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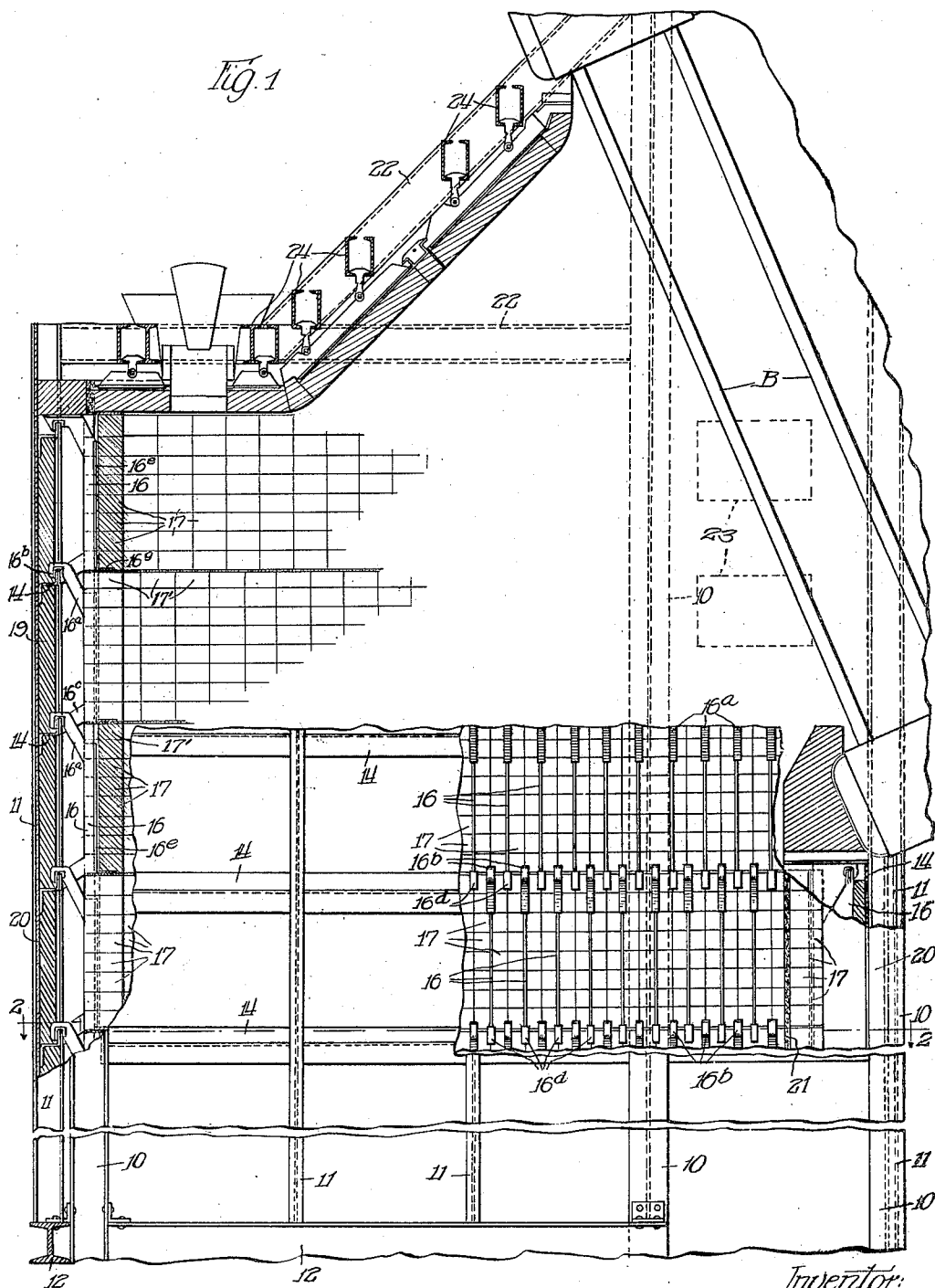
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1,747,822

