

March 25, 1958

A. G. LAMBERT

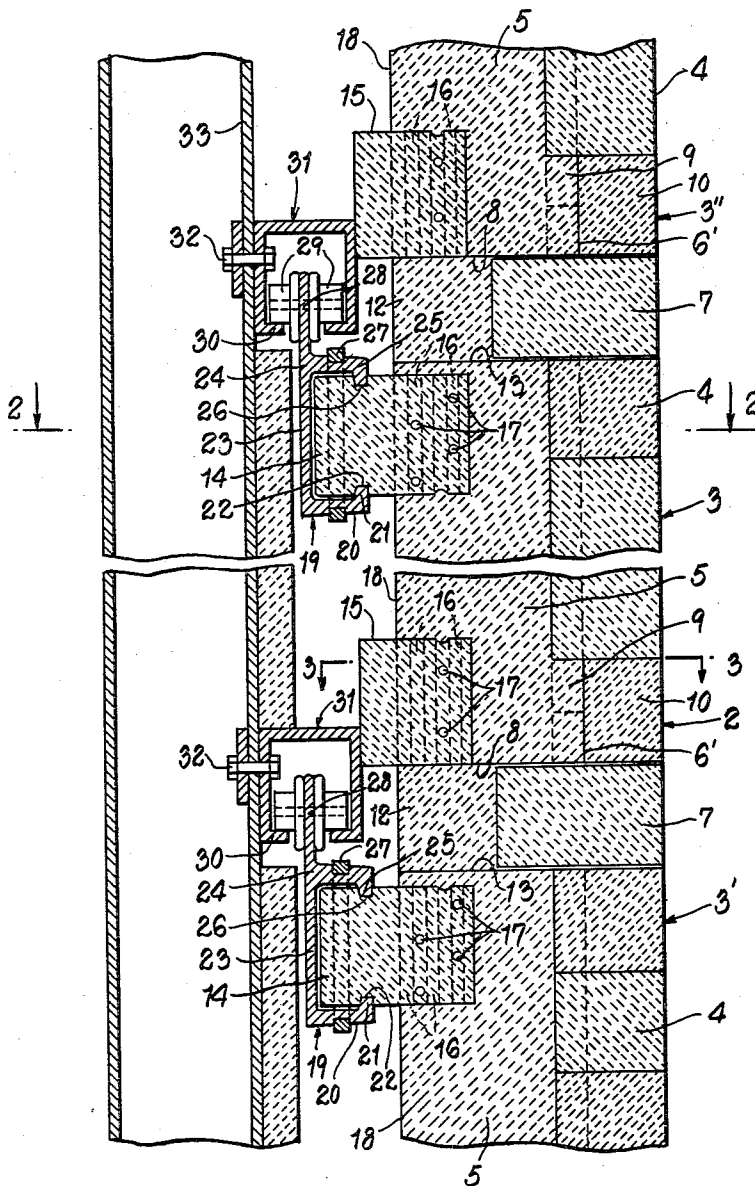
2,827,784

FURNACE WALL CONSTRUCTION

Filed June 12, 1953

4 Sheets-Sheet 1

Fig. 1.



INVENTOR.

