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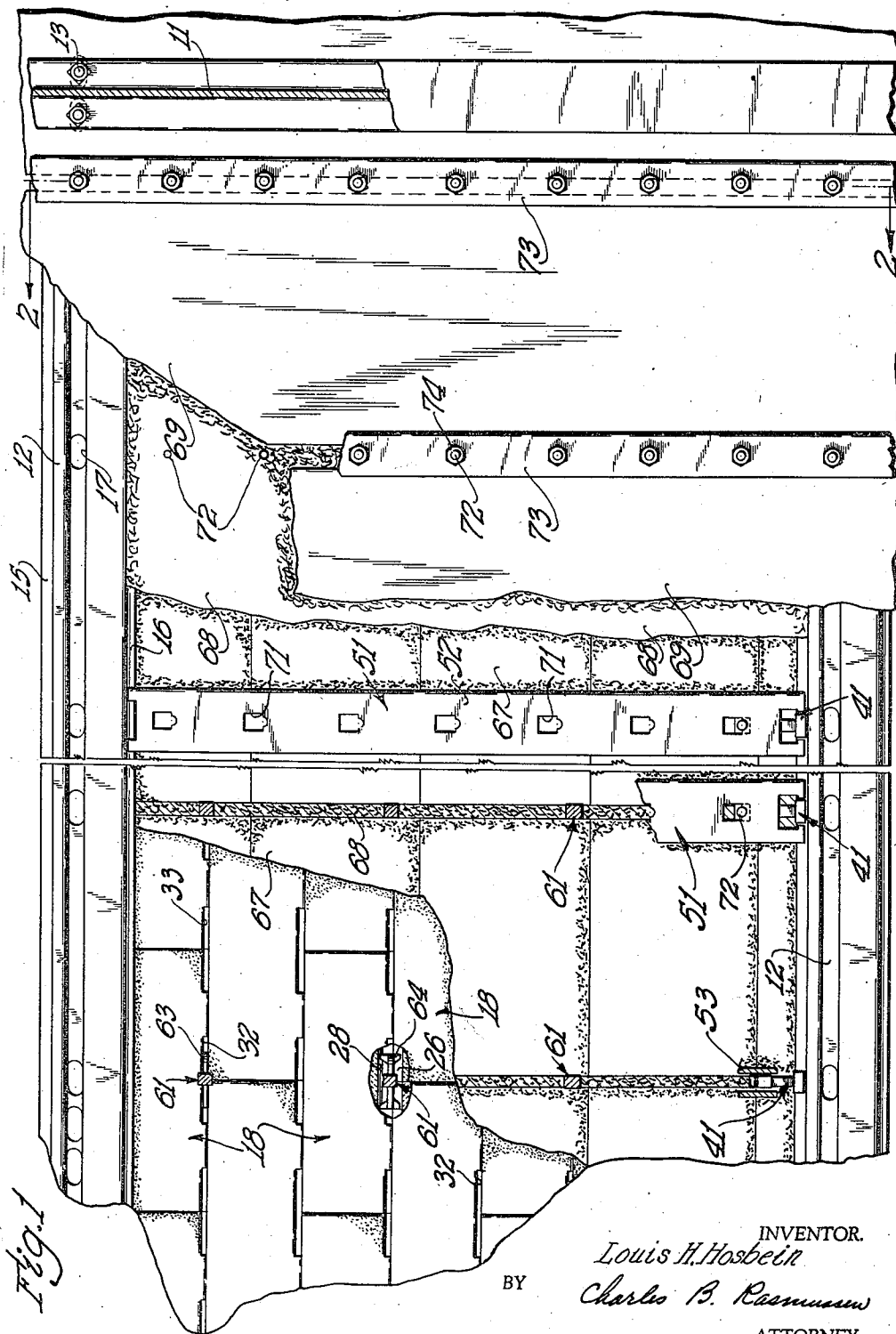
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FURNACE WALL CONSTRUCTION