FURNACE CONSTRUCTION

Filed Jan. 7, 1924

3 Sheets-Sheet 1



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**Feb. 18, 1930.**

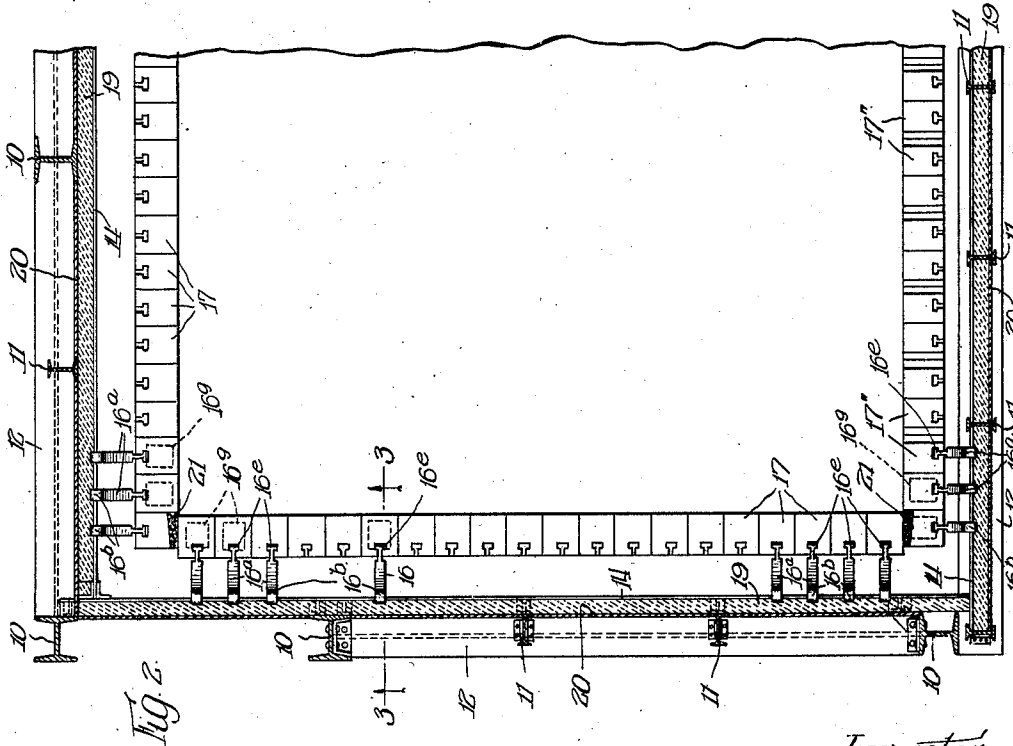
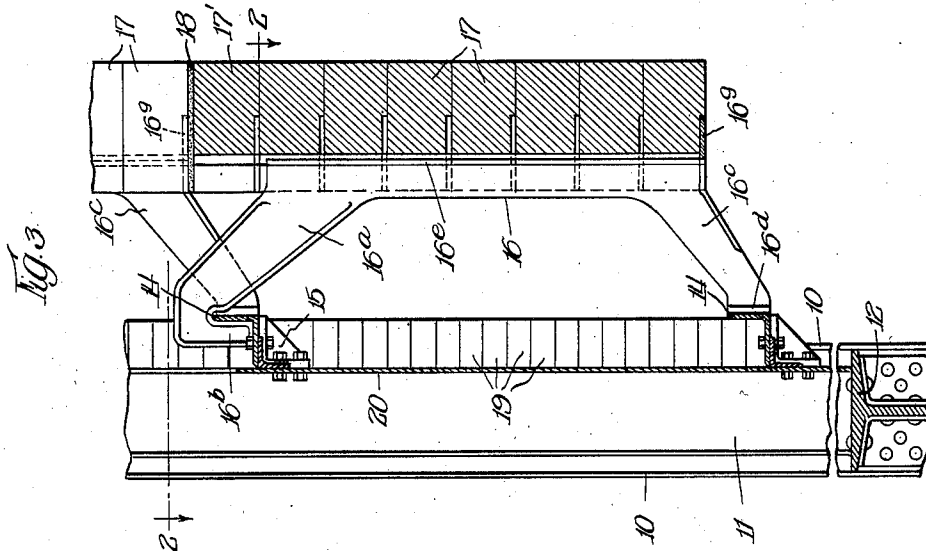
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## FURNACE CONSTRUCTION

Filed Jan. 7, 1924

3 Sheets-Sheet 2



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1,747,822

FURNACE CONSTRUCTION

Filed Jan. 7, 1924

3 Sheets-Sheet 3

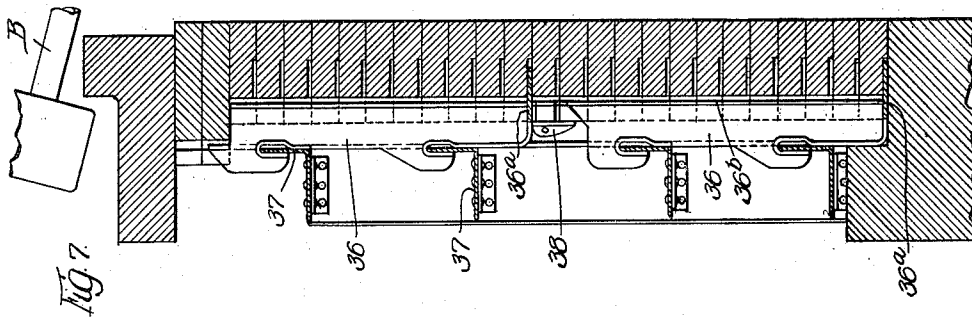


Fig. 7

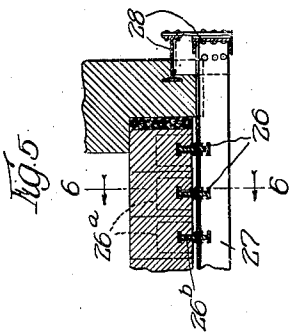


Fig. 5

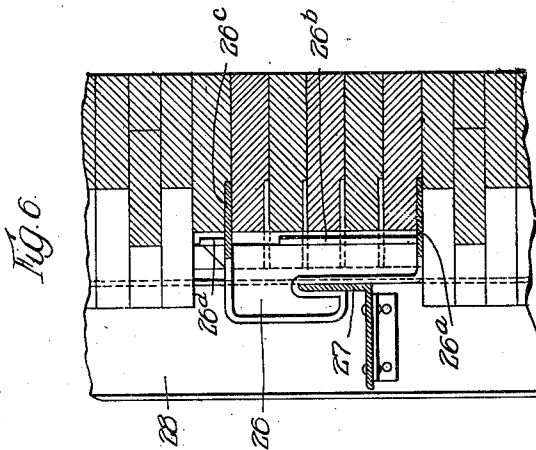


Fig. 6

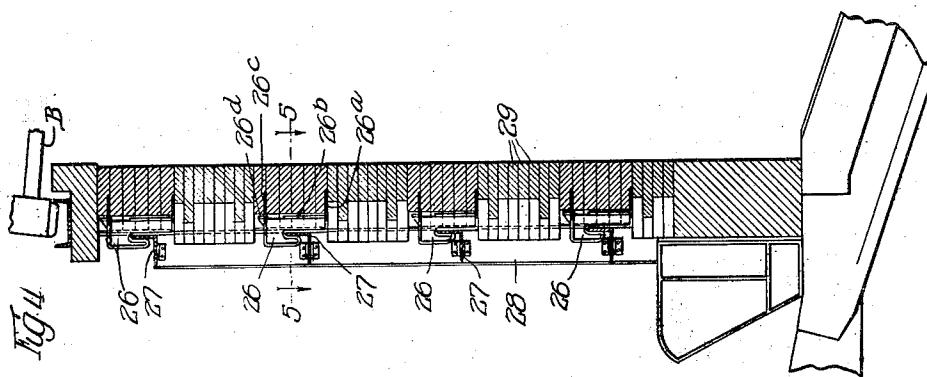


Fig. 4

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## UNITED STATES PATENT OFFICE

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## FURNACE CONSTRUCTION

Application filed January 7, 1924. Serial No. 684,698.

