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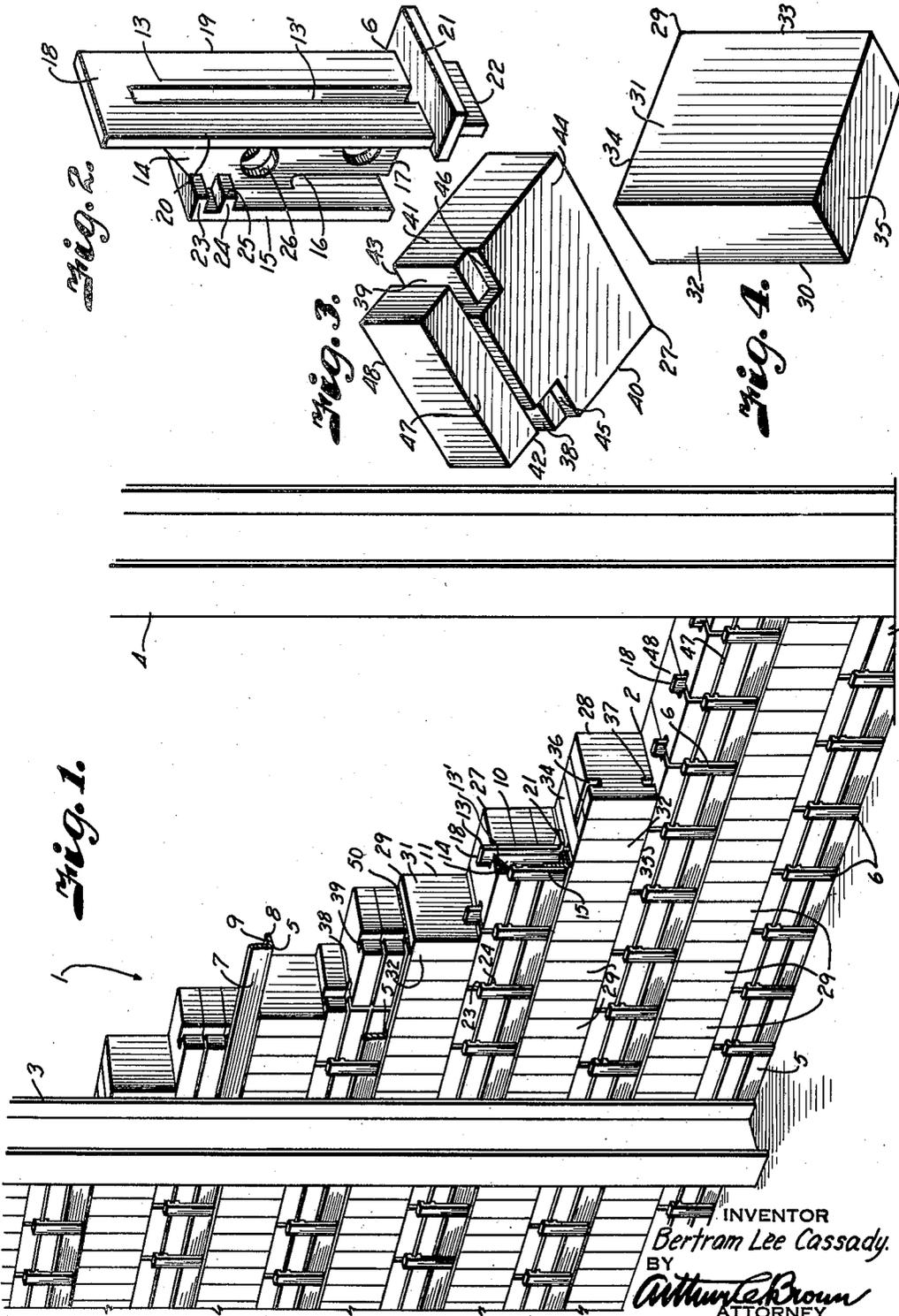
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FURNACE WALL OR SIMILAR STRUCTURE

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## FURNACE WALL OR SIMILAR STRUCTURE

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This invention relates to a wall structure particularly composed of juxtaposed tiles such as used in forming the heat retaining surfaces of fire-boxes and other refractory or insulating type walls.

