Jan. 17, 1939. C. S. REED ET AL 2,144,597

PANEL WALL CONSTRUCTION

Filed May 21, 1935 3 Sheets-Sheet 1

Fig. 1

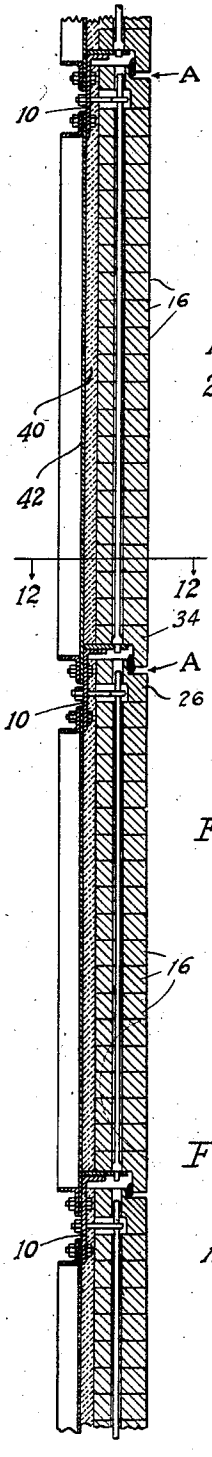


Fig. 2

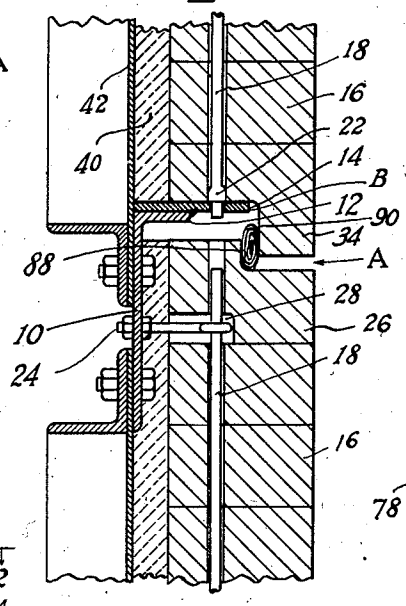


Fig. 6

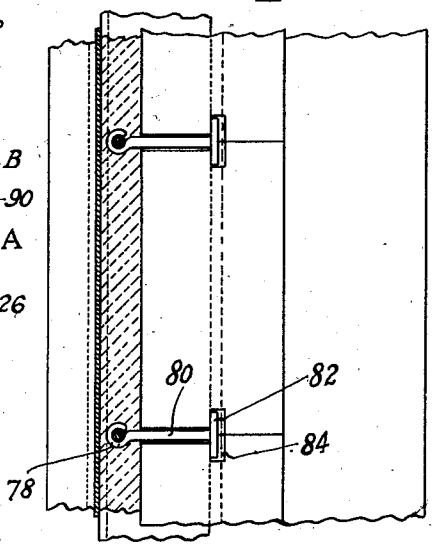


Fig. 4

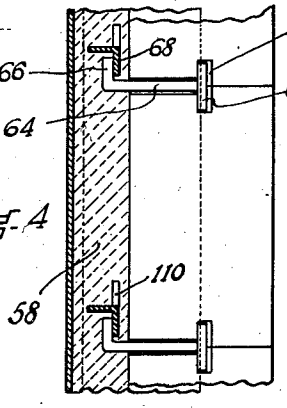


Fig. 5

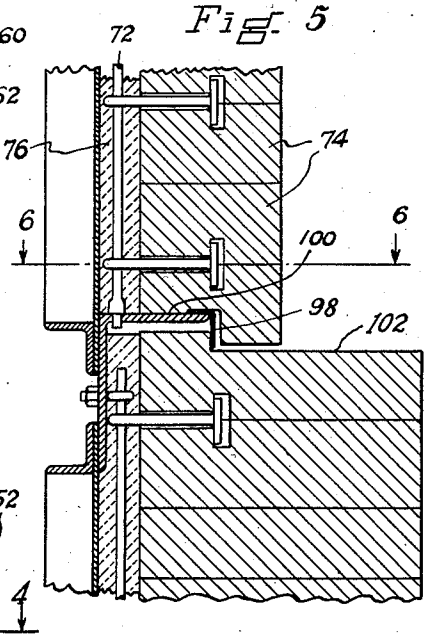
