June 2, 1925. 1,540,069

L. H. HOSBEIN

FURNACE CONSTRUCTION

Filed Jan. 5, 1922

Fig. 1

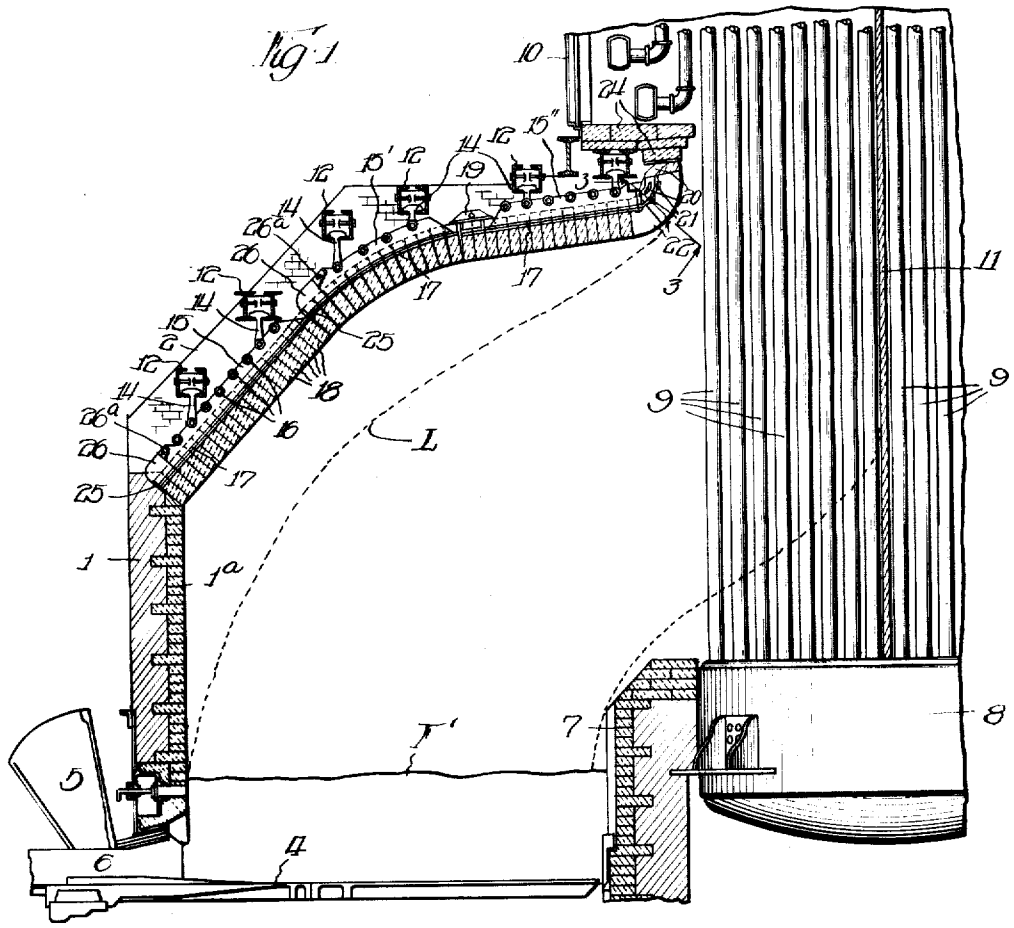


Fig. 2

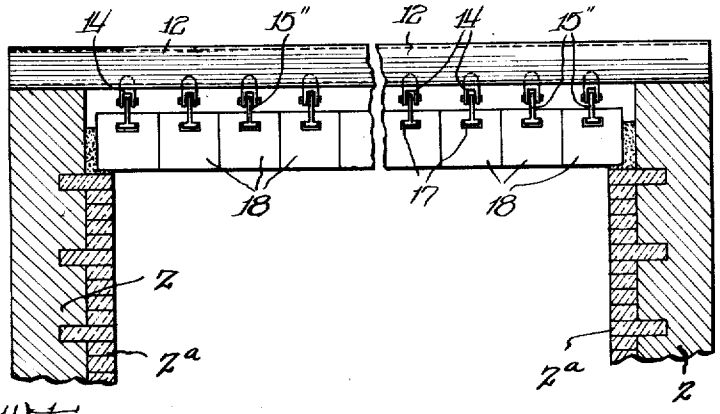
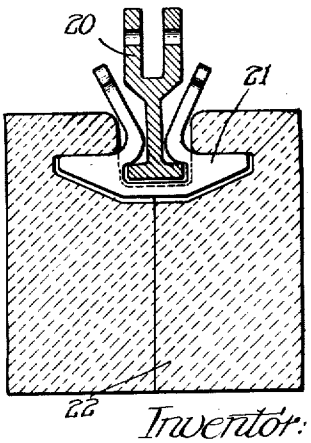


Fig. 3



Witness:
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attys.

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UNITED STATES PATENT OFFICE.

LOUIS H. HOSBEIN, OF CHICAGO, ILLINOIS, ASSIGNOR TO M. H. DETRICK COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

FURNACE CONSTRUCTION.

Application filed January 5, 1922. Serial No. 527,248.

To all whom it may concern:

Be it known that I, LOUIS H. HOSBEIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnace Constructions, of which the following is a specification.

This invention relates generally to furnace construction, and particularly to improvements in the construction of boiler furnaces, the salient feature of the invention residing in a new and improved construction and arrangement of the furnace arch.

The general purpose of the invention is the provision of an improved construction of boiler furnaces which will contribute to the efficiency of furnaces having deep fire chambers and facilitate the upkeep of the arches constituting a part of such furnaces.

A more particular object of the invention is the provision of a construction which will attain the result first above specified by reducing the volume of cold space in a furnace of the type mentioned and by increasing the outlet area to the boiler passages.

Another particular object of the invention is the provision of a construction which will contribute to the result second above mentioned by the employment of an arch construction of the suspended type, whereby the original installation and replacements are facilitated, and by the construction of such suspended arch in such fashion as to protect the exposed surface portions to the greatest degree against the destructive influences of the heat and the erosive action of the draught gases and products of combustion.

Another important object of the invention is the provision of a new and improved arch construction of the suspended type which will contribute to the accomplishment of the aforementioned objects, and which will require in its construction minimum variety in the types or forms of requisite parts, and particularly minimum variety in the types of fire brick or tile utilized to form the heat resisting surface.