Tiles of this character, particularly those used for refractory purposes, are subjected to such severe operating conditions that they spall away and leave pockets which, unless repaired, rapidly increase in size through further spalling and erosion brought about by increased turbulence of the gases playing in the pockets and by slag which collects upon and runs down the refractory surfaces. Since it is usually necessary to rebuild the walls entirely or at least renew large sections in replacing deteriorated refractories, the walls are left in operation as long as possible and no attempt made to repair relatively small sections. It is desirable, however, for efficient operation that the walls be smooth and free of spalled portions and pockets which interfere with movement of the gases and result in erosion as above noted.

I have, therefore, provided a tile and wall construction wherein any deteriorated section may be readily repaired or replacement effected without disturbing adjacent sections.

Other objects of the invention are to provide a brick or refractory tile of one size and shape for use throughout the construction of a single wall thickness; to provide means for securely and releasably anchoring selected refractories and to retain such refractories in anchored position by similarly shaped key tiles so as to provide a wall of solid and safe construction; to provide a wall construction composed of alternate courses of flat and edge laid tile with certain of the edge tiles being removable to permit release of adjacent tiles; to provide shelf-like supports for the respective courses whereby each course is supported from crushing loads of the upper courses; and to provide an improved anchorage for tiles.

It is a further object of the invention to provide tile connecting plates or inserts cooperating with the tile anchors for preventing parting of the tiles with respect to the anchors.

In accomplishing these and other objects of the invention, as hereinafter pointed out, I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of a portion of a furnace wall embodying the features of the present invention.

Fig. 2 is a detail perspective view of one of the tile anchors.

Fig. 3 is a perspective view of one of the horizontally positioned anchor engaging tiles.

Fig. 4 is a similar view of a key tile.

Fig. 5 is an enlarged vertical section through a portion of assembled wall.

Fig. 6 is a detail horizontal section through the wall on the line 6-6 of Fig. 5.

Fig. 7 is a partial elevational view of a modified form of wall construction.

Fig. 8 is a vertical section through the form of wall illustrated in Fig. 7, and taken on the line 8-8.

Fig. 9 is a horizontal section on the line 9-9 of Fig. 7.

Fig. 10 is a perspective view of one of the plates for connectingly retaining selected tiles to prevent spreading thereof.

Referring more in detail to the drawings:

1 designates, for example, a fire-box of a furnace such as may be employed in firing large boilers used in commercial power plants and which includes walls 2 that consist of juxtaposed refractory tiles backingly supported by a structural framework. The structural frame usually consists of vertical columns such as I-beams 3 and 4 to which are secured vertically spaced horizontal members 5 on which courses of the tiles are supported and secured by anchors 6. In the illustrated instance the members 5 are composed of angle-irons having one flange 7 attached to the columns and their other flanges 8 projecting inwardly to form shelf-like supports 9, the angles 5 being spaced according to height of the tile courses 10 and 11 which are imposed therebetween. Fixed to the flanges 7, at spaced points along the length of the respective angles, are the tile anchors 6, one of which is individually illustrated in Fig. 2. Each anchor 6 includes a flat, plate-like head portion 13 connected by spaced web portions 14 with a similar but shorter plate portion 15. The lower ends of the respective portions terminate in substantially the same horizontal plane and the webs 14 have slots 16 opening from the lower ends thereof adjacent the plate portion 15 to accommodate the flanges 7 when the plate portions 15 are hooked thereover to seat the lower edges 17 of the webs on the shelf-like ledges formed by the inwardly extending flanges 8. The upper ends of the plate portions 13 extend above the web portions 14 to form tile engaging portions 18 for selected tiles carried in the courses 11 and the side edges of the plate portions 13 form lateral wings 19 and

20 to be engaged by the tiles in the courses 10, as later described. The part of the plate portion 13 intermediate the webs is slotted as at 13'.

Formed on the lower ends of the plate portions 13 are shelf-like projections 21 adapted to support the engaging portions of the tiles in the courses 10, as later described. Extending downwardly from the shelf-like projections in the plane of the plate portions 13 are tongues 22 adapted to engage selected tiles in a lower course 11, the tongues 22 being of narrower width than the plate portions 13 corresponding to the thickness of the tiles in the courses 11, as clearly shown in Fig. 2. The relative widths of the tongue 22 and plate portion 13 may vary depending upon the tile thickness and the relationship of the thickness to the width of the tiles. To illustrate, if the thickness of the tile is one-half the width, the tongue 22 must be narrower than the tile thickness. If the tile thickness is one-third the tile width and the vertical brackets shown in Fig. 2 are located directly above one another, the tongue on every other bracket may be wide enough to engage three tiles. On this type construction only one key tile is used.