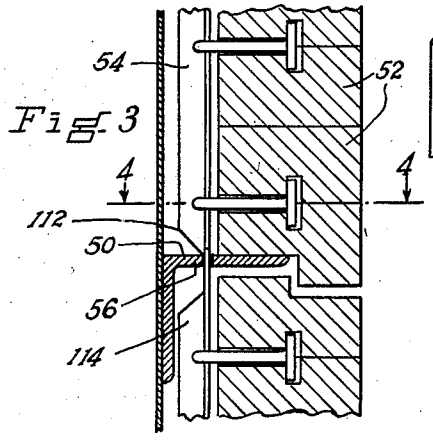


Fig. 3



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PANEL WALL CONSTRUCTION

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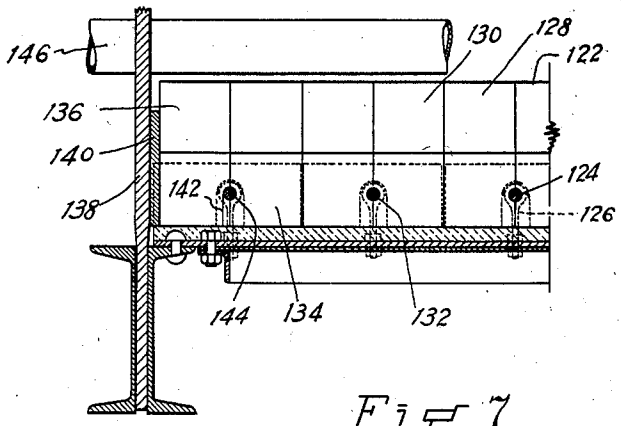


Fig. 9

Fig. 7

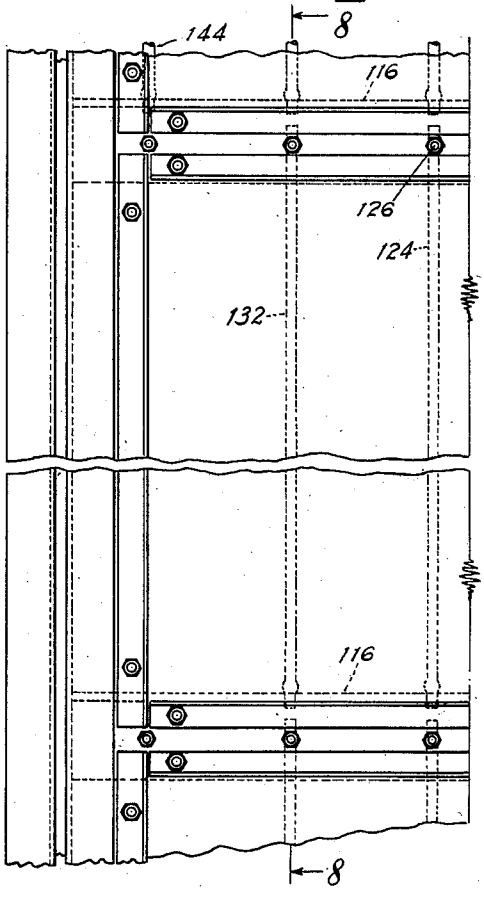
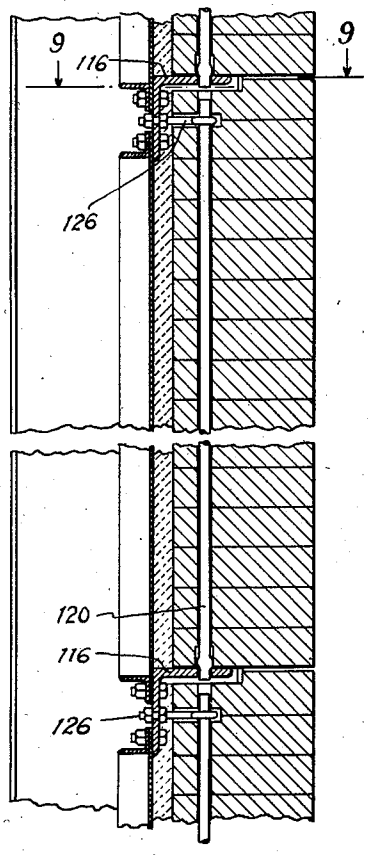