Filed Oct. 18, 1939

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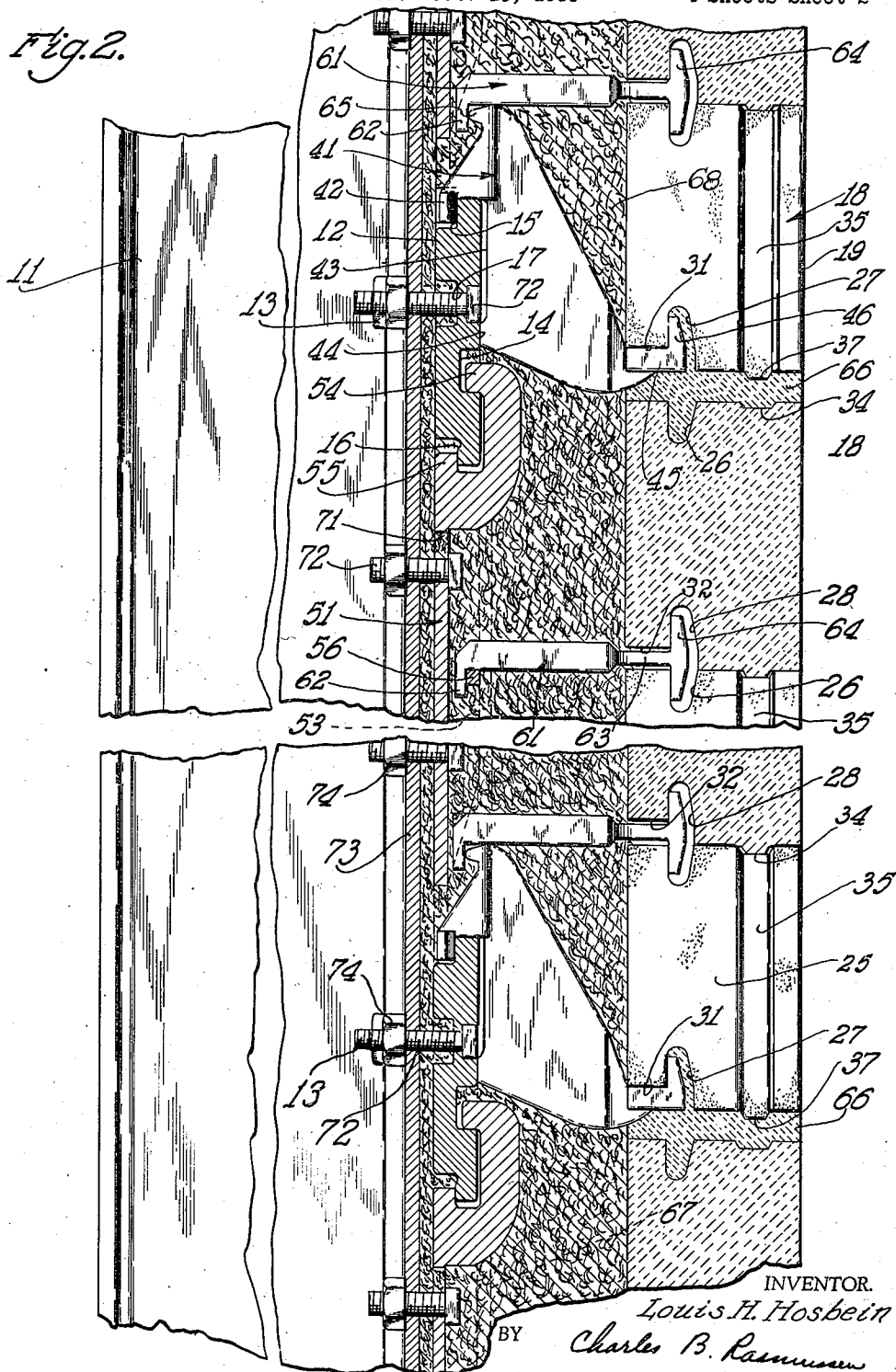
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Fig. 2.



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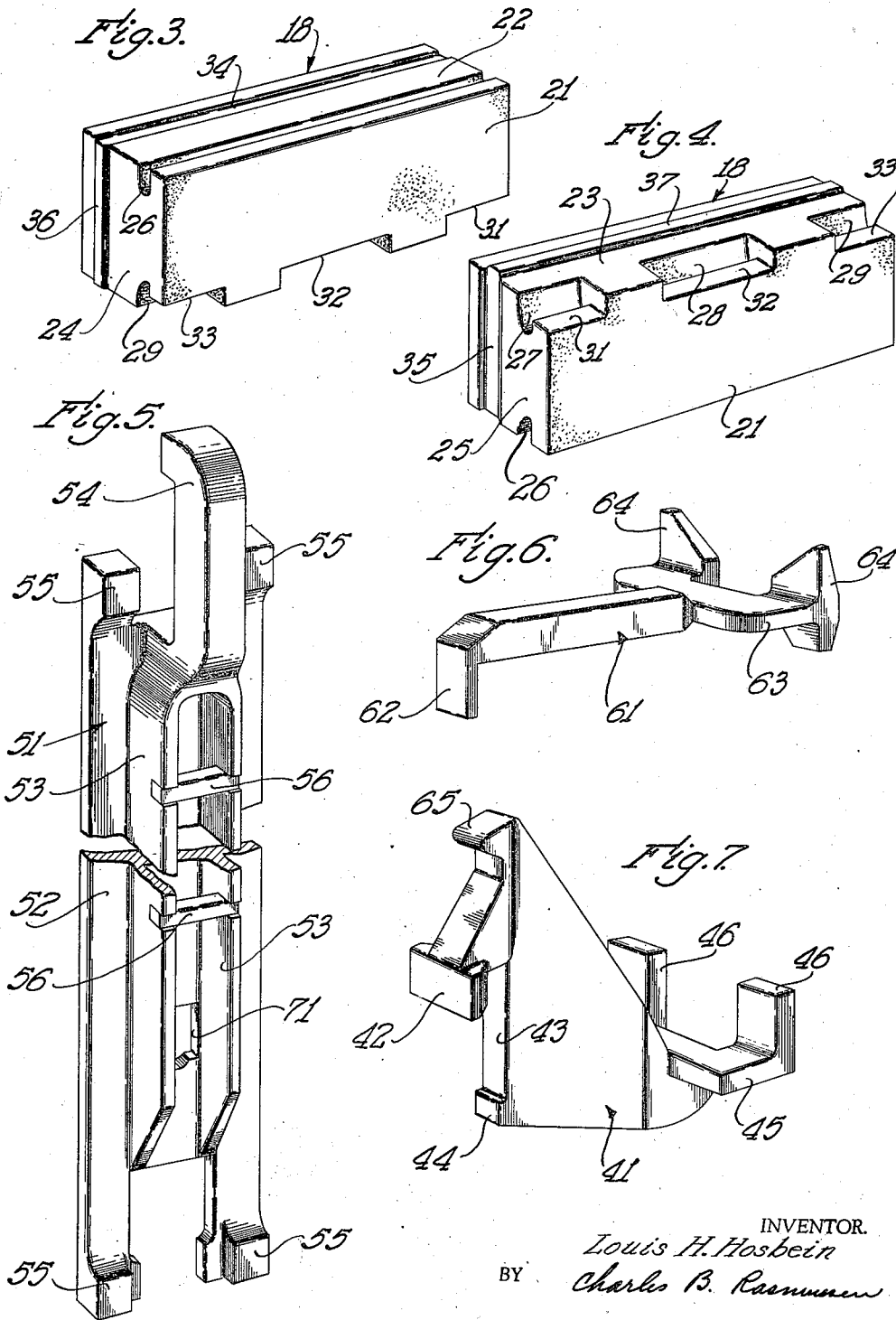
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FURNACE WALL CONSTRUCTION

