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FURNACE WALL CONSTRUCTION

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2 Sheets-Sheet 1

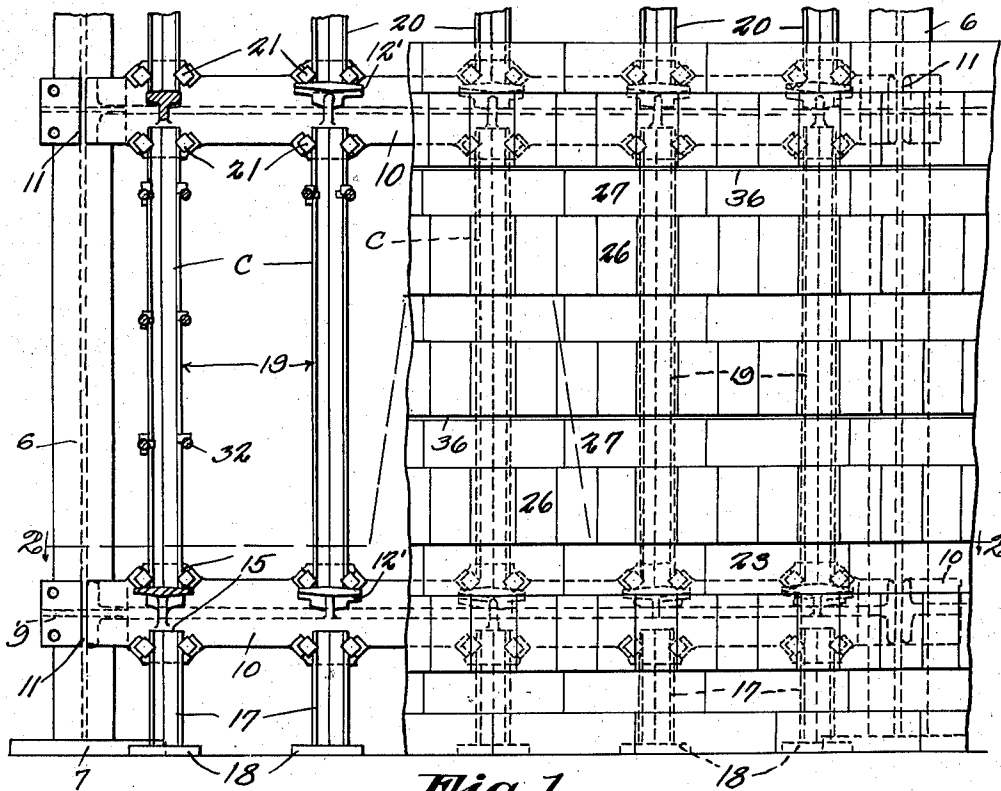


Fig. 1.

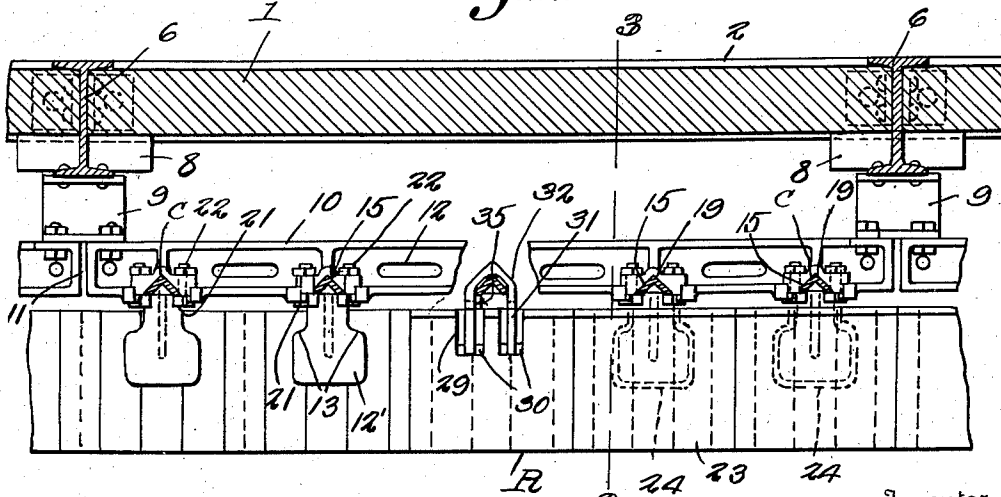


Fig. 2.

