Sept. 6, 1932. F. I. SHEAHAN 1,875,667

FURNACE WALL CONSTRUCTION

Filed Jan. 27, 1930

Fig. 1.

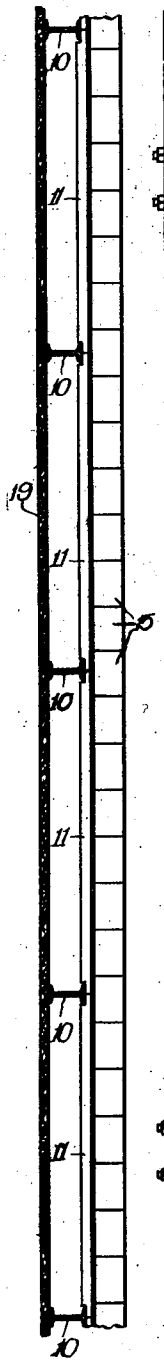


Fig. 2.

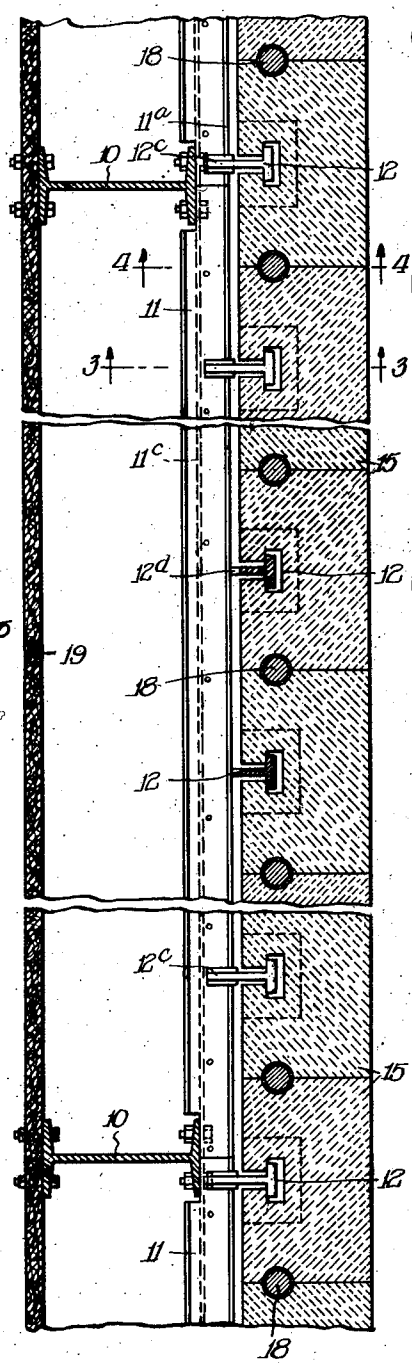


Fig. 3.

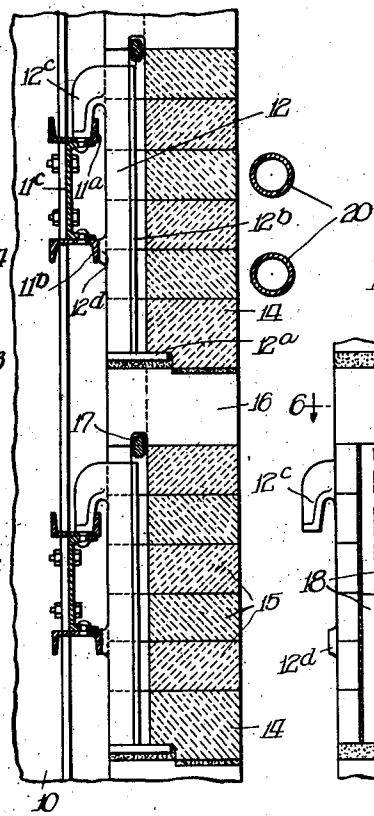


Fig. 4.

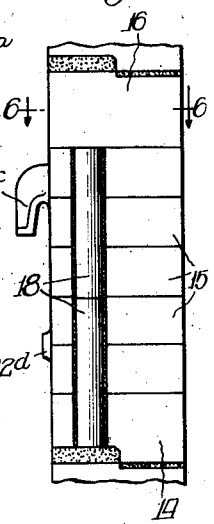


Fig. 5.