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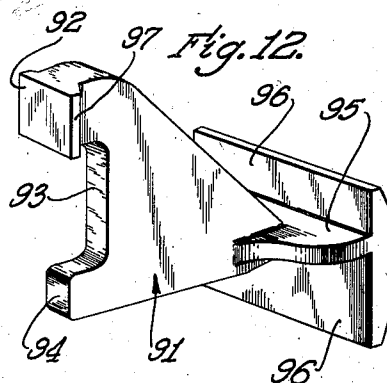
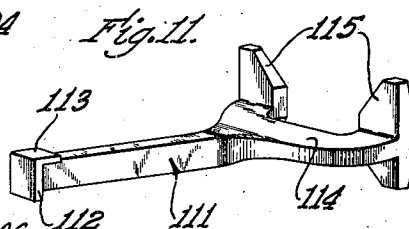
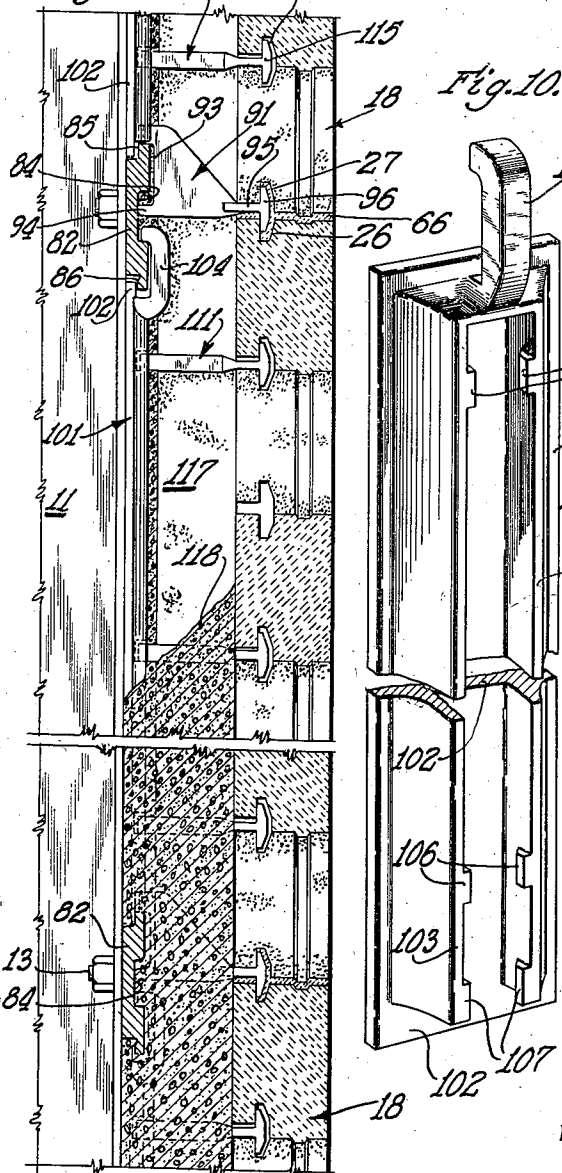
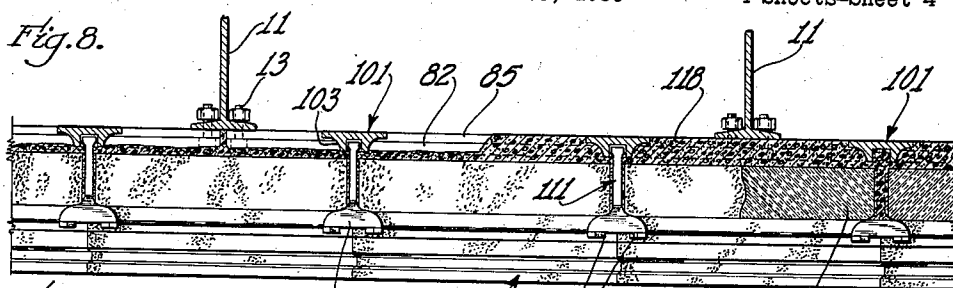
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FURNACE WALL CONSTRUCTION

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4 Sheets-Sheet 4



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FURNACE WALL CONSTRUCTION

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Application October 18, 1939, Serial No. 300,020

12 Claims. (Cl. 72-101)

This invention relates in general to furnace construction, and more particularly to improvements in sectionally supported walls. The instant application is a continuation in part of my co-pending application, Serial No. 269,401, filed April 22, 1939.

A principal object of the invention is the provision of a relatively thin wall for high-temperature furnaces which has extremely low heat transfer characteristics.

Another important object of the invention is the provision of a wall for high-temperature furnaces comprising relatively thin refractory members sectionally supported in staggered relationship to each other by metal members having minimum contact therewith.

A further important object of the invention is the provision of such a wall which includes a backing of plastic material substantially enclosing said metal supporting members and eliminating substantially all air spaces in the wall.