AIME G. LAMBERT

BY

Kenyon & Kenyon
ATTORNEYS

March 25, 1958

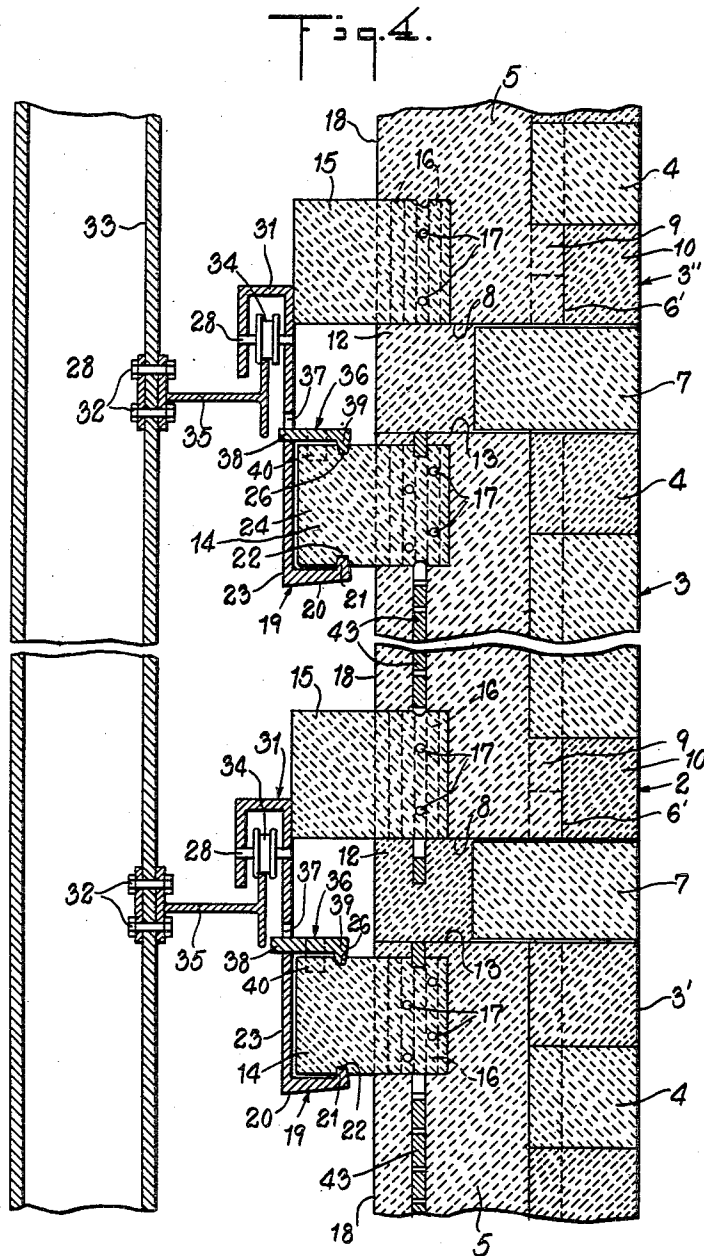
A. G. LAMBERT

2,827,784

FURNACE WALL CONSTRUCTION

Filed June 12, 1953

4 Sheets-Sheet 3



INVENTOR.
AIME G. LAMBERT

BY

Kenyon & Kenyon
ATTORNEYS

March 25, 1958

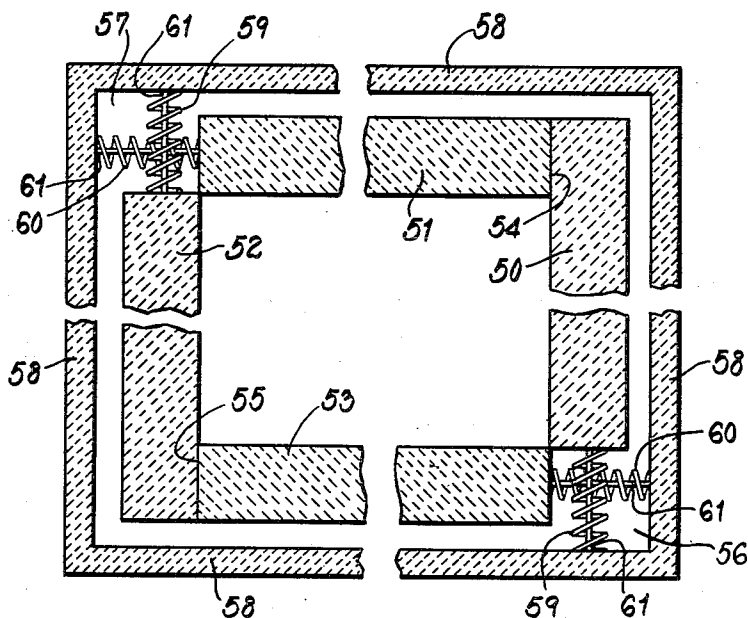
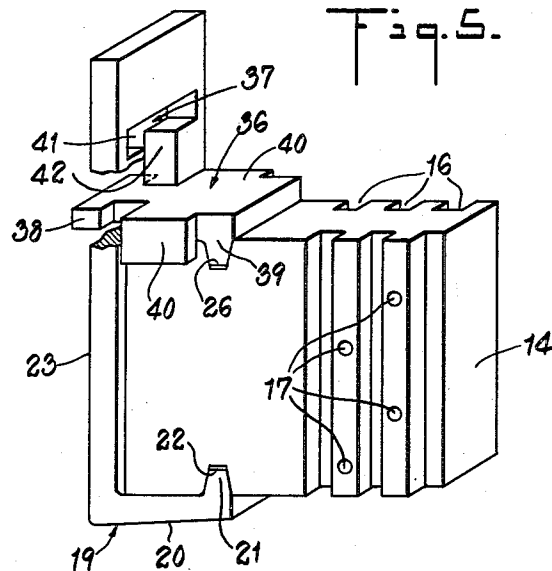
A. G. LAMBERT