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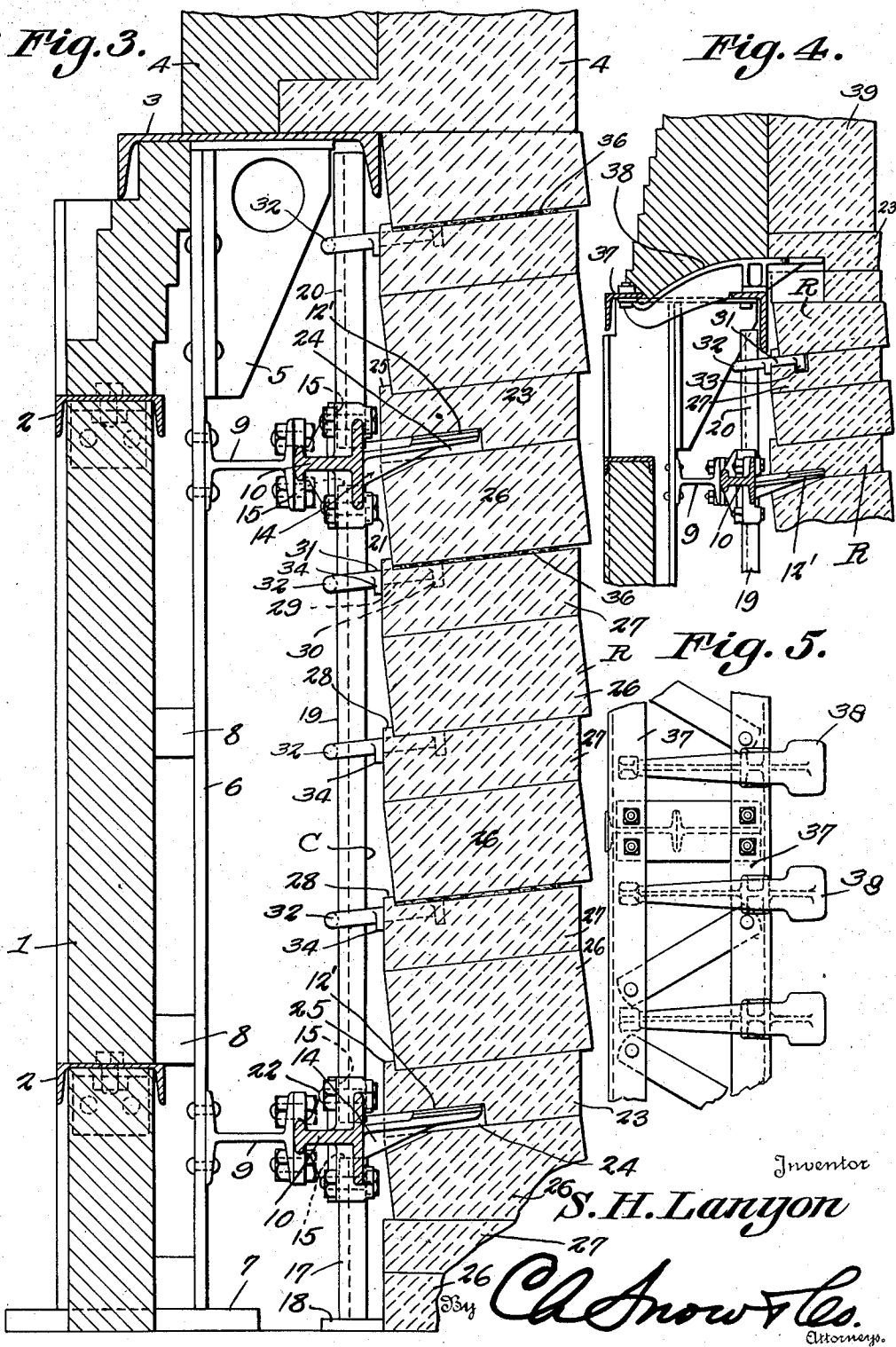
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UNITED STATES PATENT OFFICE