Another object of the invention is the provision of such a furnace wall that is relatively inexpensive, is adapted to be erected and repaired from the exterior of the furnace, and that may employ a simple, low cost, readily removable outer casing.

A further object of the invention is the provision of such a furnace wall which is so designed that the metal supporting structure, the refractories, and the insulation material may be separately and successively erected in the construction thereof.

Another important object of the invention is the provision of a relatively thin wall for high-temperature furnaces of simplified construction with an outer surface of plastic material having finish characteristics, thereby eliminating the need for a sheet metal outer finish casing.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

In the drawings,

Figure 1 is a rear elevational view of a furnace wall embodying the features of the invention with parts broken away and partly in section to show the interior construction thereof;

Figure 2 is a transverse, vertical section taken substantially on the line 2-2 of Fig. 1;

Figures 3 and 4 are perspective views of one of the refractories or tiles employed, taken from the top and bottom thereof, respectively;

Figure 5 is a perspective view of one of the auxiliary hanger members of Figs. 1 and 2;

Figure 6 is a perspective view of one of the horizontal retaining members of Figs. 1 and 2;

Figure 7 is a perspective view of one of the main refractory supporting hanger members of Figs. 1 and 2;

Figure 8 is a transverse, horizontal section through a modified construction of furnace wall embodying the features of the invention;

Figure 9 is a transverse, vertical sectional view of the wall of Fig. 8;

Figure 10 is a perspective view of a modified form of auxiliary hanger member employed in the wall of Figs. 8 and 9;

Figure 11 is a perspective view of one of the horizontal retaining members of the wall of Figs. 8 and 9; and

Fig. 12 is a perspective view of one of the modified main refractory supporting hanger members of Fig. 9.

Referring more particularly to Figs. 1 to 7 of the drawings, reference numeral 11 indicates a vertically disposed frame member, of which a plurality are provided in spaced relationship longitudinally from each other in the direction of the wall. A plurality of horizontally disposed frame or supporting members 12 are secured by means of bolts 13 to the vertical frame members 11 to provide a skeleton frame for the wall having any suitable or desired type of foundation therefor. The frame members 11 may be of any suitable shape, while the horizontal frame members 12 are provided with longitudinally extending recesses 14 in their inner surfaces (Fig. 2) and longitudinally extending, marginal recesses 15 and 16 along the upper and lower edges of their rear surfaces (Figs. 1 and 2). The recess or channel 14 is positioned a short distance below the horizontal center line of each of the frame members 12, and the latter are preferably provided with a plurality of elongated apertures 17 extending therethrough substantially on the center line thereof. The apertures 17 are spaced longitudinally of the members 12 for the purpose of accommodating the bolts 13 and for another purpose to be later more fully described.

The inner surface of the instant furnace wall (to the rear of Fig. 1 and to the right in Fig. 2) comprises a plurality of refractory tiles or bricks, indicated generally by reference numeral 18. Referring more particularly to Figs. 3 and 4, each of the bricks or tiles 18 is in the shape of a rectangular parallelogram having front and rear surfaces 19 and 21, respectively, top and bottom

surfaces 22 and 23, respectively, and right and left end surfaces 24 and 25, respectively. It will be understood that the refractory 18 is being viewed from the rear in Figs. 3 and 4. The top surface 22 is provided with a longitudinal groove 26 disposed adjacent the rear surface 21, and the lower surface 23 is provided with a similar groove which comprises three separated portions 27, 28 and 29. The grooves 27, 28 and 29 are in longitudinal alinement with each other and in vertical alinement with the groove 26. The rear surface 21 of the refractory is cut away at its lower edge at 31, 32 and 33 to provide access to the grooves 27, 28 and 29, respectively, from the rear of the brick. The upper surface 22 of the refractory 18 is also provided with a longitudinal groove 34 extending parallel to the groove 26 adjacent the front surface 19. The groove 34 is in vertical alinement with a groove 35 extending in communication therewith along the left hand end 25 of the tile. The grooves 34 and 35 are appreciably more shallow than the grooves 26 to 29. The right hand end 24 of the tile is provided with a flange 36 which is in vertical alinement with the grooves 34, 35 and extends outwardly from the end surface a distance substantially equal to the depth of the latter grooves. The bottom surface 23 is provided with a similar rib portion 37.

When the refractories 18 are laid in the manner shown in Figs. 1 and 2 to form the inner portion of the wall, the bricks of adjacent horizontally disposed rows are positioned in staggered relationship relative to each other, with the ribs or flanges 37 of one row of bricks engaging within the grooves 34 of the bricks of adjacent rows, and the ribs 36 and grooves 35 engaging with the respective grooves and ribs of the adjacent bricks of the same row. With this arrangement, the joints between the refractories 18 extending from the front to the rear thereof will be in broken lines instead of straight lines to prevent leakage transversely through the wall, and each of the separate tiles will aid in maintaining the ones adjacent thereto in proper alinement.

