

Nov. 24, 1953

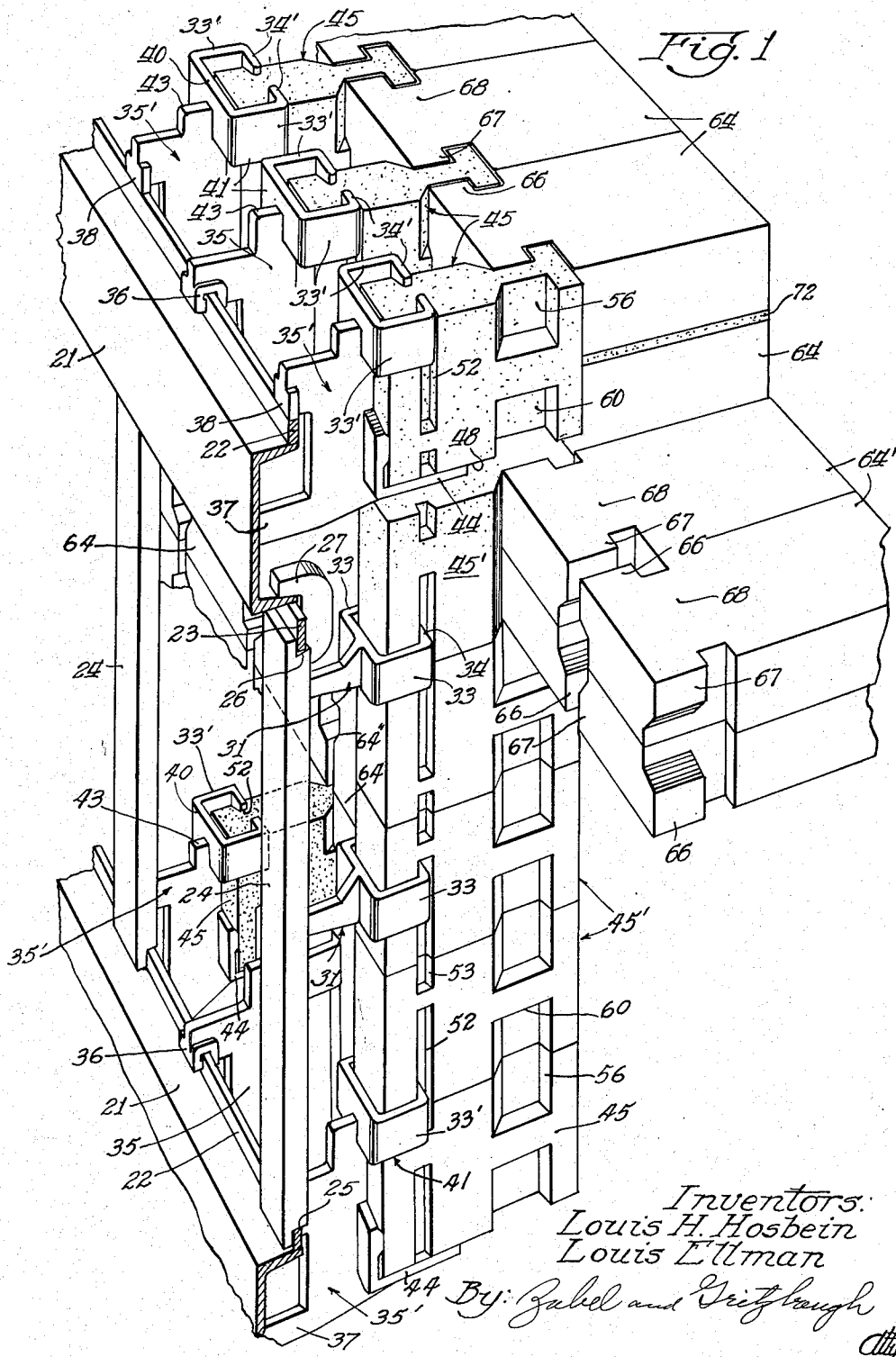
L. H. HOSBEIN ET AL

2,660,050

SECTIONALLY SUPPORTED FURNACE WALL

Filed Nov. 24, 1947