This invention relates to furnace construction, and while adapted to use in furnaces of different varieties, it is of particular advantage in the construction of furnaces of considerable vertical extent, such as are adapted for the burning of pneumatically fed pulverized fuel for the heating of steam boilers.

The general purpose of the invention is to provide an improved construction especially adapted for use in furnace walls, which will possess great durability and stability, which will facilitate installation and repair, and which will contribute materially to the efficiency of the operation of the furnace.

Among the more particular or specific objects of the invention are the following:

The provision of a furnace wall construction having a desirable flexibility and wherein the refractories are maintained against shifting inwardly or outwardly out of the intended vertical plane;

The provision of a furnace wall construction wherein the heat-resisting refractories are not required to carry any great portion of the dead load of the structure or excessive pressures resulting from thermal expansion;

The provision of a furnace wall construction wherein refractories may be installed, removed or replaced in any limited area without requiring extensive dismantling or removal of all of the refractories above such area;

The provision of a furnace wall construction which will afford an arrangement whereby the furnace wall refractories may be safeguarded against excessive overheating;

The provision of a construction wherein the entire furnace wall may be carried on structural members in such fashion that the individual refractories may have a certain amount of independent movement so as to accommodate themselves to contraction and expansion in their own structure and in the furnace structure as a whole, without producing distortion or displacement of the wall, and wherein the supporting structural members are afforded requisite protection from the heat of the furnace;

The provision of a furnace construction designed to accommodate admission of air

through any selected portion of the walls, and adapted for alteration in that respect with facility;

The provision of a furnace construction possessing aforementioned characteristics, and in which a minimum of different forms of refractories are required, and the supporting members also are of minimum variety as to form;

The provision of a construction having characteristics above specified and in which the strength of the wall supporting members is utilized to the best advantage, so that they may be of minimum weight, the supported refractories being carried thereon in such fashion as to minimize the effect of eccentric loading of the supporting structural elements;

The provision of a construction which admits of great versatility and variety in the design of the furnaces in which it is employed, and which will have a great range of use without requiring variation in any of the characteristic details of the construction.

Other and further objects of the invention will be pointed out hereinafter, indicated in the appended claims, or obvious to one skilled in the art upon an understanding of the present disclosure. For the purpose of this application I have elected to show herein certain forms and details of furnace construction representative of my invention; it is to be understood however that these are here presented for the purpose of illustration only, and that therefore they are not to be regarded as exhaustive of the variations of the invention, nor are they to be given any interpretation such as might have the effect of limiting the claims, short of the true and most comprehensive scope of the invention in the art.

In the drawings,

Fig. 1 is an elevational view of a portion of a pulverized fuel burning boiler furnace embodying features of my invention, the illustration showing the upper portion and front wall of the furnace in sectional elevation, and portions of the side wall in part broken away;

Fig. 2 is a part cross section of the furnace

construction illustrated in Fig. 1, the same representing approximately the left-hand half thereof taken on the line 2—2 but with certain detail elements omitted;

5 Fig. 3 is a detail in the nature of a fragmentary section such as might be taken on the line 3—3 of Fig. 2, the same showing one of the wall hangers in elevation;

10 Fig. 4 is a detail in the nature of a part sectional elevation of the front wall of a boiler furnace in which my invention is embodied in another form;

Fig. 5 is a detail of the construction illustrated in Fig. 4, same being in the nature of a cross section taken at the corner or junction of the front wall and side wall of the furnace on the line 5—5 of Fig. 4;

15 Fig. 6 is another detail, on a larger scale illustrating certain features of the construction shown in Fig. 4, same being a part sectional elevation of the front wall on the line 6—6 of Fig. 5;

25 Fig. 7 is a part sectional elevation of a front wall construction for a boiler furnace embodying features of my invention in a further different form.

Described generally, in one aspect my invention contemplates the provision of an external supporting frame made up of structural elements, including posts or columns which are carried on a suitable foundation, and having the refractories, which form the gas confining walls of the furnace chamber, supported on this frame and maintained there~~y~~ in such relationship that they are held against shifting, bulging or toppling over in any direction, while at the same time they are permitted certain freedom of individual or relative movement, so that they may accommodate themselves to changes in temperature without adversely affecting the integrity or form of the furnace wall, or its association with other elements of the installation, such as boiler parts, fuel feeding instrumentalities, etc. The invention has other aspects, and these, as well as a more detailed understanding of the foregoing, will be most readily ascertained by reference in detail to the drawings forming a part of this specification.

30 In the illustrative construction shown in Figs. 1, 2 and 3, the numeral 10 designates column members, which very conveniently can be the boiler columns employed for supporting parts of the boiler installation. Depending on circumstances, of course, the boiler columns may be supplemented with others to accomplish the purpose of those elements in the present invention. They may be formed of rolled steel members supported at their lower ends on suitable foundations. As shown in the embodiment illustrated in Figs. 1 and 2, which is a design for a very large and tall furnace, these supporting col-  
 65 umns may be supplemented, at various in-

tervals about the area of the furnace chamber, with other column members 11 in the nature of stud columns. These may be carried on the supporting columns 10 by means of stringer beams 12, which are bracketed to the columns 10 adjacent their lower ends. To the vertical frame members thus afforded by the columns 10 and 11 are secured the transverse or horizontally extending hanger supports 14. These may be formed conveniently of angle bars or Z-bars, bolted to brackets 15 carried by the vertical frame members. They preferably are arranged at uniform spacing one above another, and extend in parallel relationship from side to side of the frame structure. They present, toward the furnace chamber, upwardly directed flanges.