Means are provided for sectionally supporting the several refractories 18 and for facilitating the erection and removal and replacement thereof from the rear of the wall. Removably mounted upon the several horizontally disposed frame or supporting members 12 are a plurality of main refractory supporting hanger members, indicated generally by reference numeral 41. As will be seen in Figs. 2 and 7, each of the hanger members 41 comprises a main body portion which is disposed transversely of the wall and terminates at the rear adjacent the upper end thereof in a downwardly extending hook member 42. The rear edge of the hanger member 41 is cut away at 43 adjacent and below the hook 42, and terminates at its lower end in a rearwardly extending pad 44. With such configuration, the hanger member 41 is adapted to be removably mounted upon a horizontal frame member 12 with the hook 42 engaging within the upper channel or groove 15, the cut-away portion 43 providing clearance for the upper part of the frame member 12, and the pad 44 resting against the forward surface of the frame members. At its forward end, the hanger member 41 is provided with a forwardly extending flange 45 which terminates in upwardly extending, longitudinally spaced lugs 46. Each of the hanger members 41 is adapted to support a plurality of refractories 18,

eight in number for example, although engaging only the lowermost one of this group of refractories. Such engagement is had only between the cut-away portion 32 of the tile and the flange 45 of the hanger member, and between the lugs 46 and the groove 28 (Fig. 2), if the hanger 41 is positioned to engage the central part of the lowermost refractory 18. It is preferred, however, that the end portions of two adjacent tiles in the same row be engaged and supported by the hanger 41, as shown in the drawings. When the tiles are so laid, engagement is had only between the flange 45 of the hanger member 41 and the end cut-away portions 31, 33 of adjacent refractories, and between the lugs 46 and the end grooves 27, 29. The flange 45 thus functions to provide the necessary vertical support for the associated group of refractories 18, the weight of the latter being transmitted to the associated horizontal frame member 12 by the hook 42 and pad 44 of the hanger 41.

Means are provided for retaining the remaining refractories 18 of the group or section supported by the hanger 41 in proper vertical alinement to prevent inward bulging of the wall. An auxiliary hanger member, indicated generally by reference numeral 51, is provided for each section of refractories 18 supported by a hanger member 41. Each of the auxiliary hanger members 51 (Figs. 2 and 5) comprises an elongated channel member having a main body portion 52, a pair of outwardly extending, parallel flanges 53, and a hook member 54 extending upwardly therefrom and formed integrally therewith. The upper and lower ends of the body portion 52 terminate in transversely spaced, forwardly extending pads 55.

An auxiliary hanger member 51 is removably mounted upon a horizontal frame member 12 in vertical alinement with each of the main hanger members 41. The upper end of the hook member 54 of the auxiliary hanger 51 engages within the groove 14 in the forward surface of the horizontal frame member 12, with the upper pair of pads 55 being disposed within the lower marginal groove 16 in the rear surface of the frame member. The lower pair of pads 55 engages within the upper marginal groove 15 of the next lower horizontal frame member 12 and on either side of the hook 42 of the next lower main hanger member 41. A plurality of cross pieces 56 are disposed in suitable recesses provided in the flanges 53 of the auxiliary hanger member 51 and are rigidly secured thereto in any desired manner. The cross pieces 56 are vertically spaced from each other a distance equal to twice the height of the refractories 18.

A horizontally disposed retaining member, indicated generally by reference numeral 61, is adapted to be mounted upon each of the cross pieces 56. Each of the retaining members 61 (Figs. 2 and 6) terminates at its rear end in a downwardly extending flange portion 62 which engages behind the associated cross piece 56, the main body portion of the retaining member 61 extending between the flanges 53 of the auxiliary hanger member 51. The forward end of the retaining member 61 comprises a horizontally disposed shell 63 which terminates at its outer end in spaced, vertically disposed flanges 64 extending above and below the shelf 63. The retaining member 61 is of such length that the rear surfaces of the flanges 64 will engage the rear surfaces of the grooves 26 and 28 in the associated refractories 18, when properly mounted as shown in Fig. 2, to prevent forward bulging of the wall.

Since the upper flanges 64 will engage the central groove 28 in the lower surface of one refractory 18 and the lower flanges 64 will engage the end portions of the grooves 26 in the upper surfaces of the two refractories in the next lower row, it is not essential to have a retaining member 61 disposed between the next two lower rows of refractories. In other words, it is only necessary to employ retaining members in the joints between every other row of tiles, as shown in Fig. 1. It will be seen that the central cut-away portions 32 of the refractories 18 provide clearance for the shelves 63 of the retaining members 61.

Since the main hanger member 41 is entirely unconnected with the refractory or refractories 18 directly below it, it is necessary that the retaining members 61 be so spaced vertically, that the upper one associated with the auxiliary hanger member 51 is disposed between the two upper refractories of a particular section or group. With an even number of refractories in each vertically disposed section or group, the lower retaining member 61 associated therewith will be disposed between the two lower refractories of the section, as shown at the top of Fig. 2. In order to reduce the weight of the auxiliary hanger member 51, the flanges 53 are cut away adjacent the lower end thereof, and the lower retaining member 61 is supported and held against forward transverse movement by the main hanger member 41. This is accomplished by providing a rearwardly extending shoulder 65 at the upper end of the main hanger member 41 (Figs. 2 and 7). The shoulder 65 is disposed in vertical alignment with the cross pieces 56, and the rear flange 62 of the associated member 61 engages this shoulder in the same manner as the other members 61 engage the cross pieces 56.

This arrangement has the additional advantage of enabling two upper rows of refractories 18 to be added to the top of the wall with the use of only one member 41 and one member 61 per section or group of refractories, while eliminating the necessity of employing an additional auxiliary hanger member 51. The wall may thus be built up above the top horizontal frame or supporting member 12 so as to afford complete protection for the latter. In order to provide for vertical expansion of the wall, a suitable high temperature resistant material is interposed between the lower refractories of each section or group and the upper refractories of the next lower section, to provide an expansion joint 66 (Fig. 2). This material will completely fill the adjacent grooves in the refractories and entirely cover the forward end of the main hanger members 41.