2,827,784

FURNACE WALL CONSTRUCTION

Filed June 12, 1953

4 Sheets-Sheet 4



INVENTOR.
AIME G. LAMBERT

BY

Kenny & Kenny
ATTORNEYS

1

2,827,784

FURNACE WALL CONSTRUCTION

Aimé G. Lambert, Woluwe-St.-Pierre, Brussels, Belgium

Application June 12, 1953, Serial No. 361,389

7 Claims. (Cl. 72—101)

The present invention relates to improvements to furnace walls for use in furnaces adopted for high temperature operation, and in particular to walls of the type formed of a number of tiers of elements suspended from external horizontal frameworks.

It is well known that such walls for use in high temperature furnaces expand and contract in relation to the temperature of the walls.

In known walls of this type, whose tiers have a height of about 80 to 90 centimeters, the vertical expansion occurs easily by the aid of asbestos joints provided between adjacent tiers. The expansion in a horizontal direction can take place through the intermediary of asbestos fillers or packings provided at the ends of the walls. However, the refractory elements suspended from the horizontal frameworks, through the intermediary of suspension or hook-on parts, are not able, in expanding, to carry these parts along with them, so that the connecting elements, such as tenons, between the said refractory elements and the suspension parts become fractured, which lessens the stability of the masonry.

It is true that it has already been proposed that the furnace walls be provided at places with vertical joints intended to absorb the horizontal expansions. These vertical joints, however, have the disadvantage of disintegrating after a certain time, so that the tightness of the walls is impaired.

In order to avoid this drawback, a layer of fire-proof material is often applied to the face of the wall not exposed to the fire; but in this case, because of the great heat conductivity of the interior refractory elements as compared with that of the external insulating layer, the suspension parts are brought to a very high temperature, and, in order to be capable of resisting this high temperature, must be made of cast iron or steel especially adapted for use at high temperatures. The insulating layer, moreover, deteriorates by becoming cracked and dislocated. As to the suspension parts, they transmit the heat which they collect, and, being connected by the refractory elements of the walls to the above-mentioned external frameworks, this produces great loss of heat and an unallowable excess heating of the said frameworks.

The present invention has for its object combinations by the aid of which the above-mentioned drawbacks of the known combinations are avoided, and they are replaced by advantages such as those consisting of securing freedom for both horizontal and vertical expansion of the furnace walls, without risk of rupturing the parts for suspending the stacked refractory elements; of avoiding contact between the refractory elements (which are in operation brought to high temperatures) and the frameworks from which these elements are suspended through the intermediary of suspension parts; of securing tightness of the walls while eliminating the vertical expansion joints normally provided in these walls; and of securing the restoration to position of the elements constituting the furnace walls following a horizontal expansion of these walls.