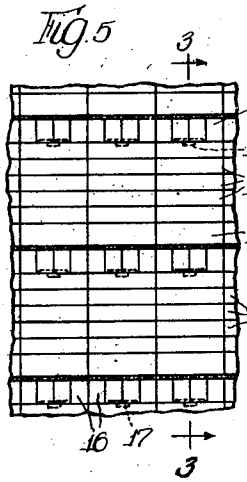
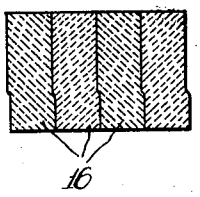


Fig. 6.



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UNITED STATES PATENT OFFICE

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FURNACE WALL CONSTRUCTION

Application filed January 27, 1930. Serial No. 423,713.

This invention relates to the construction of furnaces or heating or combustion chambers, such as boiler furnaces, oil stills, and the like, having walls of refractory material such as fire brick.

A general object of the invention is the provision of a refractory wall construction in which the wall refractories are afforded definite support and anchorage, the supporting framework is afforded suitable protection against injury from heat, the wall is practically proof against gas leakage, and the structure may be built at comparatively low cost.

A particular object of the invention is the provision of a construction for sectional supported walls which are carried on a metallic frame, and wherein the amount of material required for the frame to support a wall of given weight may be very substantially reduced from that heretofore requisite in walls of that type.

Another particular object is the provision of improved features or structural elements in such wall construction whereby the advantages indicated above may be attained.

Other and further objects of the invention will be pointed out or indicated hereinafter, or will be apparent to one skilled in the art upon an understanding of the invention or its employment in practice.

For the purpose of aiding in a description of the invention, I illustrate in the accompanying drawing forming a part of this specification, and hereinafter describe, certain examples of construction embodying the invention. It is to be understood, however, that these are presented for purpose of illustration only, and are not to be accorded any interpretation calculated to limit the claims short of the true and most comprehensive scope of the invention in the art.

In the drawing,

Fig. 1 is a cross section through a portion of a furnace wall of a length, for example, of thirty feet;

Fig. 2 is a cross section on a larger scale;

Fig. 3 is a part sectional elevation on substantially line 3—3 of Fig. 2;

Fig. 4 is a detail in the nature of a part sectional elevation on line 4—4 of Fig. 2;

Fig. 5 is a detail showing a portion of the interior wall surface in elevation; and

Fig. 6 is a cross sectional detail on substantially line 6—6 of Fig. 4.

The art is familiar with various types of furnace wall construction wherein the refractories which constitute the furnace chamber wall proper are arranged in sections which are supported independently of one another on an exterior framework, and the refractories are anchored in place to prevent their inadvertent dislodgement from the wall. In installations wherein the wall refractories are exposed directly to the maximum furnace temperatures, it is customary to afford such walls an external air cooling to prevent the temperature of the wall refractories being raised to a point at which they would be rapidly destroyed by fusion or slagging. In some types of installations, however, the wall refractories are to a greater or less extent shielded or protected from the extreme high furnace temperatures by water tubes which are arranged within the furnace chamber in juxtaposition to the interior wall surface and form part of the boiler circulatory system. Also in some types of furnaces, petroleum stills, for example, the furnace temperatures are not extremely high, but the function of the refractory wall is none the less important, not only in confining the furnace gases and inducing combustion thereof, but also in effecting the desired radiation of heat to the still tubes. Refractory walls for furnaces of this type may be made somewhat thinner than is requisite for furnaces operating at high temperatures.

The present invention provides a construction for a frame supported sectional wall which possesses all of the advantages of flexibility, facility of installation and repair, durability and interchangeability of parts, and yet which may be constructed and maintained at very low cost, as compared to the cost of frame supported sectional walls generally. This highly important result is obtained primarily by improvements in the construction and assembly of the elements

which support and anchor the wall refractories, by virtue of which it is possible to obtain the requisite stiffness and stability of the frame structure with appreciably less material than heretofore regarded as necessary to give the proper factor of safety.