After all of the refractories or tiles 18 have been laid to provide the inner portion of the wall, in the manner above described, the space between the rear surfaces of the refractories and the forward surfaces of the horizontal frame members 12 is substantially filled with blocks 67 of any suitable heat resistant or insulation material. As will be seen in the left hand portion of Fig. 1, the insulation blocks 67 are of slightly less length than the refractories 18, so that they will fit between adjacent vertical rows of hanger members 41 and retaining members 61. The spaces between the insulation blocks 67 and all spaces extending rearwardly from the front surfaces of the horizontal frame members 12 and the auxiliary hanger members 51 are then filled with a suitable plastic insulation material 68. The plastic material 68 thus forms a continuous sheet of insulation which terminates at its rear

surface slightly to the rear of the rear surfaces of the horizontal frame members 12.

A plurality of vertically extending plates 69 are then mounted at the rear of the wall to provide an outer casing therefor. The plates 69 may be of substantially the same width as the insulation blocks 67. In order to rigidly retain the casing plates 69 in position, the auxiliary hanger members 51 are provided with a plurality of vertically spaced, rectangular apertures 71 centrally disposed in the main body portion 52 thereof. Each of the apertures 71 is provided with a semi-circular, cut-away portion or extension in its lower edge. A bolt 72 is adapted to be inserted into each of the apertures 71 from the rear of the wall, the inner head of the bolt being narrower in width than the main portion of the aperture 71. When the bolt 72 rests upon the lower surface of the aperture 71, however, the lower portion of the head thereof engages against the front surface of the body portion 52 of the auxiliary hanger member 51. Elongated, vertically disposed outer batten strips 73 having suitable longitudinally spaced apertures therein are then mounted upon the plurality of bolts 72. Suitable nuts 74 are screwed upon the bolts 72 to draw the batten strips 73 tightly against the casing plates 69 to force the latter into rigid contact with the outer surfaces of the horizontal frame members 12. Additional bolts 72 may also be disposed through the associated aperture 71 in the horizontal frame members 12. With this arrangement, and since an excess of plastic insulation material 68 has been spread upon the rear surface of the blocks 67, such excess plastic insulation 68 will be forced into any available air spaces by the tightening of the nuts 74 on the bolts 72. Consequently, substantially all air spaces in the wall will be eliminated. It will be readily understood that the rear casing plates 69 may be of any suitable width or length. For example, instead of being of a length substantially equal to the height of the furnace wall and of a width substantially equal to the distance between center lines of adjacent auxiliary hanger members 51, as shown in Fig. 1, the plates 69 may be of any suitable multiple of such width and any desired fractional part of such length.

The modified construction disclosed in Figs. 8 to 12 is substantially similar to that hereinbefore described, with the primary exception that the outer metal protective plates 69 of the wall of Figs. 1 to 7 are eliminated. To accomplish this result, while providing a furnace wall with an outer surface having finish characteristics, the auxiliary hanger members 51 of the wall of Figs. 1 to 7 have been altered in construction, and the shapes of the main refractory supporting hanger members 41 and the retaining members 61 have also been changed.

Referring more particularly to Figs. 8 to 12, the wall therein disclosed comprises a plurality of vertically disposed frame members 11, identical to the members 11 of the first modification, and a plurality of horizontally disposed frame or supporting members 82, which are similar to the supporting members 12 of the first modification, and are secured to the vertical frame members 11 by means of bolts 13. The frame members 82 are each provided with a centrally disposed, longitudinally extending recess 84 in the inner surface thereof (Fig. 9), and longitudinally extending, marginal recesses 85 and 86 along the upper and lower edges.

A plurality of main refractory supporting hang-

er members, indicated generally by reference numeral 91, are provided which are identical in function and similar in construction to the main hanger members 41. Each of the main hanger members 91 (Figs. 9 and 12) comprises a main body portion which is disposed transversely of the wall and terminates at the rear upper end thereof in a vertically flanged pad 92. The rear edge of the hanger member 91 is cut away at 93 adjacent and below the pad 92, and terminates at its lower end in a rearwardly extending pad 94. With such configuration, the under surface of the upper pad 92 is adapted to rest upon the upper edge of the horizontal frame member 82, as shown in Fig. 9, with the lower pad 94 resting against the rear wall of the recess 84, and the cut-away portion 93 providing clearance for the upper part of the frame member 82. At its forward end, the hanger member 91 is provided with a forwardly extending, horizontal shelf 95 which terminates in a vertical flange 96 extending above and below the shelf 95. The upper, rearwardly extending stud 92 of the member 91 is provided with vertical flanges 97 which protrude laterally therefrom for a purpose to be later more fully described.

An auxiliary hanger member, indicated generally by reference numeral 101, is removably mounted upon a horizontal frame member 82 in vertical alignment with each of the main hanger members 91 in similar manner to the positioning of the hanger members 51 of the construction of Figs. 1 to 7. Each of the auxiliary hanger members 101 (Figs. 9 and 10) comprises an elongated member having an imperforate base or back portion 102, a pair of outwardly and forwardly extending, parallel flanges 103, and a hook member 104 extending upwardly therefrom, the members 102, 103 and 104 being formed integrally with each other. The upper end of the hook member 104 engages within the groove 84 of the horizontal frame member 82 (Fig. 9), with the upper end of the base member 102 being disposed within the lower marginal groove 86 in the rear surface of the frame member. The lower end of the plate or base member 102 engages within the upper marginal groove 85 of the next lower horizontal frame member 82. The parallel flanges 103 terminate short of the ends of the base member 102 to permit such engagement of the latter with the associated recess in the horizontal frame member 82.