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FURNACE WALL CONSTRUCTION

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13 Claims. (Cl. 72—101)

This invention relates to a furnace wall construction, one of the objects being to provide sectionally supported air-cooled furnace walls including retainer columns having shelf members which serve to support shelf tile which, in turn, are utilized for supporting the intermediate tile.

A further object is to provide means for tying the intermediate tile to the columns.

A still further object is to so position the retainer columns relative to the outer columns and casing as to provide ample space for the circulation of air utilized for cooling purposes.

A still further object is to so construct the furnace wall that the load carried by the retainer columns acts to exert an upward force upon the outer columns of the furnace.

Another object is to provide a furnace construction wherein repairs and replacements can be made conveniently without the necessity of tearing down the wall, it being possible, furthermore, to so support the solid wall construction above the sectional wall as to permit removal of the top section without disturbing the solid wall construction thereabove.

Other objects are to so construct and arrange the parts of the wall as to compensate for expansion and contraction in all directions while maintaining the efficiency of the structure.

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 combinations 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.

In the accompanying drawings the preferred forms of the invention have been shown.

In said drawings:

Figure 1 is an inner elevation of a furnace wall construction such as constitutes the present invention, a portion thereof being broken away.

Figure 2 is a section on line 2—2, Figure 1, a portion being broken away to show in plan one of the retainer elements.

Figure 3 is a section on line 3—3, Figure 2.

Figure 4 is a vertical section through the top portion of a slightly modified form of wall construction.

Figure 5 is a plan view of the brackets and their connections shown in Figure 4.

Referring to the figures by characters of reference, 1 designates the outer wall or casing of the furnace which is made preferably of suitable

clay material in which is embodied any desirable metal frame-work indicated generally at 2, there being, in the structure illustrated in Figure 3, a channel 3 resting on the outer wall casing and constituting a sill for supporting the upper solid wall structure 4 of the furnace. Depending from this channel 3 are rigid hangers 5 to which are secured the upper ends of the outer columns 6 of the furnace wall, these columns being extended downwardly to a suitable base 7. Projections 8 are carried by the outer columns 6 at the inner surface of the wall or casing 1 for the purpose of steadying the wall 1. These projections or steadying portions can be located at any points deemed advisable.

Joined to the columns 6 are inwardly extended fillers 9 formed of metal. Preferably these fillers are provided with webs adapted to flex when subjected to up and down pressures resulting from expansion and contraction of the furnace wall but it is to be understood that under some conditions it will not be necessary to use a filler capable of flexing.

The outer columns 6 are preferably regularly spaced and the fillers are likewise regularly spaced. To the inner faces of the fillers are bolted or otherwise connected shelf beams 10 disposed in alinement and extended horizontally with their ends slightly spaced apart as indicated at 11 in Figure 2. These shelf beams are preferably provided with openings 12 so as to permit up and down circulation of air through them.

Extending from the inner face on each shelf beam are regularly spaced shelf members 12' having flat upper faces which are inclined upwardly at a slight angle and are widened to provide side shoulders 13 at points between their ends. Each shelf is reinforced by a web 14 formed thereunder as a part thereof so that the shelf and its beam 10 thus constitutes a strong one-piece structure.