The nature of the invention will be most quickly understood by reference to the illustrative embodiments shown in the drawing. Let Fig. 1 be regarded as representing a stretch of wall of considerable extent, say of a length of thirty feet, the same forming a part of a furnace or combustion chamber such as a radiant petroleum still, for example. Along the wall, at appropriate intervals, are arranged the frame columns 10, suitably supported in upright position. These form the principal supporting members of the wall structure. As illustrated, for the purpose of demonstrating one of the important advantages attained by the present invention, these column members, assuming this section of wall to be thirty feet in length, are placed at intervals of seven and one-half feet. For convenience in the manufacture and assembly and interchangeability of parts of the structure, it is desirable that the spacing of these columns be uniform. Fixed to and supported by these column members are stretcher members 11, which extend horizontally from one column to another. As best seen in Fig. 3, these stretcher members have upper flanges 11^a and lower flanges 11^b which are parallel and preferably lie in the same plane, and which flanges are spaced apart by a considerable interval that is spanned by a web portion 11^c. These stretcher members may be made quite economically and conveniently of three channel sections riveted together in the relationship shown. Thus a member is provided which is reversible, its upper and lower halves being identical. The length of the stretcher members is sufficient to extend from center to center of adjacent columns, and outer corner portions of the upper and lower channel members may be notched out to accommodate the column flanges. They are attached to the flanges of the columns by bolts passing through the webs 11^c. Thus horizontal series of the stretcher members may be mounted on the columns in parallel relationship one above another. The stretcher members constructed as shown have very decided stiffness across both their axes, for the amount of metal which they contain, and thus may be depended upon to support extensive spans of the suspended wall without appreciable deflection either inwardly, outwardly or downwardly. This permits the spacing of the column members by substantial intervals, thus minimizing the number of such column members requisite for a given extent of wall.

The refractory wall is of sectional construction, the sections being supported independently one above another so that the weight of one is not imposed on those below it, expansion of respective sections is accommodated, and sections or parts thereof may be removed and replaced independently. For supporting and anchoring the wall refractories, tile retaining brackets or hangers are provided, as of the form illustrated best in Fig. 3. The form here shown comprises a bar-like body portion 12 having a shelf member 12^a at the lower end and lateral flanges 12^b along one margin. From the opposite margins of the body portion projects a hook arm 12^c, at the upper end of the body member, and a spacing projection 12^d at a distance below the hook arm. These tile retaining hangers or brackets are preferably made of cast iron. The length and relationship of the hook arm 12^c and spacing projection 12^d are such that when the former is engaged with the upper flange 11^a of a stretcher member, the spacing projection 12^d will engage the outer face of the lower flange 11^b. Thus the tile retaining hangers may be suspended in series on the respective stretcher members, with the hangers occupying a vertical position and with the body portion spaced away from the stretcher members. The refractory tiles 14 and 15 are supported on the hangers with the lateral faces of tiles on juxtaposed hangers in abutment. These tiles are generally of rectangular form with T-shaped slots at their outer ends, which slots accommodate the body portion 12 and the flanges 12^b of the hangers with sufficient clearance to allow a slight mobility of the tiles with respect thereto. The tiles are slid onto the upper ends of the flanges and body portion and are retained against dislodgment by the engagement of the flanges in their slots. The tiles 14, which are at the bottom of the hangers, have depending portions which extend across the inner margins of the shelves 12^a for sealing cooperation with refractories on the subjacent section. The vertical spacing of the stretcher members, and hence of the hangers, is such that there is sufficient space between the hangers to permit the insertion and removal of tiles 14 and 15 in any section without disturbing the superjacent section. The upper course of each section is formed of the tiles 16 which are considerably smaller than the tiles 15. The tiles 16 have an upstanding portion adjacent their outer ends adapted for overlapping cooperation with the depending portions of the tiles 14 and 15 of the superjacent section to form a sliding joint, and an expansion space is left between the course of tiles 16 and the tiles 14 and brackets of the superjacent section to allow for vertical expansion of the lower section without imposing strains on the refractories in the superjacent section. This expansion space is filled with a compressible sealing material,

such as a mixture of fire clay and asbestos. The tiles 16 have transverse notches in their lower faces adapted to align with the head portion of the T-shaped slots of the tiles 15, and may be anchored in place by means of anchor castings 17 which fit into the slots of the tiles 15 and extend to the sides thereof and register in the slots of the tiles 16. These anchor casting may be of the type disclosed in the co-pending application of Raymond D. Foltz, Serial No. 135,747, filed September 16, 1926. They are disposed at intervals, as illustrated in Fig. 5, leaving certain of the tiles between them free for removal outwardly from the wall, thus affording space for disengagement of the anchored ones from the anchor castings 17 by movement laterally in the wall. The tiles 16 may be formed with laterally offset shoulders and depressions, as illustrated in Fig. 6, in order to form a tortuous joint between them and thus increase the tightness of the seal against gas leakage. In order to increase the tightness of the joint between laterally abutting tiles 14 and 15, those tiles may be formed with grooves in their side margins, as of the form shown in Fig. 2, and sealing keys or plugs 18 inserted in the openings afforded by these grooves. After a number of the courses of tiles 14 and 15 have been laid, these plugs or keys may be inserted from the top after being doped with fluid fire clay. In various installations this matter of tight joints is of importance, both as a measure for protecting the external metal work of the frame and to prevent the ejection of gas into the air space outside the refractory wall on the occasion of explosions which are likely to occur periodically when the furnace is fired with liquid or pulverized fuel sprayed into the combustion chamber. Since the air circulated in such air space is usually brought back into the combustion chamber with the fuel to serve as primary combustion air, it is of importance that it be as free as possible from inert or partially consumed combustion gases. In order to enclose the air circulating space at the outer side, so as to form circulating ducts, an external sheathing 19 of suitable material, such as refractory insulating board, may be attached by bolts to the outer flanges of the column members 10.