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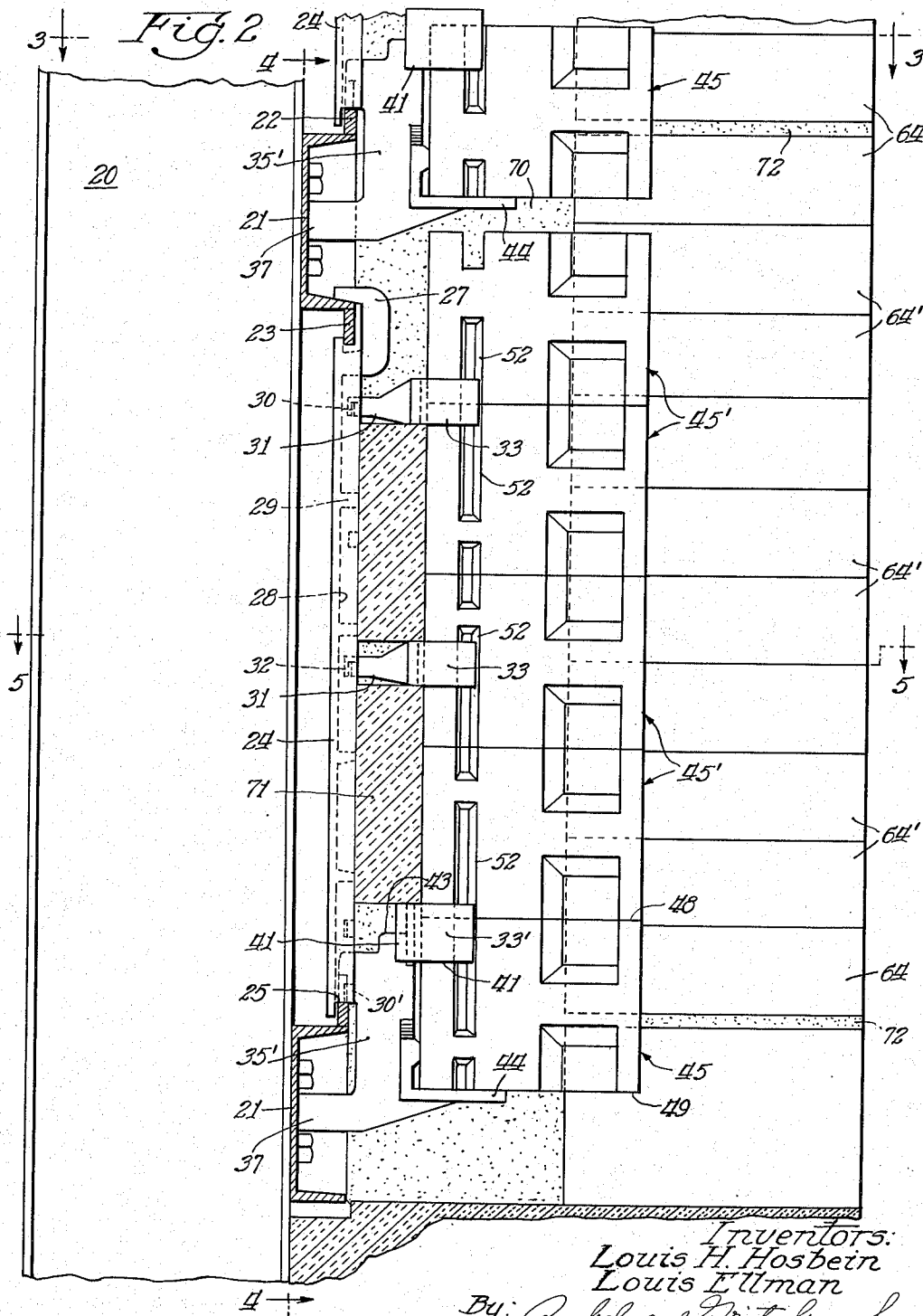
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SECTIONALLY SUPPORTED FURNACE WALL