These hanger supports 14 constitute the retaining supports for the tile retaining members or wall hangers 16. These may be formed as cast-iron members in the nature of brackets. They have a tension arm 16<sup>a</sup> terminating in a hook 16<sup>b</sup>, and a compression arm 16<sup>c</sup> terminating in a foot 16<sup>d</sup>. The arms 16<sup>a</sup> and 16<sup>c</sup> are connected by a bar portion having lateral marginal flanges 16<sup>e</sup>. At its lower end, adjacent the arm 16<sup>c</sup>, this bar portion and its flanges terminate at a shelf portion 16<sup>f</sup> projecting at right angles to the longitudinal dimension of the flanges 16<sup>e</sup>, and in a direction opposite the compression arm 16<sup>c</sup>. The spacing of the supporting members 14 is established with reference to the distance between the hook member 16<sup>a</sup> and the foot member 16<sup>d</sup>, so that, when the former is engaged with one of the members 14, the foot member 16<sup>d</sup> will be in cooperative relationship with the inner face of the subjacent supporting member 14. Each of the wall hangers is adapted to carry a number of slotted refractory tile 17, the lowermost of which rests upon the shelf 16<sup>f</sup>, such tile being shown as provided with depressions to accommodate the shelf. These tile have T-shaped slots, as shown in Fig. 2, which accommodate the bar portion of the hanger and the flanges 16<sup>e</sup>. When so engaged with and supported on a hanger the tile are held in alignment vertically, but have a limited amount of individual play on the hanger.

The walls of the furnace chamber are built up of groups of refractories thus supported on the hangers which are carried on the members 14 and placed in such relationship collaterally that the sides of the refractories on aligned juxtaposed hangers will make contact. Thus there are provided a number of horizontally arranged series of hangers each supporting a limited number of refractories with the sides of the latter in alignment. The hangers in vertically adjacent series are arranged in staggered relationship, so that the tile on the hangers in each series break joints with the tile on those in superjacent or

subjacent series. As a result, on each of the supporting members 14 there will be a distribution of the weight of the refractories carried on two of the series of hangers. As will be seen in Fig. 3, through the tension arm 16<sup>a</sup> the weight of the refractories carried on the hanger is imposed on the upper supporting member 14 as a couple or turning moment tending to swing that member and its supporting columns inwardly. That moment, however, is counteracted by the weight of the tile carried on a hanger in the superjacent series, which is transmitted to the member 14 through the compression arm 16<sup>c</sup> of said superjacent bracket, as a moment tending to swing that supporting member and its supporting columns outwardly. The summative effect, therefore, of the loading of each of the supporting members 14 in this fashion, will be simply to subject them to a vertical resultant which will be carried by the columns with only a relatively small net force tending to swing them inward.

The suspension of the refractories in this fashion on the hangers 16 permits each hanger and its group of refractories to have a shifting movement relative to those about it, but only in the plane of the wall. Between the uppermost refractories engaged with the flanges 16<sup>c</sup> of the hangers in one series, and the refractories engaging the shelves 16<sup>c</sup> of the hangers in the superjacent series, are inserted refractories 17', and if desired, a thin layer of compressible refractory material 18 to form an expansion joint. In order to remove and replace any refractory on any one of the hangers 16 therefore, it is necessary simply to remove the key brick 17' at the top of the tier of refractories on that hanger, and then remove the refractories from the latter, one at a time, by sliding them upwardly on the flanges 16<sup>c</sup> and removing them inwardly through the space afforded by removal of the key brick. For the purpose of distinction, I may refer to the refractories 17', which are thus supported on the hangers, but not engaged therewith, as laid refractories.

As a means for controlling external air circulation over the wall refractories and their supporting hangers, I surround the furnace chamber with an outer or sheathing wall built up of the brick 19 which are supported on the members 14, wherefore the portions or sections of said outer wall which are supported on any of the respective members 14 are removable without requiring dismantling of the portions supported on others thereof. This gives an air space entirely about the refractory wall, and the admission of air and its circulation through said space may be controlled by suitable dampers 23 at desired locations. This arrangement may be further availed of in connection with admission of combustion air into the furnace

chamber. As is well known, particularly in furnaces designed for burning pulverized fuel, it is frequently desirable to provide for admission of combustion air at various points along the height of the furnace. My construction is of particular advantage in making provision for the necessary air ports without in any degree affecting the stability of the wall structure. This is accomplished as illustrated in Fig. 2, by the provision of narrow refractories 17'', which are disposed at the desired points, being supported on and engaged with the hangers 16, just as the tile of normal width. At the points where such narrow refractories are inserted, however, space will be left between them and adjacent refractories, affording communicating ports P between the interior of the furnace chamber and the surrounding air chamber, accommodating the admission of air into the former. By virtue of this arrangement, the introduced air may be given a preliminary heating incident to its travel through the air chamber, a factor which is sometimes of importance; and inasmuch as some of that heat is taken from the hangers 16, it is to be observed that the arrangement affords an effective safeguard against overheating of those members and the refractories in contact with them. A suitable exterior finish may be provided by a cover 20 of plate, bolted to the members 14 or to other suitable transverse members or carried on the column members 10 and 11. At the angle junctions of the walls, suitable expansion and packing joints may be provided by asbestos or other compressible refractory material packed into spaces 21 afforded by suitable formation of the overlapping refractories.

As a top closure or arch for a furnace chamber constructed in this fashion, I provide an arch of the suspended type. Such arch, of course, will take any particular form appropriate to the particular installation. Provision is made for supporting such arch on the external framework, as by means of the beams 22 connected to the column members 10, and the arch beams 24 carried by said beams 22 and affording members extending over the furnace chamber to support the arch bars and the refractories suspended thereon. By virtue of such arrangement the arch and the furnace walls are independent of one another, so that replacement or alterations may be made in one without necessitating any dismantling of the other.