Another specific object is the provision of such a construction of arch which may be installed with facility in previously existing furnaces not designed particularly for such arch.

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 pertaining to such structures upon an understanding of the present disclosure. For the purpose of the present application I have illustrated in the accompanying drawings forming a part of this specification a certain embodiment of my invention as applicable particularly to a furnace designed for a boiler of the Wicks vertical tube type. It is to be understood, however, that this disclosure is here presented for its illustrative purpose only, and not with the idea that it is exhaustive of all forms in which the invention may be embodied or of all installations in which it may be incorporated. Therefore the disclosure is not to be construed in any sense such as would operate to limit the invention hereinafter claimed, short of its true and most comprehensive scope in the art.

In the said drawings—

Fig. 1 represents a sectional side elevation of a furnace;

Fig. 2 is a section approximately on the line 2—2 of Fig. 1; and

Fig. 3 is a section approximately on the line 3—3 of Fig. 1.

In view of the foregoing statement of the general nature of the invention, further understanding thereof may best be had by reference to these drawings in detail. By notation of the reference characters applied it will be understood that the numeral 1 designates the front wall of the furnace having its inner facing of fire brick 1^a, and that the numerals 2 designate the side walls having their inner facings of fire brick 2^a over their area within the fire chamber. The numeral 4 designates fuel supporting portions, with which may be associated a suitable stoking mechanism, such as the underfeed stoker of well known type illustrated, which includes the hopper 5 and the ram cylinder 6, wherefrom fuel may be fed to the fuel bed. The surface line of the latter is illustrated approximately by the line F. At the rearward termination of the grate is a low bridge wall 7 back of which the boiler is set, and here illustrated in part only by the mud drum 8, tubes 9 and front structure including the flue opening 10. A customary vertical baffle 11 is interposed between the lower portions of the front tiers and the rear tiers of the tubes 9.