Pursuant to the invention, in a furnace wall formed of

2

a number of tiers each comprising stacked refractory elements suspended from horizontal frameworks, the said refractory elements of the same stacks are fastened to a block cast from insulating or refractory material, which is itself suspended, through the intermediary of at least one plate made of a fire-proof material of great strength mechanically, from a hook-on part provided with a rolling device resting upon one of the aforementioned horizontal frameworks.

- 10 In accordance with one characteristic of the invention, the plate for suspending the aforementioned blocks from the hook-on parts is advantageously constructed of a material having a large content of asbestos, and is molded integrally with the said block in the vicinity of the end of this block, near the framework from which the block is suspended. This plate, in accordance with another characteristic of the invention, may extend as far as the vicinity of the opposite end of the block in which it is partly embedded, in such a manner as to bear against the subjacent framework, which prevents warping of the block in question. Instead of providing a single plate extending approximately from the upper end to the lower end of the block, it is possible to provide two separate plates, one of which, disposed in the vicinity of the upper end of the block, serves as an insulating connection between this block and the hook-on part, and the other of which, embedded or socketed in the block in the vicinity of the lower end of this block, serves as a suspending and insulating element, bearing against the framework situated below that framework from which the block in question is suspended.

- In accordance with the invention, the hook-on parts have the general shape of an L, the horizontal leg of which has at its outer end an upwardly directed beak or projection engaged in a recess formed in the lower edge of the insulating suspension plate. The L-shaped hook-on part preferably has, parallel with its horizontal web, a branch that is fixed or movable, which also has, at its outer end, a downwardly directed projection engaged in a recess formed in the upper edge of the suspension plate. In order to prevent this suspension plate from becoming accidentally detached from the hook-on part, there is preferably provided a detachable device which may for example be constituted by a dowel pin attached in a removable manner to the horizontal web of the hook-on part and to the horizontal branch carried by the vertical web of this part. Instead of this dowel pin, it is possible to provide vertical flanges integral with one and/or the other of the horizontal portions of the hook-on part. Thus, these flanges may be provided at the ends of one of the flanges of an I-shaped profile, whose web is approximately parallel with the horizontal web of the L-shaped hook-on part and passes through a longitudinal slot formed in the vertical web of the hook-on part, the other flange of the I-shaped profile bearing against the vertical web of the hook-on part.

- As to the rolling device connected to the hook-on parts: it may be constituted in accordance with the invention by at least one roller carried by a journal passing freely through an opening formed at the upper outer end of the hook-on part, this roller resting upon a rail which constitutes a horizontal frame of the furnace wall. The roller in question may roll either on a horizontal flange of the said rail, or on a vertical flange of it.

- The connection between the stacked refractory elements and the molded block set back-to-back with them may be effected by a dovetail joint, by mortise and tenon, or by an analogous arrangement, in such a way as to make the refractory elements integral with the said block, in a horizontal direction at least; and this block may if required be reinforced by the aid of one or more plates, perforated if desired, made of an insulating material which has great mechanical resistance to high temperatures.

In accordance with still another characteristic of the invention, there is provided at one end of each wall of a furnace, at the level of each tier, at least one spring bearing against an external sheathing of the furnace, and serving to restore the constituent elements of the wall to their original position after horizontal expansion of this wall. In such a furnace each wall preferably bears at one end against another wall, and is subjected at its other end to the action of springs, the arrangement being advantageously such, in the case in which the furnace is rectangular, that a series of springs, alternately perpendicular to one another, are provided in two diagonally opposite corners of the furnace.

Other characteristics and details of the invention will appear in the course of the following description of the drawings annexed to the present application, which drawings illustrate schematically, and merely by way of example, some ways of constructing furnace walls and furnaces in accordance with the invention.

In these drawings:

Fig. 1 is a partial vertical section of a fragment of a furnace wall in accordance with the invention.

Fig. 2 is a section along line II—II of Fig. 1.