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5 Sheets-Sheet 2



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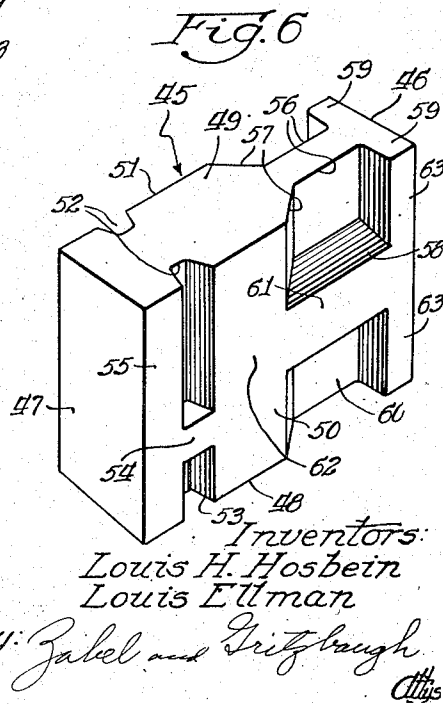
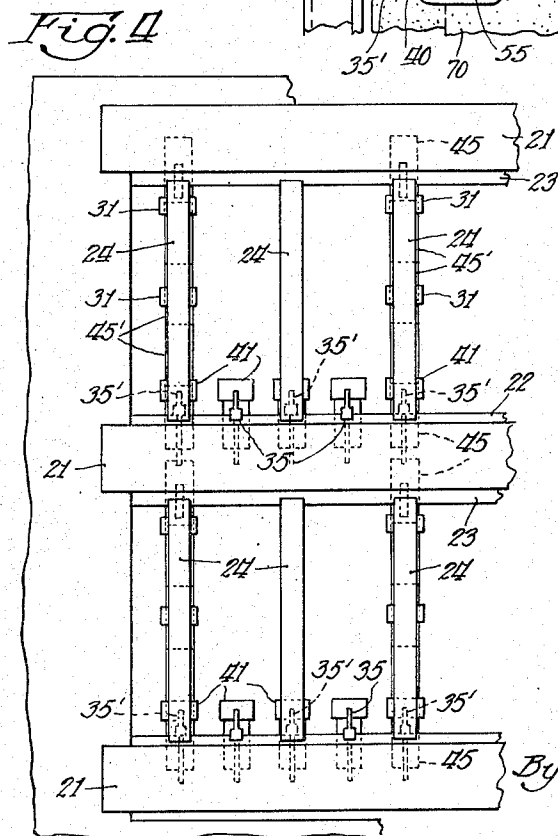
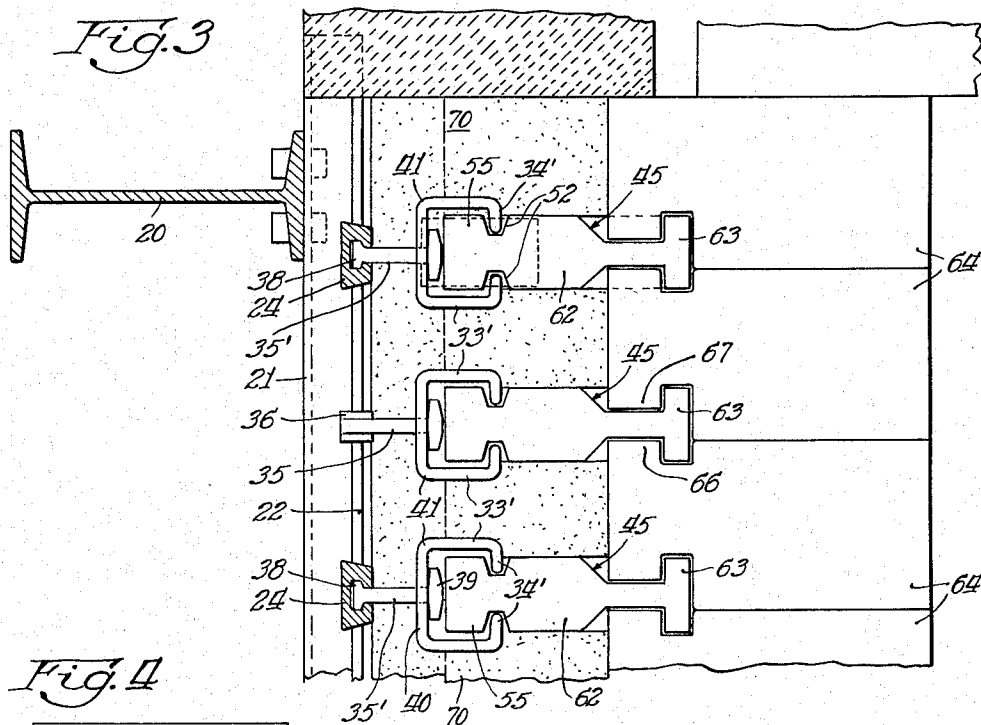
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SECTIONALLY SUPPORTED FURNACE WALL