For the support of the arch, a plurality of

hanger beams 12 are laid so as to extend transversely of the furnace, and are suitably supported at their ends, as upon the side walls. Each of the beams supports a series of hangers 14 suspended thereon for sliding and pendulous movement, and on these hangers are slung the arch bars which extend longitudinally of the furnace. I have illustrated herein three types of these bars comprising a series of straight front bars 15, a series of curved intermediate bars 15′ and a series of straight rear bars 15″. As illustrated in Fig. 1 each bar has a plurality of pin seats 16 in its web affording selective points of attachment for the hangers 14; and, as illustrated in Fig. 2, each bar has laterally projecting flanges 17 along the lower margin of the web, affording connecting elements for supporting the arch tile upon the bars. The arch tile 17 are made of refractory material, and are of uniform shape and dimensions within allowable limits. They are rectangular, relatively thin, and formed with slot ways adapted to accommodate the web and flanges of the arch bars, so that the tile may be slid onto the latter and find pendulous or rocking support thereon.

As contemplated by my invention, the relative disposal of the hanger beams 12 is such that the front bars 15 will be suspended in a rather steeply slanting position, abutting the front wall 1 at their forward ends. The intermediate bars 15′ are supported in such disposal that they will abut the rearward ends of the aligned front bars, and they are preferably curved in a vertical arc so as to follow a rearward ascending course. The rear bars 15″ are supported adjacent the rearward extremities of the intermediate bars, and may abut the latter, or may be spaced therefrom by an interval which may be spanned by a bridge bar 19 which finds support at its extremities on the adjacent tile on the intermediate and rear bars, which bridge bar is formed to support one or more tile filling the interval between the adjacent end tile on the bars last mentioned. The rear bars 15″ are preferably hung so as to slope slightly upwardly from front to rear, and support at their rearward extremities the end brackets 20. These brackets carry lateral longitudinally extending flanges which support the laterally projecting brick hangers 21 upon which segmental brick 22 are suspended in such association as to form an arcuate rear end for the arch, carrying it up to the apron or sill tile 24. This rear end construction constitutes a distinct invention which is fully described and claimed in my co-pending application Serial No. 489,411 filed August 3, 1921. The lower ends of the bars are preferably provided with stop members 25 which contact the forward faces of the front end tile on the bars, and thereby retain the tile on the bars at the proper inclinations and in contact to preserve the continuity of the arch. These stops may be formed on separable end extensions 26 of the bars connected thereto by the keys 26ª. This construction permits the bringing of the front end of the arch down a substantial distance below the upper limit of the passage from the furnace chamber into the boiler passages, and thereby permits the use of a very low front wall. This is of distinct advantage in the matter of repair and upkeep, as well as in the matter of original cost, as the relining of the low front wall, which is required periodically, necessitates the tearing out of very much less material than in the case of the high front walls heretofore employed. This arrangement, furthermore, eliminates substantially all of the cold space at the front of the furnace chamber, as the surface of the arch formed by the tile supported on the front bars follows approximately the flame line of the products of combustion when the furnace is in operation. The construction, furthermore, permits a substantial reduction of the area of the side walls within the furnace chamber, permits the use of lower side walls at the forward portion of the furnace, and thereby greatly decreases the cost of installation as well as the cost of upkeep and repair, as above pointed out. The tile supported on the intermediate bars 15 are disposed in such relationship that the juxtaposed tile are in contact at their lower portions, whereby, due to the vertical curvature of these bars, juxtaposed tile will be spaced apart slightly at their upper portions. These spaces are filled with ganister or other suitable refractory material. The rear bars 15″ are hung so that their rearward extremities will be as high as possible, allowing, of course, for the rear end fan construction to complete the rear end of the arch. This makes it possible to obtain an opening of large area between the furnace chamber and the boiler setting, whereby radiant heat from the furnace chamber and the sloping arch is rendered effective on the boiler surfaces. The construction of the arch in this fashion with the curved portion over the grate is of distinct advantage in several particulars. In the first place, it affords a contour for the arch which prevents the intersection of the flame line by any part of the arch, thus removing the tile from positions where they would be subject to rapid disintegration by the heat and erosion. In the second place, it permits radical differences in the slope and elevation between different portions of the arch, while maintaining a substantially smooth and regular surface formed conjointly by the ends of the tile. This produces an arch construction which is more durable than constructions in which the courses or refractories are cor-