Fig. 3 is a section along line III—III of Fig. 1.

Fig. 4 is a partial vertical section of a furnace wall in accordance with the invention, illustrating a method of construction, different from that of Fig. 1, for the hook-on parts having a roller in accordance with the invention; this view also showing the possible way of reinforcing the connection block between the refractory elements and the suspension plates.

Fig. 5 shows in perspective a detail of Fig. 4.

Fig. 6 is, to a small scale, a schematic plan view of the walls of a rectangular furnace in accordance with the invention.

Fig. 7 is a partial vertical section of the furnace wall and supporting block construction of a tier of a furnace wall in accordance with the invention, illustrating a method of construction, different from that of Fig. 1 or Fig. 4, for the refractory bricks are fastened to the block by the aid of a mortise and tenon joint, each refractory brick being individually and independently so connected.

In these different figures the same reference characters indicate identical elements.

In Fig. 1, a furnace wall is indicated by the general reference character 2. This wall is composed of a number of tiers 3, 3' and 3'', each comprising stacks of refractory elements or bricks 4, fastened to a block 5, obtained by molding or casting a low-density insulating and refractory material, such as a compound having a refractory cement for its base.

The refractory bricks 4 are fastened to the block 5 by the aid of a dovetail joint, as is shown at 6 and 6' in Fig. 2. Instead of such a joint, it is possible to use a mortise and tenon, as shown at 4' in Fig. 7. Any other analogous arrangement may be employed the purpose aimed at being merely to attach the juxtaposed stacks of bricks 4 to the backing blocks 5. Above each stack of bricks 4 there is provided a filler element or brick 7. This filler element 7 may be easily removed, for example, when it is desired to take apart a stack of bricks 4, for example, for the purpose of replacing a broken brick in this stack. After removal of the refractory filler element 7 situated above the stack that is to be taken apart, the bricks 4 may be withdrawn one by one by sliding them upward along the projecting dovetail 6 of the block 5.

In order to prevent the stacks or bricks 4 from falling during the removal of the filler refractory element 7, disposed at the bottom of these stacks and separating such a stack from a subjacent stack, there is provided at the lower end 8 of the block 5 a base shoulder 9 which acts as a retaining stop for the lower brick 10 of each stack. This brick 10 is of a special shape, in that it comprises, for a portion of its height and running from its upper end, a dovetail groove 6'; while for a portion of its height,

running from its lower end, it is of reduced section as is shown at 11 (see Fig. 3).

Behind the filler elements 7 there is provided a layer 12 of fire-resisting or insulating material, at the level of the horizontal frameworks which will be mentioned further on in this application.

Into the blocks 5 of insulating and refractory material there are partly embedded: on the one hand and in the vicinity of their upper end 13, a suspension plate 14; and, on the other hand and in the vicinity of their lower end 8, a slider plate 15. These plates 14 and 15 are both made of fire-proof material which has great resistance mechanically to high temperatures. As is shown by Figs. 1 and 2, the plates 14 and 15 are grooved at 16 and have holes 17. These grooves and these holes serve to secure a good attachment of the said plates into the molded or cast material of the blocks 5. As may also be seen, the plates 14 and 15, which are embedded and fastened into the blocks 5, project from the rear face 18 of these blocks.

The suspension plate 14 is mounted in a hook-on part which is indicated in a general way by the reference character 19. This hook-on part may be made of cast iron, because it is separated from the block 5 and from the stacked refractory elements in front of this block by the suspension plate 14 made of an insulating material, so that it is almost impossible to produce a transmission of heat to the said hook-on part 19.

This hook-on part has approximately the shape of an L whose horizontal leg 20 ends in a projection 21 which is directed upwardly and engages in a recess 22 formed in the lower edge of the suspension plate 14. The vertical leg or web 23 of the hook-on part carries a horizontal arm 24, similar to the horizontal web 20, and ending in a projection 25 which is directed downwardly and engages in a recess 26 provided in the upper edge of the suspension plate. In order to prevent the plate 14 from becoming accidentally detached from the hook-on part 19, there is preferably provided a retaining pin or stirrup 27, which fits on the horizontal web 20 and on the horizontal web 24 of the said hook-on part.