Fig. 8



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PANEL WALL CONSTRUCTION

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Fig. 10

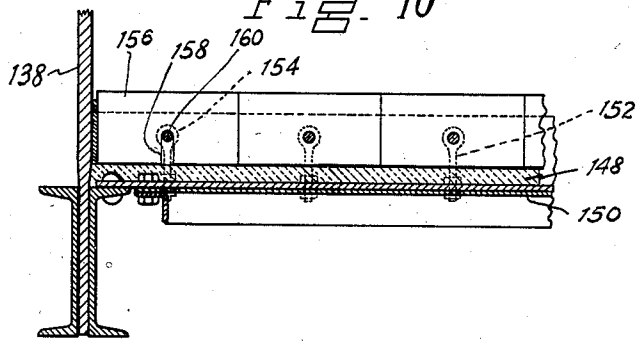


Fig. 11

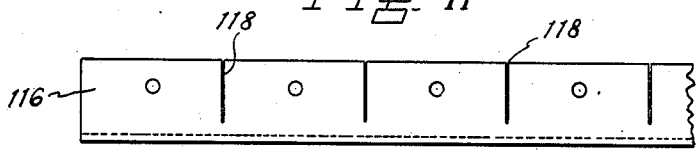
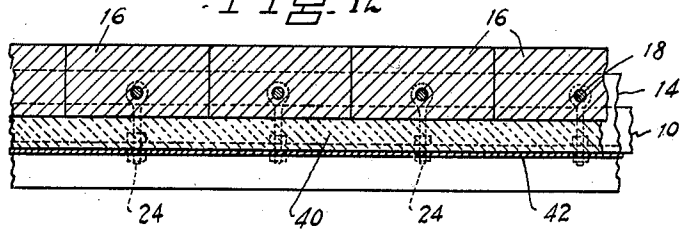


Fig. 12



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UNITED STATES PATENT OFFICE

2,144,597

PANEL WALL CONSTRUCTION

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Application May 21, 1935, Serial No. 22,544

15 Claims. (Cl. 72—101)

This invention relates to furnace construction and it is exemplified herein by what is termed a panel wall construction.

An object of the invention is to provide a furnace structure in which the refractory elements of individual sections may be readily replaced or repaired without interfering with the elements of other similar sections.

Another object of the invention is to provide a wall so arranged that injuries thereto may be conveniently and quickly repaired, particularly without disturbing or injuring portions of the wall which are not in need of repairs.

A further object of the invention is to provide a wall which can be quickly and conveniently assembled and which is inexpensive and dependable.

Another object of the invention is to provide a wall which reduces materially the loss of heat and leakage of air therethrough and which eliminates warping, bowing or other distortions due to the heat or fluid pressures thereon.

A further object of the invention is to provide a compact, light-weight, and easily handled furnace wall construction, which will be air-tight and which will permit the handling of the wall sections as units.

Other objects of the invention will appear as the accompanying description proceeds.

The invention will be described with reference to the accompanying drawings, in which:

Fig. 1 is a vertical section of a furnace wall in which light-weight insulating firebricks are used in a paneled, or sectional wall construction.

Fig. 2 is an enlarged sectional detail view taken through the juncture of two of the sections or panels of the Fig. 1 construction.

Fig. 3 is a detailed vertical sectional view of a modified panel wall construction.

Fig. 4 is a section taken on the line 4—4 of Fig. 3.

Fig. 5 is a detailed vertical section upon an enlarged scale of an additional embodiment of the invention.

Fig. 6 is a horizontal section of the Fig. 5 embodiment, taken on the line 6—6 of Fig. 5.

Fig. 7 is a partial elevation of a modified form of the wall construction.

Fig. 8 is a vertical section taken on the line 8—8 of Fig. 7.