Constructions embodying the features above described find particular utility in the tall furnaces such as those designed for the burning of pulverized fuel which is fed pneumatically, as it is not subject to any limitation whatever in so far as the compression strength of the refractories is concerned. It is of particular advantage therefore in per-

mitting the thickness of the walls to be kept within a desired limit, irrespective of their height. This is frequently of importance, not only from economy in construction and space, but also in its influence on the ability of the refractory wall to resist disintegration by heat or changes in temperature.

In the embodiment illustrated in Figs. 4, 5 and 6 the hangers are designated by the reference numeral 26 and they are supported on the horizontally extending angle members 27 carried on the column members 28. Each of the hanger-members 26 has a bottom shelf portion 26<sup>a</sup> from which rises the marginal web flange 26<sup>b</sup>, for engagement in the T-shaped slots of refractories strung thereon. Spaced above the upper terminus of flange 26<sup>b</sup> is a top shelf member 26<sup>c</sup> from which rises a flanged lug 26<sup>d</sup>. Refractories strung on the hanger between the shelves 26<sup>c</sup> and 26<sup>a</sup> will be supported by the latter, and may be removed after withdrawal of the topmost one thereof, which does not have engagement with the flange 26<sup>b</sup>. Another refractory is supported on the shelf 26<sup>c</sup> and anchored in place by the flanged lug 26<sup>d</sup> which engages in its T-shaped slot. In such fashion, groups of refractories are retained by the hangers against movement inwardly or outwardly to an extent sufficient to displace or change the contour of the wall, though the individual refractories are permitted the desired amount of independent or relative movement. Moreover they are supported independently of the refractories below them, so that they will remain in place when the latter are removed. Upon the sections thus supported and retained by the hangers 26, are disposed courses of laid refractories 29, the number of such courses being variable as desired. While not directly engaged with the hangers, these laid refractories nevertheless are retained in position by those which are directly anchored, and like the latter, are supported independently, so that other refractories below their supporting shelves may be removed without necessitating their displacement. Likewise, refractories may be removed from these laid courses without disturbing those on supporting hangers above or below them.

In the embodiment illustrated in Fig. 7 the wall hangers are designated by the reference numeral 36 and are of such vertical extent that they will engage a plurality of the horizontal supporting members 37, and each will carry a number of slotted refractories, supported on the shelf portion 36<sup>a</sup> and retained by the web flanges 36<sup>b</sup>. Interposed laid brick or refractories are retained by bridge members 38 which engage in their T-shaped slots and contact the ends of adjacent refractories, to prevent inward displacement of the laid ones.

It will be appreciated that the arrangement described provides a construction wherein a

rigid frame, effectively protected from the high temperature influences of the furnace, is effective to maintain the wall refractories securely in proper relationship to preserve the desired form and contour of the combustion chamber and the proper relationship with other elements of the installation. In addition to this, by virtue of the construction, this rigid frame exercises the further useful function of actually supporting the refractories in the wall, thus relieving the refractories of what might be detrimental weight or compression. This factor contributes to the period of utility of the refractories, obviates any sacrifice of furnace volume such as might be entailed by necessity for thick supporting walls, and permits uniform conductivity through the wall at all different points. Moreover while the refractories are maintained with stability in the desired structural relationship, they have great freedom of individual adjustability within the limits requisite to accommodate their expansion and contraction with changes in temperature. This is of importance in avoiding disintegration of the refractories such as is likely to result when they are held against self-adjustment to thermal expansion or other pressure or internal strains. The great utility of the construction in permitting replacements in limited areas without requiring extensive dismantling, will be immediately appreciated. From a commercial standpoint the construction possesses a distinct advantage in the fact that a great variety of installations may be made with the same forms of refractories and hangers, the structural frame members, of course, being fabricated to meet the requirements of each particular installation. These factors are of great importance also from the standpoint of maintenance, because of the simplicity in making replacements or repairs.

I claim:

1. A furnace structure comprising column members, transverse frame members carried thereby one above another, wall hangers supported on the frame members and extending to one side thereof, refractories supported on the hangers to form wall sections supported independently one above another, certain of said refractories being slotted and having anchoring connection with the hangers to prevent the refractories shifting inwardly or outwardly.

2. A furnace structure comprising supporting columns, transverse frame members carried thereby one above another, rows of wall hangers supported on the frame members at one side thereof and at different elevations, vertical tiers of refractories supported on the hangers and anchored to the same to form wall sections one above another, and bricks removably supported on the tiers of

refractories, said bricks and wall sections being associated to form a furnace wall.

3. Furnace construction, comprising in combination, supporting columns, transverse frame members carried thereby, wall hangers carried on said frame members and arranged in horizontal series with one series above another, shelf portions on the wall hangers, a vertical tier of refractories independently supported on each shelf portion and retained thereon against dislodgment horizontally, said tiers of refractories being associated collaterally to form furnace wall sections, and brick supported on said refractories to form the upper portions of said wall sections, said brick being removable horizontally.

4. Furnace construction, comprising in combination, supporting columns, transverse frame members carried thereby, wall hangers carried on said frame members in vertical association, shelf portions on the wall hangers, a vertical tier of refractories independently supported on each hanger and retained thereby against dislodgment horizontally, said tiers being collaterally associated to form furnace wall sections, the tiers of refractories in superjacent wall sections breaking joints with those in subjacent wall sections.

5. Furnace construction, comprising in combination, supporting members, transverse frame members carried thereby at different elevations, collaterally associated wall hangers carried on said frame members in vertically associated series, said hangers having shelf portions, refractories supported on the shelf portions of said hangers in horizontally running courses to form vertically associated wall sections, said hangers having parts engaging said refractories individually to prevent their dislodgment horizontally and a course of horizontally removable refractories between adjacent wall sections.