At its upper end the hook-on part has passing through it freely a journal or axle 28 carrying two rollers 29, each of which rests upon a horizontal web 30 of a rail which is designated as a whole by the reference character 31. This rail, which constitutes one of the horizontal frames of the furnace wall, is fastened by bolts 32 to the uprights 33.

By the aid of the roller device, constituted by the rollers 29, from which the stacks of bricks 4 of each tier of the furnace wall are suspended through the intermediary of the blocks 5, the suspension plates 14 and the hook-on parts 19, horizontal expansion of the wall can take place without difficulty and without risk of damaging or rupturing the hook-on parts. In addition, these latter parts are perfectly sheltered from the heat, to the point that there is no reason to fear jamming of the rollers 29.

In Figs. 4 and 5 there is shown, likewise by way of example, another form of construction of a suspension system in accordance with the invention. In this case the hook-on part 19 carries at its upper end a single roller 34, which is able to roll upon a vertical web of a rail 35, constituting one of the horizontal frames of the furnace wall. In addition, instead of providing a fixed horizontal arm, such as is designated by the reference character 24 in Fig. 1, there is provided a detachable horizontal arm 36, which passes through a slot 37 formed in the vertical web 23 of the hook-on part. At one end, this arm 36 carries a head 38 analogous to a hammer head, while at its other end it carries a projection 39, which is directed downwardly and engages in the recess 26 formed in the upper edge of the suspension plate 14. In addition, the horizontal arm 36 carries, between its two ends, two vertical side-plates 40, between which is inserted the upper part of the suspension

plate, these side-plates 40 preventing the suspension plate 14 from becoming accidentally detached from the hook-on part 19.

The setting into position of the detachable horizontal arm 36 is done as follows (see Fig. 5): After having engaged the head 38 through the wide part 41 of the slot 37, this arm is allowed to slide downward into the narrow part 42 of this slot, until the projection 39 becomes engaged in the recess 26 of the suspension plate 14. At this moment this plate is firmly attached to the hook-on part by the aid of the engagement of the projection 39 in the recess 26 and the insertion of the plate between the side-plates 40.

In Fig. 4 we also see that the block 5 is reinforced by the aid of a perforated plate 43 fastened to the suspension plate 14 and the slider plate 15, this latter bearing against the frame 35 situated below that frame from which the block 5 under consideration is suspended.

Finally, Fig. 6 shows schematically a furnace of rectangular shape, whose walls 50, 51, 52 and 53 are preferably constructed in the manner described above. The walls 50 and 51 bear against one another at 54, and the walls 52 and 53 at 55. At the two opposite corners 56 and 57 of the furnace, in spaces provided between the ends of the walls and the external sheathing 58 of the furnace, there is provided a series of springs 59 and 60, alternately perpendicular to one another. These springs, which are guided on the stationary rods 61, are provided at the rate of at least one spring per tier of each of the two walls abutting at the corners 56 and 57. These springs serve to restore the elements, of which the walls 50 to 53 are constituted, to their original position during the contraction of these walls following an expansion in a horizontal direction.

It is evident that the invention is not limited exclusively to the forms of construction and to the details described above, and that many modifications may be made to the arrangement, constitution and form of certain elements used in the realization, provided that these modifications are not in contradiction with the object of the claims terminating the present application.

Thus it is self-evident that it is possible to give the hook-on parts forms other than those described above, and the same thing moreover applies to the refractory bricks, the molded or cast blocks, and suspension plates.

What is claimed is:

1. A furnace wall comprising a plurality of tiers of insulating and refractory carrier blocks, refractory elements carried thereby, a supporting frame including a horizontal rail for each tier, and means for suspending carrier blocks of each tier from one of said rails, each of said suspending means comprising a carriage having rollers movable along one of said rails and a suspension member supported by said carriage and having a portion engaging a carrier block to support the weight thereof, and a plate of non-metallic insulating fire proof material projecting from one of said blocks and carried by said suspension member.