Fig. 9 is a partial horizontal section taken on the section line 9—9 of Fig. 8.

Fig. 10 is a partial horizontal section of a wall construction adapted for use in oil stills.

Fig. 11 is a detail view of the horizontal flange of an angle for use in the wall constructions.

Fig. 12 is a view in the nature of a partial horizontal section of a wall similar to that shown in Fig. 10.

Referring to the structure illustrated in Figs. 1 and 2 of the drawings the horizontals, herein shown as angles 10, may be considered as the supports for the separate sections or panels of the wall construction. These horizontals may be secured to any suitable supporting framework, and are spaced as indicated in Fig. 1. They provide bottom supports for the separate sections of the wall. As more clearly indicated in Fig. 2 each angle 10 has a horizontal flange 12 to which may be secured by welding a plate 14 running lengthwise of the wall. This plate is preferably apertured at positions which are regularly spaced at distances corresponding to the width of the vertical rows of light-weight insulating firebrick 16. Light-weight brick aligning members 18 have their ends seated within the apertures in the plates 14. These members are upset as indicated at 22 in order that they may be held in position by the plates. The bricks 16 are strung upon the aligning members 18 and the upper ends of the rows of the brick and the aligning members are held in position with reference to the horizontals 10 by means herein shown as eye-bolts 24, which are threaded over the upper ends of the aligning members and are secured to the horizontals.

In building the furnace, separate vertical tiers of the bricks are assembled in alignment with the specially formed expansion joint bricks 26 at their tops and with the eye-bolts 24 arranged in the recesses 28 in these specially formed bricks. The aligning members are inserted through the openings in the bricks and each entire assemblage may then be temporarily held in this assembled position and inserted in an opening between successive horizontals 12. The bottom end of each assembly is brought to a position within the furnace beyond the horizontal so that the top ends of the rows will escape the lower ends of the upper horizontals. Then each aligning member is forced upwardly through the bricks until its lower end is even with or above the lower surface of the lower bricks which are shown in Fig. 2 as resting upon the plate 14. The lower end of each unit is still kept inwardly of the furnace edge of the plate, and the upper end of the unit is moved into operative position and the eye-bolt 24 guided through its opening in the angle 10. The distance between the point

A which is the lower inner edge of the expansion joint brick 34 and the point B which is the inner edge of the lower plate is sufficient to allow each unit to swing about the point A as a center and escape the inner edge of the plate at B with sufficient clearance to allow the bricks to become seated in operative position upon the ledge afforded by the plate 14. Thereafter the aligning member 18 drops into operative position with its lower ends extending through the aperture in the plate 14, as shown in Fig. 2. Each tier of brick is supported at its bottom by the ledge 14 and is held in position at its top by the tightening of the eye-bolts against the horizontal 10, the eye-bolts 13 preferably having the stops 15 thereon.

The separate panels or sections of the wall may be of any desired shape, preferably square or rectangular, and after a number of the vertical tiers of brick are brought to their operative positions as above described the insulating layer 40 and the sheet metal panel 42 may be secured in position to form an air-tight wall. The panel has a main sheet metal body portion and at its perimeter it is reinforced by flanges which may be provided by angle members arranged as a frame for the main body of the panel.

In a wall constructed in accord with the embodiment indicated in Figs. 3 and 4 of the drawings there are spaced and fixed angle horizontals 50 upon which light-weight insulating firebrick 52 are directly arranged and supported in horizontal and vertical rows. In this construction the upright anchor bars 54 are seated within openings in the horizontal flanges 56 of the beams and are preferably made in the form of angles as shown. They are also seated within the insulation layer 58, thereby being located at a greater distance from the furnace face of the wall and consequently having a greater protection from overheating.

In the Fig. 3 and Fig. 4 modifications the insulating firebrick 52 are preferably formed at their corners with recesses 60 which may be made in the form of saw-cuts. When the bricks are assembled four of these recesses cooperate to form one large recess which receives one of the heads 62 of the anchors 64, the other end of which is formed at a right angle as shown. This inner angle portion 66 is positioned rearwardly of the flange 68 of the anchor member 54 so as to hold the bricks in position. Thereafter the insulating refractory material 58 may be installed.