6. In furnace construction, the combination with supporting means, of transverse frame members, wall hangers supported in collateral relationship on said frame members to form horizontal series, said series being arranged one above another, shelf portions on the wall hangers, vertical tiers of refractories supported on the shelf portions, said tiers being associated to form independently supported wall sections one above another.

7. In furnace construction, the combination with supporting members, of horizontally extending frame members arranged one above another, wall hangers sustained by each of two adjacent frame members, each hanger being in tension relationship to the upper frame member and in compression relationship to the lower frame member, and refractories supported by the hangers to form wall sections.

8. In furnace construction, the combination with supporting means, of frame members carried thereby one above another, wall hang-

ers supported on said frame members and each engaging two thereof to impart inward tension to the upper one and compression outwardly to the lower one, vertically adjacent hangers imparting respectively tension and compression stresses to the same supporting member, and refractories supported by the respective hangers in association to form wall portions.

9. In furnace construction, the combination with supporting means, of an upper horizontally extending frame member carried thereby, a lower frame member extending parallel to the upper frame member, vertically associated wall hangers, the upper wall hanger supported in tension by the upper frame member and in compression by the lower frame member, the lower wall hanger supported in tension on the lower frame member, and refractories supported by the hangers to form a wall alongside the frame members.

10. In furnace construction, the combination with supporting means, of horizontally extending frame members carried thereby one above another, a series of wall hangers supported in tension on one frame member and exerting an outward moment on a second frame member therebelow, a second series of hangers supported in tension on the said second frame member and exerting an outward moment on a third frame member below the same, the wall hangers being arranged in substantially the same plane collaterally of the frame members, and refractories supported by the hangers in the respective series to form furnace wall sections one above another in laterally spaced relationship to the frame members.

11. In furnace construction, the combination with column members, of horizontally extending frame members carried by the column members one above another, a series of wall hangers attached at their upper portions to one of the frame members and supported in compression by a second frame member therebelow, a second series of wall hangers attached at their upper portions to said second frame member and supported in compression by a third frame member below the same, the hangers of the different series being arranged in substantially the same plane collaterally of the frame members, and refractories supported on the hangers of the different series to form upright furnace wall sections one below another, some of the refractories in the different sections being anchored to the hangers to prevent their dislodgement therefrom horizontally.

12. In furnace construction, the combination with a supporting frame comprising horizontal members arranged one above another, of wall hangers supported laterally of said frame members in series arranged one above another, hangers of the upper series being hooked onto one of the frame members

and being held against outward movement by a second frame member therebelow, hangers of the subjacent series being hooked onto the said second frame member and being maintained in substantially parallel relationship by a third frame member below the same, and refractories supported by the wall hangers in the respective series to form wall sections arranged one above another collaterally of the frame.

13. In furnace wall construction, the combination with a frame including horizontally extending frame members arranged one above another, of a series of wall hangers disposed collaterally of the frame and transmitting inward pressure moments to one of said frame members and outward pressure moments to a second frame member therebelow, a second series of hangers transmitting inward pressure moments to said second frame member and outward pressure moments to a third frame member therebelow, and refractories supported on the hangers to form wall sections arranged one above another collaterally of the frame.

14. Furnace construction, comprising in combination, column members, transverse frame members joining said column members to form a self-sustaining frame structure, wall hangers supported on the frame members laterally of said frame structure, refractories carried by the hangers to form independently supported wall sections, said wall sections being associated to form a furnace chamber wall, and certain of said refractories being anchored to their supporting hangers to retain the refractories against displacement inwardly therefrom.

15. Furnace construction, comprising in combination, supporting column members, transverse frame members joining the same to form a frame structure, wall brackets supported by said frame members at one side thereof and one above another, and refractories arranged in wall sections supported by the brackets one above another in association to form a vertical furnace wall alongside said frame structure.

16. Furnace construction, comprising in combination, supporting columns, transverse frame members joining the same to form a frame structure, wall hangers suspended one above another on said frame members, refractories arranged to form wall sections supported independently one above another by the hangers, said wall sections being associated to form a vertical wall of a furnace chamber alongside the frame structure, and a furnace arch supported by said column members as a roof for said furnace chamber.

17. Furnace construction, comprising in combination, supporting columns, transverse frame members supported thereby, wall hangers supported on said frame members one above another, refractories supported by

the hangers to form a vertical wall portion spaced from the frame members, and a covering wall supported by the frame members in collateral relationship to said furnace wall to afford an intervening air chamber.

18. Furnace construction, comprising in combination, supporting columns, transverse frame members connecting the same to form a frame structure, wall hangers suspended on said frame members one above another, refractories supported on the different hangers in association to form the vertical walls of a furnace chamber and a cover wall carried by the frame members collaterally of said furnace walls, to afford an air chamber about the furnace chamber.

19. In furnace construction, the combination of horizontally extending frame members arranged in parallel relationship one above another, vertically extending wall hangers suspended on said frame members at different elevations, a plurality of refractories supported by each hanger, the refractories on the several hangers being associated to form a vertical furnace wall extending collaterally of the hangers and frame members, the hangers having portions engaging refractories supported on them to retain the refractories against displacement horizontally.

20. Furnace construction comprising, in combination, upright structural members and transverse structural members connected to form a wall-supporting frame, hangers shiftably supported on said frame at different elevations, courses of refractories supported on the hangers to form vertically associated wall sections, and means associated with the hangers and engaging the refractories to retain their inner ends in the same general plane to form the furnace wall, the several wall sections being relatively movable in the plane of the wall.

21. In furnace construction, the combination of frame members, hangers supported thereon in transversely extending rows with the rows one above another, a stack of refractories supported independently by each hanger, said hangers having retaining portions engaging the refractories to hold their inner ends in the same general plane, to form the furnace wall.