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5 Sheets-Sheet 3



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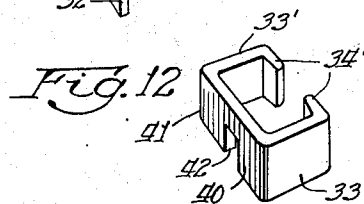
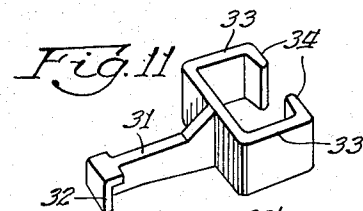
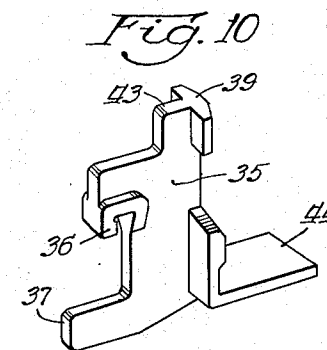
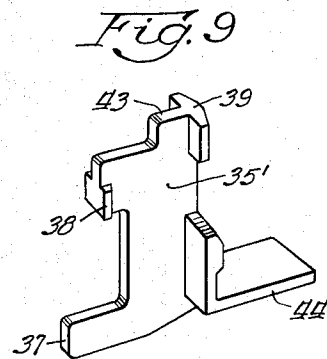
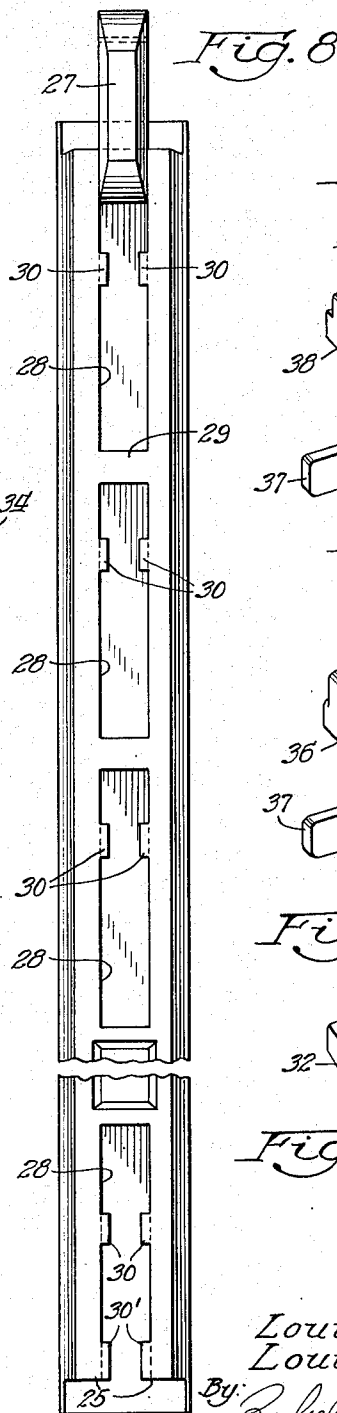
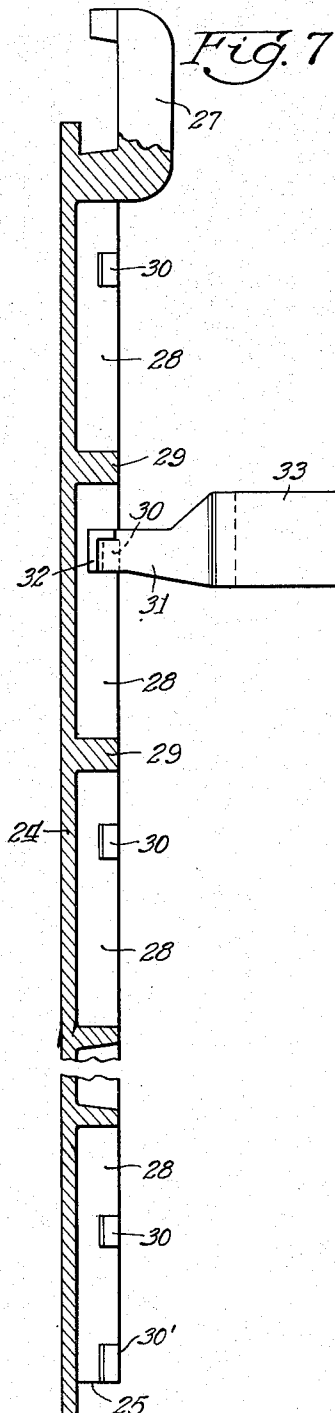
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SECTIONALLY SUPPORTED FURNACE WALL

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5 Sheets-Sheet 5



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2,660,050

SECTIONALLY SUPPORTED FURNACE WALL

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5 Claims. (Cl. 72-101)

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Our invention relates to furnace wall structure, and more particularly to an insulated wall structure of refractory members.

Our invention relates particularly to a furnace wall construction in which the refractory members are exposed to the high temperatures encountered in furnaces and which are, preferably, sectionally supported by means of a metallic framework, which metallic framework is so related to the refractory wall forming members as to be in a position remote from the high temperature zone in which the refractory members are located, and it is a particular purpose of our invention to provide refractory connecting members between the metallic framework and the refractory wall forming members, which are in the form of refractory bracket members, and which are so constructed and arranged that a thick layer of heat insulating material will be interposed between the wall forming members and any metallic parts that are utilized for supporting the wall.

In order to accomplish this purpose the refractory bracket members that connect the metallic structure with the wall forming members are made relatively narrow or thin as compared with the refractory wall forming members which the same support, and in order that said refractory bracket members will have the necessary strength to properly support the wall forming members said refractory bracket members are, preferably, made of the form of the refractory hanger members disclosed in our Patent No. 2,387,663, patented October 23, 1945, on Furnace Arch or Roof Construction. As the refractory bracket members are able to withstand higher temperatures than metallic bracket members previously used for this purpose, our invention enables furnaces to be operated at higher temperatures than would otherwise be possible, or if operated at the usual temperatures, the construction forming the subject matter of this invention enables furnaces to be operated for much longer periods without requiring repair or replacement.

It is a specific purpose of our invention to provide a structure whereby the wall of refractory members that is exposed to high heat of the furnace can be more effectively heat insulated than has been previously possible. By the use of our improved wall construction utilizing the refractory bracket members which constitute spacing and supporting members, which space the metallic structure from the refractory wall forming members and support said wall forming mem-

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bers from the metallic structure, large areas of the outer faces of the wall forming members can be provided with a thick layer of insulating material that extends to the metallic outer framework on which the entire structure is mounted.

This is particularly true in our improved wall construction because the wall is sectionally supported on metallic bracket members that have shelf-like portions with which the refractory bracket members are engaged that support the refractory wall forming members. Said refractory bracket members that are mounted on the brackets having the shelf-like members are arranged in rows substantially horizontally of the wall and are rather widely spaced apart from each other vertically, but are so spaced in the rows in which the same are arranged horizontally that the wall forming members that are connected with said bracket members are each engaged by one of said bracket members on each side thereof, said wall being further provided with refractory bracket members that are connected with the framework and with the wall forming members, which are located between the refractory bracket members mounted on said metallic brackets that have the shelf-like supporting members thereon, and which are much more widely spaced horizontally from each other than the refractory bracket members that are mounted on said shelf-like members. As a result a plurality of the wall forming members between each pair of said last mentioned refractory bracket members do not have any refractory bracket members mounted between the same and the metallic framework, but the entire area on the outer or rear side of said wall forming members has a thick mass of heat insulating material between it and the metallic supporting means, which provides much more effective heat insulation for the wall than would otherwise be possible.