beled or arranged with their ends in jutting relationship. It also permits the desirable pendulous suspension of all of the tile in the arch, so that each tile is free to adjust itself. Moreover, the construction attains these results while permitting the major portion of the arch to be carried on straight bars, thereby securing full surface contact between the juxtaposed tile throughout all but a relatively small portion of the structure. It enables the suspension of the front portion of the arch, at the front of the combustion chamber opposite the boiler opening, at a comparatively steep inclination, so that it affords an effective reflecting and radiating surface for projecting reflected and radiant heat from the combustion chamber through the boiler opening and upon the heat exchange surfaces of the boiler, while at the same time giving the requisite height above the grate to afford the necessary combustion volume. The construction moreover affords a space above the general flame line which is conducive to the production of whirls which tend to retain suspended carbon within the furnace until combustion thereof is completed. It will be noticed, by reference to Fig. 1, wherein the flame line is indicated roughly by the line designated L, that this whirl space is above the hot portion of the fuel bed, by virtue of which circumstance the suspended carbon particles are maintained at the requisite incandescence until oxygenation is completed.

In addition to the special advantages above mentioned, this construction maintains all of the advantages pertaining to suspended arches in general, including facility of installation and repair, and, moreover, this special form of arch renders feasible the use of a single form of tile throughout the arch proper, excluding, of course, the special rear end construction illustrated, which in itself requires but a single additional form of tile. The construction, moreover, avoids absolutely the formation of sharp corners or projecting turns in the surface exposed to the combustion gases, thereby reducing deterioration to a minimum. Any portion of the front or side walls may be relined without necessitating the removal of a single tile from the arch, and the arch likewise may be repaired without the necessity of wrecking any of the wall portions. By the use of the independently removable members such as the bridge bar 19 and the end extensions 26, tile may be removed and replaced in any part of the arch without necessitating the removal of a large number of tile ahead of it. It is to be observed, therefore, that the features constituting what I claim to be my invention will contribute materially both to the efficiency of operation of the furnace and economy in its construction and maintenance. Certain features herein disclosed but not claimed are claimed in a co-pending application Serial No. 489,411 filed August 23, 1921.

I claim:

1. In a furnace construction including front and side walls, an arch comprising the combination of a series of front arch bars extending longitudinally of the furnace and suspended in sloping position with their lower extremities in association with the front wall, a series of rear arch bars extending longitudinally of the furnace and suspended at the rear portion thereof at an angle to the front arch bars, a series of vertically curved arch bars disposed intermediate said front and rear series, and tile suspended on the several arch bars, said tile cooperating to form the top wall of the furnace in a contour arching upwardly from front to rear thereof.

2. In a furnace construction including front and side walls, an arch including a series of rear arch bars suspended at the rear of the furnace and extending in a direction longitudinally thereof, a series of front arch bars suspended at the front of the furnace in sloping position at an elevation below that of the rear arch bars, the lower extremities of said front arch bars being associated with the front wall, curved arch bars supported intermediate said front and rear arch bars, and tile suspended on the several arch bars, the tile on the curved arch bars cooperating with those on the front and rear arch bars to form a continuous top closure for the furnace.

3. In a furnace having a wall and a draught outlet oppositely disposed, an arch extending intermediate the two to form a top closure for the furnace chamber, said arch including a series of front arch bars suspended adjacent the wall and extending upwardly therefrom in a direction longitudinally of the furnace, a series of rear arch bars suspended adjacent the draught outlet and extending forwardly and downwardly, intermediate arch bars disposed between said front and rear series in arcuate arrangement, and tile suspended on the several arch bars and cooperating to form a continuous closure extending from the wall to the draught opening.

