile retaining members on the body portion above, below and intermediate the shelves, and refractories having anchoring engagement with said tile retaining portions to retain said refractories in vertical alignment, different refractories being supported on the respective shelves.

10. In furnace wall structure, in combination, a supporting frame portion, hangers supported thereon one above another, shelves on the hangers, refractories supported on the shelves to form wall sections independently supported one above another, and tile retaining members carried on one hanger and having anchoring engagement with refractories supported by a subjacent hanger.

11. In a furnace wall, the combination of a frame, a plurality of hangers supported thereon at one side thereof, wall sections supported independently by different hangers and associated to form a furnace wall portion, refractories in some of the sections having anchoring engagement with hangers other than those which support them.

In testimony whereof I have hereunto subscribed my name.

FRANK I. SHEAHAN.