It is a further important purpose of our invention to provide a refractory bracket member, which is suitably formed for connecting the same with metallic bracket members for retaining the same on a metallic framework and with suitable means for inter-connecting said refractory bracket members with refractory wall forming members, that is so constructed that it will have a portion of maximum thickness and thus of maximum strength that extends from the portion thereof inter-connected with the wall forming members to the portion thereof that is connected with the metallic framework. Preferably, said bracket members have a portion of such maximum thickness extending from the extreme inner

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end or face thereof to the extreme outer end or face thereof, thus making it possible to use a much narrower, or thinner, refractory bracket member than would otherwise be the case, without increasing the possibility of breakage due to the thinness thereof.

It is an important object of our invention to decrease the quantity of metal required in the supporting structure of a furnace wall and to reduce the cost thereof by replacing some of the previously used metallic supporting structure with less costly refractory bracket members.

Another object of our invention is to provide refractory bracket members that connect the metallic framework with the refractory wall forming members, which space the refractory wall from the metallic structure and support said wall forming members, which refractory bracket members can be easily replaced individually without disturbing any substantial portion of the furnace wall or the metallic supporting structure.

Other objects and advantages of our invention will appear as the description of the drawings proceeds. We desire to have it understood, however, that we do not intend to limit ourselves to the particular details shown or described, except as defined in the claims.

In the drawings:

Fig. 1 is a fragmentary perspective view of a furnace wall made in accordance with our invention.

Fig. 2 is a fragmentary vertical sectional view through a portion of said furnace wall.

Fig. 3 is a fragmentary horizontal sectional view taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary rear or outer face view of our improved wall construction.

Fig. 5 is a fragmentary horizontal sectional view taken on the line 5—5 of Fig. 2.

Fig. 6 is a perspective view of one of the refractory bracket members used in our improved wall construction.

Fig. 7 is a vertical sectional view through a metallic bracket supporting bar forming part of the metallic structure of our wall construction, partly broken away, showing one of the retaining brackets in position thereon.

Fig. 8 is a face view, partly broken away, of said metallic bracket supporting bar.

Fig. 9 is a perspective view of one of the metal brackets mounted on the framework which has a supporting shelf thereon.

Fig. 10 is a similar view of a slightly different form of such bracket.

Fig. 11 is a perspective view of the retaining bracket shown in Fig. 7, and

Fig. 12 is a perspective view of a retaining bracket such as used with the bracket shown in Figs. 9 and 10.

Referring in detail to the drawings, our improved wall construction comprises a framework having vertically extending frame members 20 and horizontally extending frame members 21, which are secured to the vertically extending frame members in any suitable manner. The horizontally extending frame members 21 have a bar 22 extending along one of the flanges thereof to provide an upstanding flange on each of said horizontally extending frame members and have bars 23 on the other flanges thereof to provide downwardly extending rib portions or flanges on the lower flanges of said horizontally extending frame members 21. Bars 24 are pro-

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vided, which extend vertically and which have shoulders 25 and 26 that are adapted to engage the flanges or ribs 22 and 23, respectively, said bars also having hooks 27 thereon that engage around the lower flanges of the horizontally extending frame members 21 to secure said bars 24 in position. The hook 27 is first engaged with the lower flange of frame member 21 and is then swung counter-clockwise, as viewed in Figs. 1 and 2, to engage the reduced lower end portion thereof with the flange 22, and with the shoulder 25 engaging the top edge of the rib 22, and the shoulder 26 spaced from the bottom edge of the rib 23, as shown in dotted lines in Fig. 2.

The retainer bars 24 are provided with a plurality of longitudinally extending channels 28 therein, which are spaced from each other by transverse web portions 29. Each of said channels has a pair of inwardly extending lugs 30 provided between the ends thereof, which serve to support the retaining brackets 31, the angular flanges 32 on said retaining brackets being inter-engaged with the lugs 30 by inserting said bracket portions 32 in the slots 28 and moving the same into cooperative position with the lugs 30. Said retaining brackets have a pair of inwardly or forwardly extending arms 33, which terminate in inwardly extending flanges 34, thus forming hook-like members which serve to retain the refractory bracket members in a manner to be described below.