In order to provide a stop abutment for the upper tiles in the courses 10 and to further strengthen the assembly, the upper end of the plate portion 15 is provided on the respective sides of the webs 14 with inwardly extending spaced lugs 23 and 24 having faces 25 registering with the inner faces of the flanges 7. The web portions of the anchors may be provided with openings 26. The anchors thus described are spaced along the angle members 5 in accordance with the width of the tiles, and they may be welded or otherwise secured thereto.

The horizontally arranged tiles 27 in the courses 10 are of the same general size and shape as the tiles 28 in the courses 11, however, selected tiles 29 in the courses 11 serve as key tiles and are readily removable from the wall structure in that they are not engaged with the anchoring brackets.

The key tiles 29 are best illustrated in Fig. 4 and comprise rectangular blocks having flat side faces 30-31, inner and outer edge faces 32-33, and upper and lower bed edges 34 and 35. The anchor engaged tiles 28 of the courses 11 are of the same size but the upper and lower bed edges thereof are provided with transverse notches 36 and 37 adapted to receive respectively the upper ends 18 of the plate portions 13 and the tongues 22 as later described.

The individual tiles 27 in the courses 10 are of the same general dimensions as the tiles just described, and have vertical notches 38 and 39 in the side faces 40 and 41 thereof to receive the wings 19 and 20 of the respective anchors. The side faces 40 and 41 on the outer ends of these tiles are inset as at 42 and 43 to accommodate the web portions 14 of the brackets. Since the lower bed faces 44 of these tiles must be set close to the upper edge faces 34 of the tiles in the courses 11 when the tiles 27 are supported on the shelf portions 21 of the anchors, the lower bed faces are provided adjacent the notches 38 and 39 with recesses 45 and 46 to accommodate the ends of the shelf-like projections 21 on the anchors. Likewise the outer ends of the tiles have inset faces 47 to accommodate the thickness of the flanges 8 as shown in Figs. 3 and 5. The upper bed faces 48 of these tiles, however, extend in a continuous plane as best shown in Fig. 1.

To further strengthen the assembly, a metal

bar, strap, or the equivalent, as indicated at 49 may be placed between and engaged with the anchors at points between one or more courses of flat tile so that they help to keep the bottom flat set tile of one layer from bearing down on the under tile at the hot face of the wall.

In constructing a furnace of elements as above described, the framework including the columns 4 and angle members 5 is erected with the angle members spaced to accommodate the courses 10 and 11. The anchors 6, as shown in Fig. 2, are then hooked over the flanges 7 and properly spaced thereon. The bottom tiles 27 composing the lower course 10 are then placed in juxtaposition so that the notches 38 and 39 engage the wings 19 and 20 of the adjacent brackets. A second layer of tiles 27 is similarly applied to the brackets followed by a third course. The bars or straps 49 may be placed between the layers or courses during the building thereof. When the last layer is applied, the ends 18 of the anchors project above the course 10. Tiles 28 are then placed on edge with the notches 37 thereof engaging over the projecting ends 18, and the notches 36 engaging the tongues 22 of the next upper anchors. Placement of these tiles may be effected by sliding them laterally into engagement with the anchors. The intermediate or key tiles 29, in the present instance two in number, are inserted between the anchor engaging tiles to complete the next upper course 11. The courses are thus alternated until the wall has been built to the required height. Suitable expansion joints may be provided between the upper ends of the tiles in the courses 11 and the lower tiles in the courses 10 by interposing sheets of gasket-like material 50.

When the wall is thus assembled, the tiles are rigidly supported and retained in their proper position. Any of the tiles which deteriorate after operation of the furnace are removed without disturbing adjacent sections of the fire-box. Removal of the deteriorated tiles is readily effected by removing the nearest key tiles 29 in the course 11 and sliding the adjacent anchor engaging tiles 28 laterally into the space originally occupied by the key tiles 29 until the notches thereof clear the projecting portions of the anchors. These tiles may be readily withdrawn and replaced with new tiles by reversing the order of removal described in removal of the damaged tile. Should the adjacent tiles in the courses 10 have been deteriorated, a sufficient number of tiles in the courses 11 are removed, whereupon the tiles 27 are readily lifted from engagement with their anchors and replaced with new tiles.