In the embodiment of the invention shown in Figs. 5 and 6 the upright anchor rods 72 are similarly located rearwardly of the bricks 74 and are thus protected against overheating. They are positioned intermediate the insulating layer 76, and take the form of round rods, in the preferred form.

In assembling the wall indicated in Figs. 5 and 6 the eyes 78 of anchors 80 are strung upon the rods 72. Opposite the eyes the anchors have heads 82 disposed within recesses 84 which correspond to the recesses in the bricks of the Figs. 3 and 4 modifications.

In each embodiment of the invention shown in the drawings expansion joints are provided for at the upper margins of the panels. In the Fig. 1 embodiment expansion joints are provided between the bricks 24 and 26. As shown particularly in Fig. 2 these bricks have parallel upright surfaces 88 and 90 between which there may be arranged a roll of fire resisting material to form a seal. As indicated in the Fig. 5 modification a layer of heat resisting material such as woven asbestos may be arranged as a curtain 98 hanging forwardly of the inner edges of the beams 100 and preferably contacting with the upper surface of the brick 102.

Referring again to the modification shown in Figs. 3 and 4 of the drawings it will be noted by observation of Fig. 3 that two anchor members 54 and 114 are shown. The lower one passes through an opening in the angle 50 which is nearer to the observer than the opening in that plate through which the upper member passes. In other words, vertically successive anchor members are offset by reason of offset openings in the plates 56.

The anchor bar members 54 are so formed at their ends that the latter are in the form of thin plates of such a thickness that they can be readily inserted in the slots 110 in the flanges 56 of the beams 50. As indicated at 112 in Fig. 4, the flanges of the anchor members 54 normal to the plane of the wall are cut away so as to provide these end extensions. Furthermore, the slots 110 are greater in length than the width of the ends of the anchor members 54 so as to facilitate the placing of the anchor members in position. Also the upper ends of the anchor members may have their flanges 114 cut away so as to provide longer plate-like ends at the tops of the anchor members. This permits each anchor member to have its upper end inserted in a slot 110 and the entire member to be moved upwardly to such an extent that its lower end can be swung into operative position over an aligned slot in the next lower beam. The anchor member can then be allowed to drop in position with its cut away flange contacting with the beam. Its upper end is long enough so that it still remains seated in one of the slots.

Fig. 11 shows the horizontal flange of an angle for use in the illustrative wall construction. When this flange 116 is formed with spaced slots or saw cuts 118 warping of the angle and consequent air infiltration around the casing is prevented. Such warping might be caused by unequal heating and expansion of the two legs of the angle if the illustrative construction were not used.

In the wall construction shown in Figs. 7, 8 and 9 the bricks are not strung upon the retaining rods 120 before the bricks are put in position upon the angle 116. The retaining rods are positioned between successive columns of the bricks and the bricks are formed with rod receiving notches as indicated in Fig. 9. In the construction of this wall, assuming that the brick column 122 is the first column at the right-hand side of the panel, it is placed in position upon the angle. Then the retaining rod 124 is placed in the notches of the bricks of the column 122 and its lower end is inserted through the opening in the angle at the bottom of the column. The eye-bolt 126 is then threaded through the vertical flange of the upper supporting angle. After the eye-bolt is rigidly secured to this angle the two brick columns 128 and 130 may be placed in operative position as indicated. The retaining rod 132 is next installed in the same manner as the rod 124, and these operations are repeated until the last two columns 134 and 136 of the brick in the particular panel under construction, are reached. These last two columns may be assembled in operative relation to the cooperating retaining rod and eye-bolt and then this entire assembly placed in wall forming position upon the supporting angle.

face of the wall contact wtih the lower beams, an inner wall including light-weight insulating firebrick arranged in tiers between successive beams, means for separately anchoring the tiers to the beams, an outer wall including metallic panels, and means for securing the panels to the beams.

8. In a panel wall furnace construction, an inner wall including independently supported vertical tiers of insulating firebrick, supports, means for securing the tiers to the supports, sheet metal panels, means for securing the panels to the supports, expansion joint constructions between the tiers of the vertically successive panels, the brick retainer means being readily detachable from the supports so that they are removable with the tiers as units and the construction being such that the panels and the tiers of firebrick can be independently removed and replaced without access thereto from the interior of the furnace.