Each of the horizontally extending frame members 21 has a plurality of metallic bracket members 35 mounted thereon, said bracket members 35 having a hook-like or channelled portion 36 that hooks over the flange 22 and having an outwardly extending finger or foot portion 37 that engages the web portion of the member 21. The bracket members 35 are mounted on the horizontally extending frame members 21 between the points where the vertically extending retaining bars 24 are engaged with said horizontally extending frame members. The bracket members 35' shown in Fig. 9, are substantially the same as the bracket members 35, except that instead of having the channel-shaped hook-like portions 36, said bracket members have the laterally extending flanges 38 thereon that engage back of a pair of inwardly extending lugs 30' that are provided in the lowermost channel 20' of each of the retaining bars to hold the same against outward movement. Both brackets are provided with the fingers 37 that engage the webs of the horizontally extending frame members 21. Also both the brackets 35 and 35' are provided with a T-head portion 39 back of which the transverse wall portion 40 of a bracket 41 lies when the slot 42 in said bracket 41 is engaged with the portion 43 of either of said brackets 35 or 35'. The brackets 41 provide forwardly extending portions 33' and inwardly extending hook ends 34' corresponding to the portions 33 and 34 of the brackets 31 for securing the refractory bracket members thereto.

Each of the brackets 35 and 35' is also provided with an inwardly extending shelf-like portion 44. The shelf-like portions 44 are provided to mount the refractory spacing brackets 45 thereon. Said refractory spacing brackets 45 are a block-like member having flat inner and outer end faces 46 and 47 and flat top and bottom faces 49 and 48, as well as flat side faces 50 and 51. Thus there are plane end faces, plane top and bottom faces and plane side faces on said block. The side faces 50 and 51 have a pair

of vertically extending grooves 52 therein that lie opposite each other and a pair of shorter vertically extending grooves 53 therein that are separated from the grooves 52 by a connecting portion 54, which is of the maximum thickness of the block, said block being of a maximum thickness defined by the flat or plane side walls 50 and 51 thereof. Thus there is a vertically extending portion 55 of said spacing retainer bracket block which is of the maximum thickness of said block that lies on the outer side of the grooves 52 and 53.

The inner end portion of the refractory spacing bracket 45 has a pair of oppositely disposed upwardly opening recesses 56 therein, which have inclined walls 57 and 58 and walls 59 that extend substantially perpendicularly to the bottom of said recess. A similar recess 60 is provided in the refractory bracket block in vertical alignment with the recess 56 on each side of said refractory bracket members, said recess 60 being similarly shaped to the recesses 56, but opening downwardly instead of upwardly and being of less height than the recesses 56. Between said recesses 56 and 60 is a connecting portion 61, which is of the maximum thickness of the refractory bracket member, and a portion 62 of such maximum thickness extending vertically of the block lies between the recesses 56 and the grooves 52, and between the recesses 60 and the grooves 53. Similarly a vertically extending portion 63 of such maximum thickness is provided between the inner end face 46 of said refractory bracket member and the recesses 56 and 60. Thus the portions 54 and 61 of maximum thickness connect the portions 55, 62 and 63 of maximum thickness, which extend continuously from the bottom to the top face of each of said spacing bracket members. A portion of maximum thickness of the block thus extends from the inner face 46 thereof to the outer face 47 thereof.

The slots 52 receive the inwardly directed hook ends 34' of the retainer members 41, while the flat bottom face 48 of each of said blocks rests on the shelf-like member 44. The refractory bracket members will thus be firmly anchored in position on the metallic framework. The inwardly directed hook flanges 34 on the retainer members 33 similarly engage the slots 52 of the refractory spacing bracket members 45'. Said refractory spacing bracket members 45' are in all respects similar to the spacing bracket members 45, but the alternate ones thereof are inverted from the position of the members 45, as will be obvious from Fig. 2, so that the slots 52 in adjoining members 45' will have the hook flanges 34 of the retainer bracket 31 engaged therewith, and thus one retainer bracket will retain a vertically adjacent pair of said refractory bracket members in position. Similarly the retainer members 41 project upwardly above the top surfaces of the refractory spacing bracket members 45, as will be obvious from Figs. 1 and 2, so that the hook flanges 34 thereon will not only engage in the grooves 52 of the spacing bracket 45, but also in the grooves 52 of a bracket 45' mounted thereabove. The height of the spacing bracket members 45 and 45' relative to the length of the bars 24 is such that the central spacing bracket member 45' of a wall section in any vertical row of said members 45 and 45' will have a bracket member 31 for retaining the same alone.

Refractory wall forming members 64 have pro-

jections 66 and 67 thereon that are received in the recesses 56 and 60 of the spacing bracket members 45. The projections 66 extend nearer to the lateral or side faces of the wall forming members 64 than the projections 67, or in other words, the connecting portion 68 between the body of the block and the projections 66 and 67 does not have its center line on the center line of the main body portion of the wall forming block 64. Accordingly by reversing the members 64 the vertically adjacent rows thereof can be staggered. Two vertically adjacent rows of the members 64 are connected with each refractory spacing bracket 45, and similarly two vertically adjacent rows of the wall forming members 64' are connected with each of the bracket members 45', the wall forming members 64' being of the same structure as the wall forming members 64, but being designated by a different reference numeral in order to bring out more clearly the differences in arrangement of the retaining or supporting means relative to the wall forming members, whereby large areas of the outer faces of the wall forming members have a thick layer of insulating material lying between the same and the metallic framework.