22. In furnace construction, the combination of frame members, hangers supported thereon in transversely extending rows with the rows one above another, a stack of slotted refractories supported independently by each hanger, said hangers having retaining portions engaging the slotted refractories to hold their inner ends in the same general plane, to form the furnace wall, and refractories which are free of the hangers arranged to close spaces between adjoining stacks.

23. In furnace construction, the combination with frame members, of hangers supported thereon in rows one above another, courses

of refractories supported on the hangers and anchored thereon with their inner ends in substantially the same plane to form a furnace wall, and refractories resting on top of the anchored courses and removable horizontally therefrom independently of refractories on superjacent hangers.

24. Furnace wall structure comprising, in combination, metallic frame members, hangers supported thereon in collateral relationship, courses of refractories supported by said hangers and arranged one on top of another to form an upright furnace wall, said courses including full-width refractories arranged with their lateral margins in abutment and part-width refractories disposed between some of the full-width refractories to afford channels through the wall, said hangers engaging some of the refractories to retain them against displacement horizontally from the wall.

25. In furnace construction, a wall structure comprising an outer wall and an inner refractory wall extending vertically side-by-side and spaced apart to afford an intervening air chamber, metallic supporting members supporting the inner wall and exposed in the air chamber, said inner wall being anchored to said supporting members to prevent its displacement inwardly of the furnace chamber, said inner wall having channels therethrough for admission of air from said air chamber to the furnace chamber, whereby circulation of air is induced across the metallic supporting members in the air chamber.

26. A furnace wall construction comprising a frame having columns supported on their lower ends and spaced apart in collateral alignment and horizontal shelf portions carried on said columns and arranged at different elevations, wall sections independently supported on said shelf portions one above another, said wall sections including refractories having freedom of movement on the shelf portions and anchored at their outer ends against displacement horizontally from the shelf portions, and compressible material inserted between adjoining wall sections to accommodate expansion.

27. A furnace wall construction comprising columns spaced apart alongside the furnace and having foundation support at their lower ends, horizontally extending members secured to the columns at different elevations and carrying inwardly extending shelf portions, wall sections supported on the shelf portions one above another and comprising refractories arranged one upon another and anchored at their outer ends to prevent their shifting horizontally out of the plane of the sections, and compressible material inserted between adjacent sections to accommodate expansion and protect the shelf portions from the furnace fire.

28. A furnace wall construction comprising column members standing on end and disposed externally of the furnace wall, upright tile retaining members spaced inwardly from the column members, connecting members joining the tile retaining members to the column members, inwardly extending shelves on the tile retaining members, said shelves being arranged at different elevations, wall sections independently supported on the shelves one above another and including refractories having interlocking engagement with the tile retaining members and compressible material inserted between adjoining sections to accommodate expansion.

29. A furnace construction comprising a sheathing wall, metallic tile retaining members supported at the inner side thereof, shelves on said tile retaining members extending toward the furnace chamber and arranged at different elevations, refractory wall sections independently supported on the tile retaining members one above another to form the furnace chamber wall spaced from the sheathing wall by an air chamber, the sheathing wall affording an air inlet for the air chamber and the furnace chamber wall affording ports for the passage of air from the said air chamber into the furnace chamber, the tile retaining members being exposed to the air in the air chamber.

30. A structural element for furnace walls, comprising a hanger casting consisting of a bar portion having lateral flanges along one side and a shelf portion projecting beyond said flanges at one end and arms projecting from the opposite side of said bar portion, one of said arms being formed with a hook portion at its outer end and the other of said arms being formed with a foot portion at its outer end.

31. A structural element for furnace wall construction, consisting of a hanger comprising a bar portion having a laterally extending flange along one side and a shelf projecting beyond said flange at one end and supporting arms extending from the side of the bar portion opposite the said flange, the upper arm having a hook portion at its outer end for engagement with a support, and the lower arm having a foot portion at its outer end for contact with a support.

32. A structural element for furnace wall construction comprising a bar-like body portion having tile retaining flanges along one side and a shelf portion projecting beyond said flanged side at approximately right angles to the body portion and an attaching arm extending from the opposite side of the body portion.

33. A furnace wall construction comprising, in combination, a frame disposed outside the furnace chamber, wall sections supported independently on the frame one above another to form a wall at one side of the

frame, said wall sections composed of refractories arranged in courses, and tile retaining members affixed to the frame and having anchoring engagement with wall refractories to retain them against displacement horizontally from the plane of the sections but permitting their disengagement by vertical movement toward superposed sections.

34. A furnace wall construction comprising, in combination, a metallic frame including column members connected by horizontal section-supporting members, wall sections supported independently on the frame one above another to form a wall at one side of the frame, said wall sections composed of refractories arranged in courses, tile retaining members affixed to the frame and having anchoring engagement with refractories in the sections such as to hold them against displacement horizontally from the plane of the sections but permitting their disengagement by vertical movement toward superjacent sections.

35. A furnace wall construction comprising, in combination, a frame made up of metallic column members connected by horizontal members arranged collaterally of the furnace chamber, wall sections supported independently by the frame one above another, said wall sections composed of refractories arranged in courses, tile retaining members affixed to the frame and anchoring refractories in the sections against horizontal displacement while permitting them to shift vertically, the refractories of adjoining sections being arranged to afford expansion joints accommodating upward expansion of the sections relative to refractories of superjacent sections.

36. Furnace construction comprising in combination, columns arranged along the furnace chamber, horizontal supporting members connected to the columns and disposed at the side thereof toward the furnace chamber, wall sections carried by the supporting members and arranged one above another to form a portion of the furnace chamber wall, said wall sections being formed of refractories arranged in courses, and tile retaining members affixed to the supporting members and engaging some of the refractories to hold them against displacement horizontally from the wall.

37. A furnace wall construction as specified in claim 36 and in which refractories of adjoining sections are arranged to afford expansion joints accommodating vertical expansion of one section relative to the other.