9. In a furnace, a panel wall construction including horizontal beams in the form of angle members constituting a part of the furnace framework, upright brick anchoring rods secured between successive beams, upright tiers of light-weight insulating firebrick arranged on the furnace sides of the rods, an outer wall spaced from the inner wall and held in position by said beams, insulating material enclosing the rods and positioned between the inner and outer walls, and anchors seated in recesses in the firebrick and extending around the rods to hold the brick in wall forming position.

10. A furnace wall structure comprising, a metal supporting framework, blocks of refractory material having a density of the order of ½ to ¼ that of standard firebrick and a heat conductivity of from 25 to 40% of the heat conductivity of standard firebrick (at temperature ranges from 500° to 1100°), and means for supporting the blocks on the framework in independent groups each of which may be handled as a unit.

11. A furnace adapted for use at high temperatures, comprising a supporting wall structure of metal framework, said structure including vertically spaced horizontal members which define wall panels, an outer wall structure consisting of metal panels secured to said horizontal members, and blocks of heat insulating material carried by the framework and forming an inner wall of the furnace, said blocks having a substantially lower density and a greater porosity with substantially lower heat conductivity than that of standard firebrick or fireclay refractory, whereby the necessity of using standard refractory materials of high density as a lining for the furnace is obviated and whereby the refractory may be removed and replaced without access thereto from the interior of the furnace.

12. In a panel wall for furnaces, supports, bottom supported tiers of insulating firebrick resting on the supports, and bottom supported brick retaining rods threaded through the bricks and maintained in position by the supports, the tiers being separately removable by tilting their lower ends into the furnace after the rods are raised to free them from the supports.

13. In a furnace, vertically spaced horizontal supports, an inner wall including tile or brick arranged in upright columns between successive supports, upright anchor members detachably secured at their upper and lower ends to the supports and corresponding to the columns in number, an outer wall spaced from the inner wall and including panels terminating at the supports, and means for securing the panels to the supports, said supports comprising metallic members affording compression supports for the brick columns and having their inner marginal portions provided with spaced slots whereby the temperature gradient of those portions will not result in such excessive stresses as would cause warping of the supports.

14. In a furnace construction, an exterior wall structure including sheet metal encasement panels, an inner wall including superposed insulating firebrick arranged in independently movable groups extending across the wall area covered by the panel, and means including elements in the nature of hook bolts for bonding the inner and outer walls while permitting a limited range of relative movements of said walls, said elements extending transversely of the walls and having laterally bent outer ends which are movable relative to the panels.

15. A panel wall construction for furnaces comprising, an inner wall including insulating firebrick arranged in independent vertical columns and weighing from ½ to ⅙ the weight of conventional firebrick, vertically spaced framework supports defining boundaries of wall panels with the brick columns positioned between them, means including brick aligners fixed to successive supports for independently anchoring the separate brick columns, an outer wall including sheet metal panels, and means for detachably securing the panels to the supports, each separate brick column with its aligner constituting an assembly which may be moved or handled as an independent unit.

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When a packing joint is left between the column 136 and the end wall 138 the top brick of the column 136 can be formed with a retaining rod notch just as are the other bricks in the panel. In this case this brick is installed before the packing joint strip 140 is placed in the position shown.

In the event that no packing joint strip is provided, the top brick of the column 136 is provided with a cut away corner portion as indicated at 142 in Fig. 9. This cut away construction permits the top brick to be moved endwise into operative position past the retaining rod 144. The depth of the cut away portion from the edge of the brick is equivalent to one-half the width of the combined retaining rod and eye-bolt construction so that this top brick can be inserted by pushing it into the opening available for it. When the packing joint strip is not provided this brick may be cemented into place.

Figs. 9 and 10 both show the end wall 138 in the form of a tube sheet, and Fig. 9 shows a fluid heat exchange tube 146 mounted in the tube sheet in proximity to the furnace face of the wall.