Referring to Fig. 5 it will be noted that there are other wall forming members 64'' between the members 64', connected with the spacing bracket members 45', that are not connected with any of the framework at all, and not with any refractory spacing bracket members. This provides large areas on the outer faces 69 of the refractory members 64' and 64'' that have a thick wall or layer of heat insulating material 70 provided between the same and the metallic supporting framework. Said insulating material is, preferably, an insulating cement, which fills not only the spaces between the various retaining and spacing brackets 45 and 45', but also the spaces between the portions of the wall forming members 64' and 64'' that do not have any refractory spacing bracket members mounted therein. The insulating cement-like material also extends around the metallic retainer members 31 and between the top and bottom faces of adjacent spacing bracket members 45 and 45', as will be obvious from Figs. 2 and 5, and all the portions of said spacing brackets 45 and 45' extending outwardly beyond the inner faces 69 of the refractory wall forming members 64 and 64' are embedded in said insulating material 70. Wherever large enough spaces exist between the various framework members, blocks 71 of insulating material are provided so as to provide a better finish for the outer surface of the wall than would be obtained by the cement-like material 70. The retainer bars 24 shown as located between the bars 24 that have the brackets 31 mounted thereon (see Fig. 4) serve merely to hold the insulating blocks 71 from outward movement.

Thus a wall is provided that has a thick layer of insulating material between all of the refractory members 64, that are exposed to the direct heat of the furnace, and all of the metallic parts of the supporting structure. Refractory spacing members that also serve as supporting means are provided between the wall forming members and the metallic supporting structure, which are of a generally rectangular character and are narrow or thin as compared with the refractory wall forming members, and have portions of the same uniform maximum thickness extending from the inner faces 46 to

the outer faces 47 thereof. Also it will be noted that there is a portion of maximum thickness of said spacing bracket members 45 and 45' that extends from the wall retaining portion 63 thereof to the portion 55 thereof that is subjected to stress by the wall when engaged with the portions 34 and 34' of the retainer brackets. The upper refractory wall forming block 64 connected with each spacing bracket member 45 not only is retained by means of the portions 63 of said spacing bracket member, but is supported by the portion 61 thereof of the maximum thickness of said bracket. The portions 61 of the spacing bracket members 45 act similarly. Thus each section of the wall is similarly supported by the maximum thickness portions 61 of the spacing brackets and the shelf-like members on the metallic bracket members 35 and 35' in cooperation with the hook flanges 34' on the retainers 41 mounted on said brackets 35 and 35'.

In order to provide an expansion joint in the structure, a layer of refractory cement 72 is provided between the upper and lower members of the vertically adjacent pairs of refractory wall forming members that are mounted on the refractory spacing brackets 45.

What we claim is:

1. A sectionally supported furnace wall, comprising a metallic framework, vertically spaced horizontal rows of horizontally spaced metallic brackets mounted on said framework, said metallic brackets having horizontal shelf portions thereon, horizontally spaced horizontally extending refractory spacing brackets mounted on said shelf portions, said refractory spacing brackets being interengaged near the outer ends thereof with the inner ends of said metallic brackets, horizontally extending wall forming refractories interengaged adjacent their outer ends with and supported by said refractory spacing brackets near the inner ends thereof and extending inwardly therefrom, the interengaging means on said wall forming refractories and refractory brackets comprising lateral recesses and projections, a pair of horizontally adjacent wall forming refractories being supported by each of said refractory spacing brackets, vertical rows of metallic retainer members mounted on said framework between said vertically spaced rows of metallic brackets, all portions of said metallic brackets and of said retainer members being spaced from said wall forming refractories, said vertical rows of retainer members being spaced much further apart horizontally than said brackets and aligned vertically with certain ones thereof, refractory spacing brackets interengaged near the outer ends thereof with the inner ends of said retainer members, said last mentioned refractory spacing brackets being vertically adjacent and vertically aligned with certain of said first mentioned refractory brackets, wall forming refractories interengaged adjacent their outer ends with said last mentioned refractory spacing brackets near the inner ends thereof and extending inwardly therefrom, a plurality of wall forming refractories mounted between refractories interengaged with said last mentioned refractory spacing brackets, all of said wall forming refractories being duplicates, and heat insulating material extending from the outer ends of said wall forming refractories to said metallic framework and between all said metallic brackets and the outer face of said wall.

2. A furnace structure comprising a metal framework, a plurality of duplicate horizontally

extending refractories forming a vertical wall, means for sectionally supporting said refractories from said framework comprising horizontally extending rows of horizontally spaced horizontally extending refractory spacing brackets mounted between said wall forming refractories and said framework and spaced from said framework, said spacing brackets each having the major portion thereof lying outwardly of the outer face of said wall and having the inner end thereof lying outwardly from the exposed face of said wall, vertically spaced horizontally extending rows of metallic bracket members detachably mounted on said framework, said metallic bracket members having all portions thereof spaced from said wall and having holding and supporting means engaging said spacing brackets in some of said horizontal rows in spaced relation to the outer face of said wall, said spacing brackets of each of said horizontal rows having vertically spaced upper and lower recesses in the sides thereof and a horizontal wall portion extending between said recesses, and said wall forming refractories including horizontal rows thereof located at vertically spaced positions in said wall, said wall forming refractories having lateral recesses engaged by said refractory spacing brackets and lateral projections seated in said upper recesses and engaging said horizontal wall portions of a corresponding horizontal row of said spacing brackets to support all of said wall forming refractories of each of said last mentioned rows on said spacing brackets, with one of said wall forming refractories on each side of each of said spacing brackets, and heat insulating material extending from the outer ends of all said wall forming refractories to said metallic framework and between the inner ends of said metallic brackets and the outer face of said wall and having said refractory spacing brackets enclosed therein, all said framework being externally of said heat insulating material.