It will be observed that by virtue of this construction the wall tiles are all definitely anchored in the wall so as to prevent their shifting inwardly into contact with tubes 20 which may be arranged in association with the inner wall surface, and to maintain the proper relationship of such surface to the tubes to obtain the desired heat radiating effects upon the latter. Although thus anchored against dislodgment, the refractories have a desirable freedom of movement permitting their adjustment relative to one another to accommodate expansion, and the respective sections have likewise a desirable latitude for expansion. At the same time the construction maintains tight joints between all of the abutting refractories.

It will be observed that although advantage is gained by this construction in permitting the overall thickness of the wall from the interior surface to outside of the sheathing 19 to be limited, none of the supporting steel work is in direct contact with the wall refractories or with other members which are in contact with the refractories. The actual heat conductive connection between the stretcher members and the wall hangers is very small, consisting only of the limited areas of contact between the hooks 12^e and projections 12^a of the hangers and the stretcher members 11. Excepting for these very small areas of contact, the stretcher members are completely exposed to the circulation of cooling air within the air circulating space, as are also the column members, and although the eccentricity of the wall sections with respect to the column members is small, the latter are spaced away from the wall refractories by a distance sufficient to permit effective ventilation and cooling. This effective cooling and minimizing of heat conduction from the refractory wall to the frame members permits a substantial reduction in the weight of the supporting frame members.

By virtue of the construction, as pointed out above, the stretcher members may be fabricated from standard sections of rolled steel channel members, and thus may be formed with strict uniformity and with definitely known strength, as contrasted to cast members, which usually show variations in dimensions and are likely to contain concealed air holes which render their strength a matter of conjecture. By forming the stretcher members with the bearing points for the hangers spaced apart vertically a substantial distance, the tortional leverage exerted on them by the weight of the wall sections is substantially reduced and the stability of the structure is materially increased.

What I claim is:

1. Furnace wall structure comprising in combination, upright frame members spaced apart along the furnace, a horizontally extending channel member attached to adjacent upright members with its web in upright position, angle members extending along the upper and lower sides of the channel member and attached to the flanges thereof to form therewith a stiff stretcher member, hangers arranged at one side of the stretcher members and each having bearing engagement with the angle members at the upper and lower sides thereof, and refractories carried on the hangers to form a wall portion entirely spaced collaterally from the upright and stretcher members.

2. Furnace wall structure comprising in combination, upright frame members spaced alongside the furnace, horizontally extending channel members spaced apart vertically, a horizontally extending web member attached at its upper and lower sides to the channel members and having supporting connection with the upright frame members, hangers disposed at one side of said channel members and each having supporting engagement with both the vertically spaced ones, and refractories supported on the hangers to form a furnace wall portion alongside the channel members and entirely spaced therefrom.

3. In furnace wall structure, the combination of parallel upright frame members, a horizontal stretcher member connected to the upright members and having portions at its upper and lower sides disposed partly between and extending partly beyond the upright members, hangers supported on said extending portions of the stretcher members and depending at the side of the latter, and wall refractories supported on and anchored to the hangers with their outer faces in proximity to but spaced from the stretcher members.

4. In furnace wall structure, the combination of parallel upright frame members arranged alongside the furnace, a horizontal stretcher member connected to the upright members and having a web portion disposed in a vertical plane and laterally extending stiffening portions disposed partly between the upright members and partly beyond the furnace side thereof, hangers extending vertically alongside the stretcher members and supported on said stiffening portions, and wall refractories supported on and anchored to the hangers with their outer faces in proximity to but spaced from the stretcher and upright members.

5. In a furnace, a wall construction comprising, in combination, upright frame members, a stretcher member extending horizontally from one to another of said upright frame members, said stretcher member having a web portion disposed in a vertical plane and attached to the upright frame members and stiffening portions extending transversely of the web portion along its upper and lower margins, hangers extending vertically alongside the stretcher member and supported thereon in contact with its upper and lower stiffening portions, and refractories supported on the hangers to form a wall portion alongside and spaced from the vertical frame and stretcher members.

In testimony whereof I have hereunto subscribed my name.

FRANK I. SHEAHAN.