38. Furnace wall construction comprising, in combination, a structural frame including horizontal members, hangers supported on said members in horizontally running series disposed one above another, said hangers having shelf portions disposed laterally of the frame, and refractories supported on said

shelf portions and forming a wall portion of the furnace chamber, some of the refractories being anchored to the hangers to hold such refractories against displacement horizontally.

39. Furnace wall construction as specified in claim 38 and including an outer wall supported by the frame in laterally spaced association with the furnace chamber wall to afford an intervening air duct.

40. A furnace wall construction comprising in combination, a structural frame including horizontal members, hangers supported on said members in horizontally running series disposed one above another, said hangers having shelf portions and lateral flanges disposed inwardly from the frame, and refractories supported on said shelf portions and forming a wall portion of the furnace chamber, some of the refractories being anchored to said flanges.

41. Furnace wall construction comprising, in combination, a structural frame including horizontal members, hangers supported on said members in horizontally running series disposed one above another, said hangers having shelf portions disposed inwardly from the frame, and refractories supported on said shelf portions and forming independently removable wall sections, one above another, some of the refractories being anchored to the hangers to hold said refractories against displacement horizontally.

42. Furnace wall construction as specified in claim 41 and wherein the wall sections are arranged with expansion joints therebetween to accommodate vertical expansion of the sections.

43. A furnace wall construction comprising, in combination, a structural frame including horizontal members arranged collaterally of the furnace chamber, hangers supported on said members and extending therefrom toward the furnace chamber, said hangers arranged in horizontally running series disposed one above another, shelf portions on the hangers, and refractories supported on the shelf portions and forming a portion of the furnace chamber wall, some of the refractories being anchored to the hangers to hold said refractories against displacement horizontally.

44. In furnace wall construction, the combination with a support, of a hanger having a laterally projecting arm with a hook engaging the support, a shelf at the lower portion of the hanger, and tile supported on the shelf, whereby the weight of the tile tends to swing the lower portion of the hanger toward the support.

45. In furnace wall construction a combination as specified in claim 44 and wherein some of the tile are anchored to the hanger to hold them against horizontal displacement.

46. In furnace construction, the combination with a support, of a hanger disposed laterally of the support and shiftably engaged therewith at its upper end, a shelf projecting from the hanger on the side opposite the support, and tile supported on the shelf so that their weight tends to swing the lower portion of the hanger toward the support.

47. In furnace construction, the combination with a support, of a hanger depending at the side of the support, said hanger having shiftably connection at its upper end with the support and lateral abutment with the support below said connection, a shelf projecting from the hanger on the side opposite the support, and refractories supported on said shelf to form a wall portion spaced laterally from the support.

48. In a furnace structure, in combination, a wall supporting frame disposed laterally of the furnace chamber, a furnace chamber wall comprising sections arranged one above another and each supported independently on said frame, means anchoring said sections against horizontal displacement and a sheathing wall comprising sections independently supported on said frame and spaced collaterally of the furnace chamber wall.

49. A furnace structure comprising, in combination, a frame disposed collaterally of the furnace chamber, said frame including horizontal members, independently supported wall sections supported on said horizontal members collaterally of the frame to form the furnace chamber wall, means anchoring said sections against displacement horizontally and a sheathing wall composed of independently supported sections carried on the horizontal members collaterally of the furnace chamber wall.

50. A furnace structure comprising, in combination, a sheathing wall, a furnace chamber wall spaced collaterally from the sheathing wall to afford an intervening air chamber, frame members for supporting the furnace chamber wall, and metallic members connecting said frame members and furnace chamber wall, said metallic members being partly embedded in the furnace chamber wall and having substantial areas exposed in the air chamber.

51. A furnace structure comprising, in combination, a frame arranged collaterally of the furnace chamber, a sheathing wall sectionally supported on said frame, and a refractory furnace chamber wall sectionally supported on said frame in collaterally spaced relationship with the sheathing wall, said refractory wall having expansion joints between superposed sections.

52. A furnace wall structure comprising a plurality of hangers disposed parallel in series with the series one above another, said hangers having marginal flanges, and parallel-sided tile supported by said hangers and arranged in superimposed courses in association to form a furnace wall portion, said tile having medial T-shaped slots at one end in which the hanger flanges are engaged.

53. A furnace structure comprising, in combination, columns ranged along the furnace chamber, horizontal frame members connecting the columns and disposed one above another, hangers supported laterally by said horizontal members, each of the hangers having cooperation with two of said horizontal members, and refractory wall sections supported by the hangers in laterally spaced relationship with said frame members.

54. In furnace wall construction, in combination, a wall supporting frame, a sheathing wall, wall sections independently supported on the frame and associated to form a furnace chamber wall, said wall sections comprising refractories anchored against horizontal displacement, certain of said refractories being arranged to afford air inlet ports through the furnace chamber wall.

55. A furnace structure comprising, in combination, a frame, a sheathing wall, a furnace chamber wall spaced collaterally from the sheathing wall to afford an intervening air chamber, said furnace chamber wall being formed of refractories arranged in wall sections, metallic members supported on the frame and supporting adjacent chamber wall sections independently, said metallic members having anchoring connection with refractories in the wall sections and having heat radiating portions exposed in the air chamber.

In testimony whereof I have hereunto subscribed my name.

RAYMOND D. FOLTZ.

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### DISCLAIMER

1,747,822.—*Raymond D. Foltz*, East Orange, N. J. FURNACE CONSTRUCTION.  
Patent dated February 18, 1930. Disclaimer filed May 21, 1938, by the  
assignee, *M. H. Detrick Company*.

Hereby enters this disclaimer to claims 1, 2, 3, 7, 14, 15, 17, 23, 26, 27, 35, 36,  
37, 38, 39, 41, 43, 48, 49, 50, 51, 53, and 55 of said Letters Patent.  
[*Official Gazette June 14, 1938.*]