3. A sectionally supported wall, comprising a metallic framework, metallic brackets detachably mounted on said framework, said metallic brackets having horizontal shelf portions thereon spaced from said framework, a plurality of duplicate horizontally extending refractories forming a vertical wall section, all portions of said metallic brackets being spaced from said refractories, and means for supporting said refractories forming said wall section comprising a horizontal row of horizontally spaced horizontally extending refractory spacing brackets each having the major portion thereof lying outwardly of the outer face of said wall forming refractories and having a portion of maximum thickness extending from the inner end thereof to the outer end thereof, said spacing brackets being mounted between said framework and said wall section forming refractories and in spaced relation to said framework, and engaging said wall forming refractories outwardly from the exposed face of said wall section, said spacing brackets being vertically slidably connected with said metallic brackets and mounted on said shelf portions, said spacing brackets having vertically spaced upper and lower recesses in the sides thereof and a horizontal wall portion extending between said recesses, and said wall forming refractories having lateral projections and recesses, the lateral projections of the bottom horizontal row of wall forming refractories of said wall section being seated in said upper recesses and engaging said horizontal wall portions and said spacing brackets engaging in

said recesses in said bottom row of wall forming refractories to support all of the wall forming refractories of the said bottom horizontal row of said section, said metallic brackets engaging said spacing brackets in spaced relation to said wall forming refractories and all portions of said metallic brackets being spaced from said wall forming refractories.

4. A sectionally supported wall, comprising a metallic framework, metallic brackets detachably mounted on said framework, said metallic brackets having horizontal shelf portions thereon spaced from said framework, a plurality of duplicate horizontally extending refractories forming a vertical wall section, all portions of said metallic brackets being spaced from said refractories, and means for supporting said refractories forming said wall section comprising a horizontal row of horizontally spaced horizontally extending refractory spacing brackets each having the major portion thereof lying outwardly of the outer face of said wall forming refractories and having a portion of maximum thickness extending from the inner end thereof to the outer end thereof, said spacing brackets being mounted between said framework and said wall section forming refractories and in spaced relation to said framework, and engaging said wall forming refractories outwardly from the exposed face of said wall section, said spacing brackets being vertically slidably connected with said metallic brackets and mounted on said shelf portions, said spacing brackets having vertically spaced upper and lower recesses in the sides thereof and a horizontal wall portion extending between said recesses, and said wall forming refractories having lateral projections and recesses, the lateral projections of the lowest horizontal row of wall forming refractories of said wall section being seated in said upper recesses and engaging said horizontal wall portions, and said spacing brackets engaging in said recesses in said lowest row of wall forming refractories to support all of the wall forming refractories of said lowest horizontal row of said section, said metallic brackets engaging said spacing brackets in spaced relation to said refractories and all portions of said metallic brackets being spaced from said wall forming refractories, and heat insulating material extending from the outer ends of said wall forming refractories to said metallic framework and between the inner ends of said metallic brackets and the outer face of said wall and having said spacing brackets enclosed therein, all of said framework being externally of said heat insulating material.

5. A furnace structure comprising a metal framework, a plurality of duplicate elongated horizontally extending refractories forming a vertical wall, said refractories being mounted in said wall with the length thereof extending trans-

versely of said wall, means for sectionally supporting said refractories from said framework comprising horizontally extending rows of horizontally spaced horizontally extending refractory spacing brackets mounted between said wall forming refractories and said framework and spaced from said framework, said spacing brackets each having the major portion thereof lying outwardly of the outer face of said wall and having the inner end thereof lying outwardly from the exposed face of said wall, vertically spaced horizontally extending rows of metallic bracket members detachably mounted on said framework, said metallic bracket members having all portions thereof spaced from said wall and having holding and supporting means engaging said spacing brackets in some of said horizontal rows in spaced relation to the outer face of said wall, said spacing brackets of each of said horizontal rows having vertically spaced upper and lower recesses in the sides thereof and a horizontal wall portion extending between said recesses, and said wall forming refractories including horizontal rows thereof located at vertically spaced positions in said wall, said wall forming refractories having lateral recesses engaged by said brackets and lateral projections seated in said upper recesses and engaging said horizontal wall portions of a corresponding horizontal row of said spacing brackets, and heat insulating material extending from the outer ends of all said wall forming refractories to said metallic framework and between the inner ends of said metallic brackets and the outer face of said wall and having said refractory spacing brackets enclosed therein, all said framework being externally of said heat insulating material, said spacing brackets being much narrower than said wall forming refractories, and each of said spacing brackets supporting a pair of horizontally adjacent refractories of one of said last mentioned horizontal rows thereof, all the refractories of each of said last mentioned horizontal rows being supported by said spacing brackets.

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