Each of the flanges 103 is provided with a plurality of laterally and inwardly extending lugs 106 spaced vertically from each other a distance equal to twice the height of the refractories 18. The lugs 106 on the two flanges 103 are disposed in opposite relationship to each other as shown in Fig. 10. Each flange 103 terminates at its lower end in an inwardly extending lug 107 which is similar to the lugs 106. In assembled position, the flanges 97 of the main hanger members 91 engage behind the lugs 107 on their associated auxiliary hanger members 101. Thus, while the vertical component resulting from the weight of the refractories 18 supported by a main hanger member 91 is transmitted thereby to the associated horizontal frame member 82, part of the horizontal component thereof is transmitted to the frame member 82 by the pad 94 and the remainder is transmitted by the flanges 97 of the pad 92 to the lugs 107 of the associated auxiliary hanger member 101. This arrangement has the advantage over that disclosed in Figs. 1 to 7 of entirely eliminating

any possibility of hot spots in the rear surface of the wall due to the transmission of heat thereto by the main hanger members 91, the latter distributing the heat more effectively to the metal frame work than the main hanger members 41.

A horizontally disposed retaining member, indicated generally by reference numeral 111, is adapted to be mounted upon each pair of lugs 106 of the auxiliary hanger member 101. Each of the retaining members 111 (Figs. 8, 9 and 11) terminates at its rear end in a vertically disposed pad 112 having a horizontally disposed shelf portion 113 formed at the upper end thereof. The pad 112 is adapted to be positioned behind the associated lugs 106 of the auxiliary hanger member 101, and the shelf 113 rests upon the upper surfaces of the lugs 106 (Fig. 9) to maintain the retaining member in proper position. The forward end of the retaining member 111 comprises a horizontally disposed shelf 114 which terminates at its outer end in laterally spaced, vertically disposed flanges 115 extending above and below the shelf 114. These retaining members 111 function in identical manner to the retaining members 61 of the construction illustrated in Figs. 1 to 7.

It will be readily apparent that the refractories 18 are supported and maintained in proper position by the members 91, 101 and 111 in the same manner as by means of the members 41, 51 and 61. After all of the refractories or tiles 18 have been laid to provide the inner portion of the wall, in the manner hereinbefore described, the space between the rear surfaces of the refractories and the forward surfaces of the horizontal frame members 82 is substantially filled with blocks 117 of any suitable heat resistant or insulation material, which are substantially identical to the blocks 67. Since these insulation blocks are wider than they are high, it is readily apparent that they may be inserted between adjacent auxiliary hanger members 101 with their longest dimension disposed vertically, and then rotated through 90° to bring them into proper position. The blocks 117 may thus be stacked one upon the other behind the refractories 18, as shown in Figs. 8 and 9. The spaces between the insulation blocks 117, those surrounding the main body portions of the hanger members 91 and retaining members 111, and all spaces extending rearwardly from the blocks 67 to the rear surfaces of the horizontal frame members 82 and the auxiliary hanger members 101 are then filled with a suitable hard, weather-proof plastic material 118. The plastic 118 is finished off flush with the rear surface of the horizontal frame members 101, so as to give an outer surface to the furnace wall which is susceptible of having any desired exterior finish, such as paint or the like, applied thereto. The appearance of the exterior of the furnace wall may thus be greatly enhanced, while this modified construction eliminates the necessity of employing the outer metal plates 69 used in the wall of Figs. 1 to 7.

Referring to Fig. 8, it will be noted that the marginal flanges of the vertical members 11 and 101 constitute retaining means for the plastic material 118.

From the above description, it will be clearly understood that the complete wall of either modified construction herein disclosed may be assembled or constructed from the rear thereof, or from the exterior of the furnace. Another important advantage of this furnace wall is that

the separate parts thereof, namely the metal frame work, the refractories, and the insulation material, may be separately and successively erected or assembled. This enables the iron workers to erect the metal frame work entirely independently of any further work to be done on the furnace wall. The tile setters may then, at any subsequent time, come in and lay the refractories 18, including the insertion or placing of the members 41 and 61 or 91 and 111. After this part of the job has been completed, the insulation men may lay the blocks 67 or 117 and apply the insulation material 68 or the plastic material 118. The use of the casing plates 69 will necessitate the return of the metal workers to complete the construction of the wall, but the modified structure illustrated in Figs. 8 to 12 may be completed in separate, successive steps by different groups of workmen entirely independently of each other.

In like manner, if it becomes necessary to repair any particular section or sections of the instant wall, such sections may be readily removed and replaced from the exterior of the furnace. This has the material advantage of eliminating the necessity of the usual delay attendant upon cooling down of the furnace when any repairs to the walls are necessitated. In addition to being relatively inexpensive in construction, the instant wall has extremely low heat transfer characteristics, while maintaining all the advantages of a hard refractory wall. The usual hot spots to be found in prior art walls are completely eliminated, substantially all air spaces within the wall are filled, and the amount of metal employed and its contact with the refractories forming the inner portion of the wall are reduced to a minimum.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A furnace wall, comprising a supporting frame, a plurality of interengaging refractories mounted in staggered relationship relative to each other, hanger means mounted on said frame in spaced relation to said refractories for engaging only a relatively small portion of each of said refractories to support and positively retain the same in proper alinement, and a backing of insulation material for said refractories substantially enclosing said hanger means.

2. A furnace wall, comprising a supporting frame including a plurality of horizontal members, a plurality of identical refractory bricks, means mounted on said horizontal members for engaging a relatively small portion of only some of said bricks to support said bricks and whole sections of bricks disposed above and adapted to be supported by said engaged bricks and thus to support all of said bricks, and separate means mounted on said horizontal members independently of said first means for engaging only a relatively small portion of each of the unengaged bricks to positively retain the same in proper alinement.