Within the upper and lower portions of the beam 10 above and below each shelf 12' are cored recesses 15. In the structure illustrated these recesses are triangular but it is to be understood that they can be made of any other shapes. In these recesses are adapted to be seated the ends of the sections of the retainer columns C. These columns can be made of angle members, the sections being of suitable lengths. For example a lower section 17 can extend from a base plate 18 or the like welded or otherwise joined thereto, the upper end of this section being snugly seated within the lower recess 15 directly thereabove in

the lower beam 10. Another section 19 has its lower end seated in the upper recess 15 in said beam while its upper end is seated in the lower recess 15 in the next beam 10 thereabove. A third section 20, in the structure illustrated, extends from the upper recess 15 in the upper beam 10 to a point within the channel 3 from which it is spaced to allow for expansion. These sections are all in vertical alinement and their ends are held to the beams 10 by the heads 21 of bolts 22 which are extended through the walls of the recesses and securely tightened. It is to be understood, however, that any other suitable means may be employed for fastening the retainer column members securely to the beams 10 so that each column, although made up of separate superposed sections, will constitute a practically continuous unbroken column designed to properly support the load to which it is subjected.

The shelves 12' are spaced apart such distances that when a single shelf tile 23 is mounted at its center on one shelf, its ends will be extended close to the ends of those shelf tiles supported on the adjacent shelves 12'. In order that the shelf tiles may be properly engaged by the shelves 12, each of said tiles is formed with a recess 24 in its bottom face at that end nearest the beam 10 and this recess is widened for the purpose of accommodating the wide portion of the shelf 12' and at the same time leave enough clearance to permit slight relative longitudinal and lateral movement of the tile and shelf.

Each shelf tile which obviously is inclined so as to be substantially parallel with its shelf 12', is formed with an upstanding stop rib 25 at that end thereof nearest the beam 10 and this stop rib constitutes an abutment for one or more fire brick 26 mounted on the shelf tile 23. Each course of fire brick, except the course under the shelf tile, supports a course of intermediate tiles 27 likewise formed with stop ribs 28. Each intermediate tile, which is preferably of the same length as the shelf tiles, has spaced recesses 29 extending into the top surface thereof from that end nearest the columns 16 and the closed ends of these recesses are provided with depressions 30.

Seated in the pair of recesses in each intermediate tile are the spaced arms 31 of a retaining element 32. This element embraces the column C and the free ends of its arms are provided with depending lugs 33 (see Figure 4) which extend downwardly into the depressions 30. Retaining lugs 34 are also extended downwardly from the arms 31 and are adapted to engage the adjacent ends of the tile 27. Another stop lug 35 is extended laterally from one of the arms of the retaining element and engages the adjacent edge of column C. (See Figure 2.) Thus these retaining elements serve to tie the intermediate tiles to the columns C and at the same time hold them spaced properly from these columns.

Successive courses of fire brick, intermediate tile and shelf tile are built up to form the inner refractory wall R of the furnace, it being understood that where the shelves 12' are situated they will support courses of shelf tile and their superimposed tile.

A layer 36 of asbestos or other suitable packing material is interposed between certain courses of intermediate tiles and the courses of fire bricks thereabove. These layers thus provide expansion joints.

Obviously fire brick and tile will be built up in courses beneath the lower series of shelves 12' as shown in Figure 3 so that a solid refractory

wall will thus be extended from the bottom of the furnace to the top structure 4.

Although each of the retainer columns C have been shown of separate sections rigidly joined, it is to be understood that each column can be formed of a single length of material if so desired. Such a modification is so obvious that detailed illustration thereof is not believed to be necessary.

By employing fillers 9 of different widths, the widths of the air spaces between the outer wall and the inner refractory wall can be varied to meet the requirements. Furthermore instead of so mounting these fillers as to flex upwardly and downwardly they could be made to flex laterally should conditions require it. Likewise under some conditions, as where a battery of oil burners are employed below the air-cooled walls, suitable means, such as brackets, may be substituted for the fillers 9 for transferring the load of the retainer columns and the structure supported thereby, to the steel frame work of the outer wall or casing 1.

It is to be understood that the fabric layers providing the expansion joints are not to be located adjacent to the shelves but must be interposed between courses remote from the shelves.