The modified form of invention shown in Fig. 7 includes angle brackets 54 which are of similar design but of greater length and arranged so that the ends thereof interlock the respective courses as clearly shown by the dotted lines. The horizontal tiles 55 in this form are similar to the horizontal tiles in the preferred form but they are only half width and provided with notches 56 in one side edge only so that two tiles are required in closing the spaces between the respective anchors. The edge tiles 57 engaging the ends of the anchor brackets are two in number and arranged on edge similar to the tiles in the courses 11 in the preferred form. The key tiles 58 are of approximately the same dimensions as the horizontal tiles and are arranged between the edge tiles 57 and adjacent horizontal tiles to retain the anchored tiles in engagement with the angle brackets. In case a repair is required in a section com-

posed of horizontal tiles, the key tiles 58 are removed in the manner of the key tiles of the preferred form. The adjacent horizontal tiles may then be readily removed by shifting them laterally into the space previously occupied by the key tiles until the notches thereof clear the wings of the anchors. The edge tiles 57 may also be shifted from engagement with the anchors upon removal of the key tiles.

In order to assure against parting of the horizontal tiles that are engaged with the anchors, flat metal plates 59 having openings 60 may be passed over the ends of the brackets between selected tiles and secured by double pointed nails 61. If desired these points may be a part of the plate. While these plates keep the tiles from parting in a horizontal plane at the anchors, they do not anchor the tile in the wall as this is accomplished by the notched engagement of the tiles with the anchors.

While I have particularly referred to refractories and refractory tiles, it is obvious that the invention may include tiles made of insulating or other material according to the purpose for which they are to be used.

While I have shown and described the horizontal members 5 as angle-irons, it is obvious that they may be T-bars, Z-bars, I-beams, channels, or other structural shapes capable of forming a support for the anchors. It is also obvious that the shelves on the anchors may be made continuous to serve the purpose of the continuous flange of the horizontal members 5.

I have illustrated tiles with plane faces, but it is obvious that one or more faces of the tiles may be shiplapped, tongue and grooved, or otherwise keyed together without departing from the spirit of the invention.

From the foregoing it is obvious that I have provided a wall structure wherein sections of tile may be readily removed without disturbing adjacent sections so that it is not necessary to rebuild the entire wall or even large sections thereof when small repairs are required. It is also obvious that I have provided a wall wherein the tiles are securely anchored to provide a safe and rigid construction.

What I claim and desire to secure by Letters Patent is:

1. In a structure of the character described, a supporting frame, anchors carried by the supporting frame and having lateral wings spaced inwardly from said supporting frame, spaced courses of superimposed tiles having side portions engaging said lateral wings of the anchors, and key tiles between the spaces courses of anchored tiles for retaining engagement of the anchored tiles with said wings.

2. A structure of the character described including a supporting frame, tile anchors carried by said frame having lateral wings spaced inwardly of the supporting frame, spaced courses of superimposed horizontally arranged tiles having side portions engaged with said wings, courses of vertically arranged tiles between said spaced courses, selected vertically arranged tiles being engaged with said anchors, and others of said vertically arranged tiles forming key tiles for retaining said anchor engaging tiles.

3. In a structure of the character described, vertically spaced horizontal supports, anchors secured to said horizontal supports and having lateral wings, horizontally arranged tiles carried on said supports and having notches in sides thereof engaging the wings of said anchors, and ver-

tically arranged tiles superimposed on the horizontally arranged tiles, with selected vertical tiles having notches engaging the ends of said wings.

4. In a structure of the character described, vertically spaced horizontal supports, anchors secured to said horizontal supports and having lateral wings, horizontally arranged tiles carried on said supports and having notches in sides thereof engaging the anchors, said anchors having end portions projecting above and below said horizontally arranged tiles, and vertically arranged tiles superimposed on the horizontally arranged tiles with selected vertical tiles having notches engaging said end portions of the anchors.

5. In a structure of the character described, vertically spaced horizontal supports, anchors carried by said supports having lateral wings extending vertically with respect to said supports and having tile engaging portions at upper and lower ends of said wings, horizontally arranged tiles having side notches engaging said wings, and vertically arranged tiles having edge notches engaging the ends of said anchors.

6. In a structure of the character described, vertically spaced horizontal supports, vertically arranged anchors carried transversely on said supports having laterally extending tile engaging wings and tile engaging portions at the ends of said wings, horizontally arranged tiles having notches engaging said wings, vertically arranged tiles having notches engaging the ends of said anchors, and plate-like inserts on said anchors and having the sides thereof secured between selected laterally adjacent tiles for preventing parting of the tiles with respect to said anchors.