3. A furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of refractory

bricks, means mounted on said horizontal members for engaging a relatively small portion of only some of said bricks to support said bricks and whole sections of bricks disposed above and adapted to be supported by said engaged bricks and thus to support all of said bricks, a plurality of vertical members removably mounted on said horizontal members, and means mounted on said vertical members for engaging only a relatively small portion of each of the unengaged bricks to retain the same in proper alinement.

4. A relatively thin furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of refractory bricks mounted in interengaging sections, separate means mounted on said horizontal members engaging a relatively small portion of only some of the bricks of each section to support said bricks and the sections adapted to be supported by said engaged bricks, and separate means mounted on said horizontal members independently of said first means for engaging only a relatively small portion of certain of the unengaged bricks to retain the same in proper alinement.

5. A relatively thin furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of refractory bricks mounted in interengaging sections, main hanger members mounted on said horizontal members for engaging a relatively small portion of only some of the bricks of each section to support said bricks and the sections adapted to be supported by said engaged bricks, an auxiliary hanger member mounted on a said horizontal member in association with each of said main hanger members, and a plurality of retaining members mounted on each of said auxiliary hanger members for engaging only a relatively small portion of the unengaged bricks to maintain the same in proper alinement.

6. A relatively thin furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of refractory bricks mounted in interengaging sections, main hanger members mounted on said horizontal members for engaging a relatively small portion of only some of the bricks of each section to support said bricks and the sections adapted to be supported by said engaged bricks, an auxiliary hanger member mounted on a said horizontal member in association with each of said main hanger members, a plurality of retaining members mounted on each of said auxiliary hanger members for engaging only a relatively small portion of the unengaged bricks to maintain the same in proper alinement, and a backing of insulation material substantially enclosing said main hanger members and said retaining members.

7. A relatively thin furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of refractory bricks mounted in interengaging sections, main hanger member mounted on said horizontal members for engaging a relatively small portion of only some of the bricks of each section to support said bricks and the sections adapted to be supported by said engaged bricks, an auxiliary hanger member mounted on a said horizontal member in association with each of said main hanger members, a plurality of retaining members mounted on each of said auxiliary hanger members for engaging only a relatively small portion of the unengaged bricks to main-

tain the same in proper alinement, a backing of insulation material substantially enclosing said main hanger members and said retaining members, and a metallic casing held in rigid engagement with the rear surface of said backing of insulation material.

8. A furnace wall, comprising a supporting frame, a plurality of refractory bricks, means mounted on said frame for engaging a relatively small portion of only some of said bricks to support said bricks and whole sections of bricks disposed above and adapted to be supported by said engaged bricks and thus to support all of said bricks, separate means mounted on said frame independently of said first means for engaging only a relatively small portion of the unengaged bricks to retain the same in proper alinement, a plurality of blocks of insulation material mounted in engagement with the rear surfaces of said bricks, and a backing of plastic insulation material substantially filling all air spaces in said wall and enclosing said supporting and retaining means.

9. A furnace wall, comprising a supporting frame, a plurality of refractory bricks, means mounted on said frame for engaging a relatively small portion of only some of said bricks to support said bricks and whole sections of bricks disposed above and adapted to be supported by said engaged bricks and thus to support all of said bricks, separate means mounted on said frame independently of said first means for engaging only a relatively small portion of the unengaged bricks to retain the same in proper alinement, a plurality of blocks of insulation material mounted in engagement with the rear surfaces of said bricks, a backing of plastic insulation material substantially filling all air spaces in said wall and enclosing said supporting and retaining means, and a metal casing held in rigid engagement with said backing of plastic insulation material.

10. A furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of refractory bricks, a plurality of vertically disposed hangers removably mounted on said horizontal members, a plurality of horizontally disposed hangers each removably engaging and supported by a said member and a said vertical hanger for engag-

ing a relatively small portion of only some of said bricks to support said bricks and whole sections of bricks disposed above and adapted to be supported by said engaged bricks and thus to support all of said bricks, and means removably mounted on said vertical hangers for engaging only a relatively small portion of each of the unengaged bricks to retain the same in proper alinement.

11. A relatively thin furnace wall adapted to be constructed and repaired from the exterior of the furnace, comprising a skeleton metal frame, a plurality of identical hard refractory bricks adapted to be laid sectionally in interengaging relationship from the exterior of the furnace to form the inner portion of the wall, hanger means removably mountable on said frame from the exterior of the furnace for engaging only a relatively small portion of each of said bricks to support and retain the same in proper alinement, a plurality of insulation blocks adapted to be laid between said hanger means in engagement with the rear surfaces of said bricks, and a backing of plastic material substantially filling all air spaces in the wall and enclosing said brick engaging hanger means.

12. A relatively thin furnace wall, comprising a supporting frame including a plurality of vertically spaced, horizontal members, a plurality of identical refractory bricks mounted in interengaging sections, main hanger members mounted on said horizontal members and spaced vertically and horizontally from each other for engaging a relatively small portion of only some of the bricks of each section to support said bricks and the sections adapted to be supported by said engaged bricks, an auxiliary vertically disposed hanger member mounted on said horizontal members in association with each of said main hanger members and spaced rearwardly from said bricks, and a plurality of horizontal retaining members mounted on each of said auxiliary hanger members and extending inwardly therefrom, each of said retaining members terminating at its inner end in laterally spaced lugs for engaging only a relatively small portion of the unengaged bricks to maintain the same in proper alinement.

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