It will be noted that ample clearance is provided between the walls of the recesses 24 and the edges of the shelves 12' to permit any necessary lateral adjustment of the tiles relative to the shelves. For the same reason ample clearance is provided between the arms 31 and the sides of the recesses in tile 27 in which they are seated. Thus should the shelf tiles and/or the intermediate tiles run narrow, the minus errors can accumulate in that course until ample space is left between two of the tiles to permit the insertion of a section of a tile or brick to close the course. Should the tile run wide the plus error would accumulate until ultimately one end portion of one of the tiles could be chipped off to properly match the next adjoining tile. Obviously this greatly reduces the labor of fitting inaccurate special tile because should no clearance be provided between the shelves 12' and the walls of the recesses 24, at least one side of every tile would have to be chipped in order to fit inaccurate tile. Because of the foregoing advantages and the further fact that it is necessary that the short vertical joints, broken at every course, be maintained, the provision of the clearances between the shelves and the walls of the recesses is of considerable importance.

It is generally desirable to support the top structure independently of the air cooled refractory wall so as to permit sections of that wall to be removed without disturbing the top structure. Such a construction has been illustrated in Figures 4 and 5 wherein the channel member 37 which corresponds with the channel member 3 has brackets 38 suitably joined thereto, these brackets being extended under the top structure 39 so as to support it on columns 6 independently of the air cooled refractory wall R.

Obviously should any of the shelves become damaged it would not be a difficult matter to cut them off and to substitute a repair shelf adapted to be bolted, hooked on or otherwise attached to the shelf beam.

The air space between the refractory wall and the outer wall can be provided with suitably arranged partitions for controlling the direction of the flow of air between the walls. It is not deemed essential that these partitions be illustrated.

In the furnace wall construction herein described it will be noted that as the retainer columns are located between the refractory wall or furnace lining R and the outer columns 6 and as they are in themselves responsible column members, the load of the refractory lining, the shelf members and the retainer elements is carried by these retainer columns. Thus the reaction of the outer columns 6 due to the load of the refractory lining, is in an upward direction.

What is claimed is:

1. A furnace wall construction including refractory lining, retainer columns constituting the sole supports and anchors for said lining, shelf beams connecting the columns, an outer structure, connections between the outer structure and the shelf beams, said connections being proportioned to flex upwardly or downwardly when subjected to forces resulting from differential expansion in vertical planes between the outer structure and the columns, and shelves projecting from the beams for supporting shelf tile.

2. A furnace wall construction including sectional retainer columns, shelf beams connecting the same, shelves projecting from the beams for supporting shelf tile, an outer structure, and connections between the columns and the outer structure, said connections being proportioned to flex upwardly or downwardly when subjected to forces resulting from differential expansion in vertical planes between the outer structure and the columns.

3. A furnace wall construction including spaced retainer columns, shelf beams connecting the same, shelves extending from the beams for supporting the shelf tile, tile engaging retainer elements extending from each column, an outer structure, and connections between the beams and the outer structure, said connections being proportioned to flex upwardly or downwardly when subjected to forces resulting from differential expansion in vertical planes between the outer structure and the beams and columns.

4. A furnace wall construction including retainer columns, shelf beams connecting the same, an outer structure, connections between said outer structure and the columns, said connections being proportioned to flex upwardly or downwardly when subjected to forces resulting from differential expansion in vertical planes between the outer structure and the beams and columns, shelves projecting from the beams, shelf tile mounted on the shelves and arranged in courses, each tile having a recess for receiving the shelf, superposed courses of intermediate tiles, means for tying the intermediate tiles to the columns, and refractory bricks interposed between the courses of tiles, said bricks and intermediate tiles being supported by the shelf tiles.

5. A furnace wall construction including retainer columns, shelf beams connecting the same, an outer structure, connections between said outer structure and the columns, said connections being proportioned to flex upwardly or downwardly when subjected to forces resulting from differential expansion in vertical planes between the outer structure and the beams and columns, shelves projecting from the beams, shelf tile mounted on the shelves and arranged in courses, each tile having a recess for receiving the shelf, superposed courses of intermediate tiles, means for tying the intermediate tiles to the columns, refractory bricks interposed between the courses of tiles, said bricks and intermediate tiles being supported by the shelf tiles, means on the shelf tiles for hold-

ing the bricks spaced from the columns, and spacing elements on the tying means and between the columns and intermediate tiles.