2. A furnace wall comprising a plurality of tiers of insulating and refractory carrier blocks, refractory elements carried thereby, a supporting frame including a horizontal rail for each tier, and means for suspending carrier blocks of each tier from one of said rails, each of said suspending means comprising a carriage having roller means movable along one of said rails and a hook-like suspension member, and a plate of non-metallic, insulating fireproof material projecting from one of said blocks and carried by said suspension member.

3. A furnace wall constructed as described in claim 2 wherein a second plate of fire proof material is fastened to each tier and bears against the frame to prevent tilting of the tier.

4. A furnace wall construction comprising a stationary framework having longitudinally extending trackways secured thereto, a tiered refractory block wall in substan-

tially parallel relationship to said framework, said refractory wall including carrier blocks of insulating refractory material having integral means on one face thereof adapted to support fire bricks, each carrier block having a plate of insulating refractory material embedded therein and projecting from the other face thereof, said plates having a recess in the lower edge thereof, a plurality of substantially L-shaped metallic support members, each support member including a vertical web and an angularly extending leg, the upper end of each member having a roller attached thereto, said rollers engaging said trackways and being adapted to move therealong, the leg of each support member having an upwardly projecting lip thereon engaging the recess in said plate, whereby each tier of said wall is movably suspended from a trackway and is free to expand in a direction parallel to the axes of said trackways.

5. A furnace wall construction as described in claim 4 wherein each support member further includes a locking lug having a downwardly projecting lip in spaced relation to said upwardly projecting lip, said lug being rigidly joined to the vertical web of said support member, the upwardly and downwardly projecting lip engaging the edges of said plates and securing same to said trackways.

6. A furnace wall construction as described in claim 4 wherein each support member further includes a locking lug having a downwardly projecting lip in spaced relation to said upwardly projecting lip, said lug being slidably attached to the vertical web of said support member whereby said lug may be slidably engaged therewith and disengaged therefrom, the upwardly and downwardly projecting lips engaging the edges of said plates and securing the same to said trackways.

7. A furnace wall construction comprising a stationary framework having longitudinally extending trackways secured thereto, a tiered refractory block wall in substantially parallel relationship to said framework, said refractory wall including carrier blocks of insulating refractory material having integral means on one face thereof adapted to support fire bricks, each carrier block having a plate of insulating refractory material embedded therein and projecting from the other face thereof, said plates having a recess in the lower edge thereof, a plurality of substantially L-shaped metallic support members, each support member including a vertical web and an angularly extending leg, the upper end of each member having a plurality of rollers attached thereto with the axes thereof disposed in a horizontal position and parallel to each other, said rollers engaging said trackways and being adapted to move therealong, the leg of each support member having an upwardly projecting lip thereon engaging the recess in said plate, whereby each tier of said wall is movably suspended from a trackway and is free to expand in a direction perpendicular to the axes of said rollers.

References Cited in the file of this patent

UNITED STATES PATENTS

693,252	Fiske	Feb. 11, 1902
1,315,021	Jacobus	Sept. 2, 1919
1,341,645	Jacobus	June 1, 1920
1,410,729	Balz	Mar. 28, 1922
1,489,683	Allen	Apr. 8, 1924
1,521,035	Mercer	Dec. 30, 1924
1,586,859	Strachota	June 1, 1926
1,639,138	Liptak	Aug. 16, 1927
1,674,422	Allen	June 19, 1928
1,747,822	Foltz	Feb. 13, 1930
1,870,721	Foltz	Aug. 9, 1932
1,946,125	Bennett	Feb. 6, 1934
1,966,674	Liptak	July 17, 1934
2,068,863	Mannshardt	Jan. 26, 1937
2,098,586	Marble	Nov. 9, 1937
2,186,577	Davey	Jan. 9, 1940