The wall shown in Fig. 10 is what is sometimes referred to as a 6'' wall. In this case the bricks are mounted longitudinally so that they constitute a 4½'' refractory section of the wall, the remaining thickness of the wall being made up of the insulating material 148 and the panel 150. In the wall construction indicated in Figs. 10 and 12 the bricks of the separate columns are strung on their retaining rods before they are placed into operative position upon the supporting angles, and the assembled columns are then moved up into place. They are successively secured into position by allowing the retaining rods to drop through the openings in the horizontal flanges of the supporting angles and by securing the eye-bolts 152 to the vertical flanges of the angles.

Fig. 10 indicates a wall construction in which it will be assumed that the brick columns are placed in their operative positions, starting from the right-hand end of the panel shown. When the last brick column next to the tube sheet 138 is placed in position the top brick is not included in the column in order to provide for access to the eye-bolt 154. This must be manually brought into register with its opening in the vertical flange of the upper supporting angle and the eye-bolt then tightened in position. The top brick 156 is provided with a U-slot 158 so that the brick can be bodily moved into position past the retaining rod 160. It is then properly cemented into its operative position.

What is claimed is:

1. In a panel wall construction for furnaces; casing plates; tiers of light-weight insulating firebrick; a layer of thermal insulating material interposed relative to the plates and said tiers; brick anchoring means maintaining the bricks of said tiers in alignment; and wall supports to which the brick anchoring means are detachably connected so that the latter are readily detachable to permit the tiers to be removed from their wall forming positions; all of these elements being held together in a rigid and compact sectional wall unit.

2. In a panel wall furnace encasement construction; panel wall units in which outside metallic panels and separate tiers of light-weight insulating firebrick are secured together in a rigid compact structure with a layer of thermal insulating material between the panels and the tiers; a wall frame-work including spaced supports; firebrick aligning members detachably connected with said supports and holding a plurality of the tiers in their operative positions in the main units and tying the bricks of the tiers together so that they may be moved and handled as separate panel wall sub-units apart from the other elements of the main units.

3. In a furnace, vertically spaced supports defining wall panels, an inner wall including apertured tile or brick arranged in tiers between successive supports, upright anchor members fixed at their upper and lower ends to the supports and corresponding to the tiers in number, means for detachably securing the upper ends of said members to the supports, an outer wall spaced from the inner wall and including panels terminating at the supports, and means for securing the panels to the supports.

4. A panel wall construction for furnaces comprising, an inner wall including insulating firebrick arranged in tiers and weighing from ½ to ⅙ the weight of conventional firebrick, vertically spaced framework supports defining boundaries of wall panels with the tiers of brick positioned between them, means independently anchoring the separate tiers, an outer wall, an insulating layer in which said means are embedded, and means for detachably securing the outer wall to the supports.

5. In a furnace, vertically spaced horizontally extending beams presenting horizontal ledges, upright angle members seated in apertures in successive ledges, an inner wall including light-weight insulating firebrick arranged in tiers between the successive supports, anchors seated in recesses in the firebrick and having parts engaging the angle members to hold the brick in wall alignment, an outer wall including metallic panels interposed relative to successive beams, insulating material positioned between the inner and outer walls and enveloping the upright angle members and means for detachably securing the panels to the beams.

6. In a furnace, vertically spaced and horizontally extending beams presenting horizontal ledges, upright angle members seated in apertures in successive ledges and supported by the beams, said angle members each having one flange cut away more at the top than at the bottom so that the members can be seated between successive beams, an inner wall including light-weight insulating tile or firebrick arranged in tiers between the successive supports and maintained compression thereby, anchors having their inner ends seated in recesses formed in the firebrick at their corners and having parts engaging the angle members to hold the brick in wall alignment, an outer wall including metallic panels, and means for detachably securing the panels to the beams.

7. In a furnace, horizontally extending and vertically spaced beams constituting a part of the furnace framework and presenting horizontal ledges formed with slots extending therein lengthwise of the furnace wall, upright angle members having their flanges normal to the face of the furnace wall cut away for a distance sufficient to allow these members to be placed in position by inserting their lower ends through the slots in the beams at the tops of the panels and then allowing the members to drop with their inner ends extending through the slots in the lower beams until their flanges normal to the