6. A furnace wall construction including retainer columns, shelf beams connecting the same, shelves projecting from the beams, shelf tile mounted on the shelves and arranged in courses, each tile having a recess for receiving the shelf, superposed courses of intermediate tiles, means for tying the intermediate tiles to the columns, refractory bricks interposed between the courses of tiles, said bricks and intermediate tiles being supported by the shelf tiles, outer columns, and connections between the outer columns and the shelf beams for transmitting an upward force to the outer columns from the load on the shelves.

7. A furnace wall construction including a retainer column, a tile supporting shelf connected to the column, an outer column, and a filler connecting the retainer and outer columns.

8. A furnace wall construction including a retainer column, a tile supporting shelf connected to the column, an outer column, and a filler connecting the retainer and outer columns, said filler being proportioned to flex upwardly or downwardly to compensate for relative up and down movement of the columns due to expansion or contraction.

9. A furnace wall construction including an outer wall, outer columns combined therewith, means on the outer wall and columns for supporting a top structure, a top structure on said means, retainer columns tied to the outer columns, superposed shelves supported by the retainer columns, and shelf tiles mounted on the shelves and having recesses in which the shelves are seated, said recesses being proportioned to permit lateral adjustment of the tiles relative to the shelves.

10. A furnace wall construction including an outer wall, outer columns combined therewith, means on the outer wall and columns for supporting a top structure, a top structure on said means, retainer columns tied to the outer columns, superposed shelves supported by the retainer columns, shelf tiles mounted on the shelves and having recesses in which the shelves are seated, said recesses being proportioned to permit lateral adjustment of the tiles relative to the shelves, refractory bricks supported by the tiles, means on the tiles for holding the bricks spaced from the columns, intermediate tiles supported on the bricks, and means seated in the tiles and engaging the retainer columns for holding the intermediate tiles spaced from said columns.

11. A furnace wall construction including an outer wall, outer columns combined therewith, means on the outer wall and columns for supporting a top structure, a top structure on said means, retainer columns tied to the outer columns, superposed shelves supported by the retainer columns, shelf tiles mounted on the shelves and having recesses in which the shelves are seated, said recesses being proportioned to permit lateral adjustment of the tiles relative to the shelves, refractory bricks supported by the tiles, means on the tiles for holding the bricks spaced from the columns, intermediate tiles supported on the bricks, and means seated in the tiles and engaging the retainer columns for holding the intermediate tiles spaced from said columns, said tiles and bricks being supported and removable independently of the top structure.

12. A furnace wall construction including an outer wall, outer columns combined therewith, 75

means on the outer wall and columns for supporting a top structure, a top structure on said means, retainer columns tied to the outer columns, superposed shelves supported by the retainer columns, shelf tiles mounted on the shelves and having recesses in which the shelves are seated, said recesses being proportioned to permit lateral adjustment of the tiles relative to the shelves, refractory bricks supported by the tiles, means on the tiles for holding the bricks spaced from the columns, intermediate tiles supported on the bricks, and means seated in the tiles and engaging the retainer columns for holding the intermediate tiles spaced from said columns, said intermediate tiles being movable laterally relative to their holding means to compensate for expansion and size inaccuracies.

13. A furnace wall construction including an outer wall, outer columns combined therewith, means on the outer wall and columns for sup-

porting a top structure, a top structure on said means, retainer columns tied to the outer columns, superposed shelves supported by the retainer columns, shelf tiles mounted on the shelves and having recesses in which the shelves are seated, refractory bricks supported by the tiles, means on the tiles for holding the bricks spaced from the columns, intermediate tiles supported on the bricks, and means seated in the tiles and engaging the retainer columns for holding the intermediate tiles spaced from said columns, there being recesses in the intermediate tiles for receiving said holding means, the recesses in the shelf tiles and intermediate tiles being proportioned to permit lateral adjustment or movement of the tiles relative to the parts engaged thereby to compensate for expansion and contraction and for size inaccuracies.

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