7. In a structure of the character described, a horizontal supporting member having a laterally extending ledge, anchors secured to said supporting member and having plate portions and projecting shelf portions at the lower ends of said plate portions, and tiles having notched side portions engaging edges of the plate portions and having recesses for said shelf projections.

8. In a structure of the character described, horizontal supporting members, anchors secured to said supporting members and having plate portions and projecting shelf-like portions, and tiles having notched portions engaging said plate portions and adapted to be carried on said shelf-like portions.

9. In a structure of the character described, a horizontal supporting member, anchors secured to said supporting member having plate portions and projecting shelf portions, courses of tiles having notched portions engaging edges of the plate portions and adapted for support on said shelf portions, and tie means between selected courses and engaging said anchors.

10. In a furnace structure of the character described, a horizontal supporting member having a lateral edge, anchors secured to said supporting member and having plate portions, courses of tiles having notched portions engaging edges of the plate portions, and means on said anchors engaging between selected courses of tiles for effecting support of ends of the tiles from the inner surface of the furnace.

11. In a structure of the character described including vertically spaced horizontal supporting members, anchors carried by said members and spaced apart distances corresponding to the width of tile to be supported thereby, said anchors having laterally projecting wing portions and a shelf projecting inwardly from said wing portions,

superimposed tiles each having notched side edges respectively engaging the lateral wing portions of adjacent anchors with the lowermost tiles resting directly on said shelf whereby the tiles are cantilevered on said shelf and retained by said wing portions, and key tiles filling the spaces between said courses of anchored tiles.

12. In a structure of the character described including vertically spaced horizontal supporting members, anchors carried by said members and spaced apart distances corresponding to the width of tile to be supported thereby, said anchors having laterally projecting wing portions and a shelf projecting inwardly from said wing portions, superimposed tiles each having notched side edges respectively engaging the lateral wing portions of adjacent anchors with the lowermost tiles resting directly on said shelf whereby the tiles are cantilevered on said shelf and retained by said wing portions, and key tiles filling the spaces between said courses of anchored tiles, said anchors having upper and lower portions projecting above the uppermost tile in each anchored course and below said shelf for engaging notched edges of selected key tiles.

13. A furnace wall supporting tile comprising a rectangular body corresponding in length to the full thickness of a furnace wall and having notches in opposite side edges near the end thereof at the outer face of the wall, and recesses in a bed face thereof extending from said notches toward the end of the body at the inner face of the wall for accommodating the shelf portions of anchor members whereby the tile is attached to a frame and supported upon said shelf portions.

14. A furnace wall supporting tile comprising a rectangular body corresponding in length to the full thickness of a furnace wall and having a notch in a side edge near the end thereof at the outer face of the wall, and a recess in a bed face thereof and extending from said notch toward the end of the body at the inner face of the wall for accommodating a shelf portion of an anchor member with which the notch portion of the tile is adapted to engage and whereby the tile is adapted to be attached to a frame and supported on said shelf portion.

15. In a structure of the character described, the combination of a supporting frame, tile anchors carried by said frame having lateral wings spaced inwardly of the supporting frame and horizontally arranged shelf portions below said wings, spaced courses of superimposed horizontally arranged tiles including juxtaposed tiles having rectangular bodies corresponding in length to the full thickness of said courses, pairs of said juxtaposed tiles having notches in opposite side edges near the end thereof at the outer face of the courses for receiving said lateral wings and having recesses in bed faces thereof extending from said notches toward the end at the inner face of the courses for accommodating the shelf portions of the anchors, and courses of vertically arranged tiles between said spaced courses, selected vertically arranged tiles being engaged with said anchors and other of said vertically arranged tiles forming key tiles for retaining the anchor engaging tiles.

16. In a structure of the character described, the combination of a supporting frame, tile anchors carrier by said frame having lateral wings spaced apart to form vertical slots and horizontally arranged shelf portions below said wings, spaced courses of superimposed horizontally arranged tiles including pairs of juxtaposed tiles having rectangular bodies corresponding in length to the full thickness of said courses, pairs of said juxtaposed tiles having notches in facing side edges near the end thereof at the outer face of the courses for receiving said lateral wings whereby the joint between said pairs of tiles registers with the vertical slots, said pairs of tiles having recesses in bed faces extending from said notches toward the inner face of the courses for accommodating the shelf portions of the anchors, and courses of vertically arranged tiles between said spaced courses, selected vertically arranged tiles being engaged with said anchors and other of said vertically arranged tiles forming key tiles for retaining the anchor engaging tiles.

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