4. In a furnace, the combination of straight arch bars and curved arch bars disposed in alignment longitudinally of the furnace, means suspensibly supporting said arch bars, tile supported on the arch bars in suspension below the same, said tile on the straight and curved bars cooperating to form a continuous fire resisting surface.

5. In a furnace arch, the combination of straight arch bars and curved arch bars disposed in alignment longitudinally of the furnace, means above said arch bars for suspensibly supporting the same, identical

tile suspended on said arch bars and co-operating to form the furnace roof below said roof bars, the tile on the curved bars forming an arcuate area in the fire surface of the arch.

6. In a furnace construction the combination of a series of front arch bars extending longitudinally of the furnace, a series of rear arch bars disposed in longitudinal alignment with the front arch bars but in angular relationship thereto vertically, a series of intermediate arch bars disposed between the front and rear series, said intermediate arch bars being curved in a vertical arc terminating adjacent the rearward extremities of the front arch bars and forward extremities of the rear arch bars, and tile suspended on the several bars and cooperating to provide a continuous arch wall.

7. In a furnace construction the combination of a series of front arch bars extending longitudinally of the furnace, a series of rear arch bars disposed in alignment with the front arch bars, a series of intermediate arch bars disposed between the front and rear series, said intermediate arch bars being curved in a vertical arc terminating adjacent the rearward extremities of the front arch bars and forward extremities of the rear arch bars, and tile of uniform size and form suspended on the several bars and co-operating to provide a continuous arch wall.

8. In a furnace arch construction, in combination collaterally arranged arch bars suspended at an inclination, other arch bars suspended above and in alignment with said first mentioned arch bars, refractories suspended on the respective arch bars, and stops on the higher arch bars supporting the refractories thereon to prevent their weight being imposed on the refractories on the lower arch bars, the refractories on the several bars co-operating to form a fire resisting wall between the arch bars and the furnace chamber.

9. In a furnace, a series of rear arch bars, a series of front arch bars associated with the rear arch bars but arranged at different elevation and on a different slope, a series of intermediate arch bars arranged between the rear and front arch bars but having a slope different from that of the other arch bars, and tile pendulously supported on said arch bars in association to form the furnace arch having a substantially smooth fire surface of variant slope.

10. In a furnace, the combination of arch supports arranged above the combustion chamber, refractories suspended therefrom to form a flat arch portion, curved arch bars associated with said flat arch portion and having their concave sides toward the furnace chamber, tile pendulously supported on said curved arch bars in collateral relationship, and means at the lower ends of said curved arch bars for cooperation with said tile to maintain them in position to form a concave arch portion in prolongation of the flat arch portion.

11. In a furnace, a combustion chamber having a boiler opening of approximately its entire height, rear arch bars arranged over the combustion chamber with their rearward ends at the boiler opening, curved arch bars extending from adjacent the forward ends of the rear arch bars forwardly and downwardly, with their concave sides toward the combustion chamber and refractories suspended on said arch bars in association to form a roof portion for the combustion chamber, the refractories on said curved arch bars forming a concave arch portion in said roof extending downwardly in front of part of the boiler opening.

12. In a furnace, a combustion chamber having a boiler opening of approximately its full height and width, with refractories suspended over a portion of the chamber to form a rear arch portion sloping downwardly and forwardly from the top of the boiler opening, and other refractories suspended in front of said rear arch portion to form a concave arch portion in continuation thereof and depending in front of a portion of the boiler opening, said arch portions being of uniform elevation on transverse lines.

13. In a furnace arch construction, the combination of arch bars arranged in alignment but at different inclinations, refractories pendulously supported on said arch bars and cooperating to form a fire-resisting wall of variant slope between the arch bars and the furnace chamber, and stop members arranged at the lower ends of aligned arch bars for sustaining the refractories thereon at different angles.

14. In a furnace, a combustion chamber having a boiler opening of approximately its entire height, in combination with a boiler having heat transfer surfaces exposed at said opening and an arch arranged above the combustion chamber and comprising tile pendulously supported in collateral relationship with their end surfaces associated to form a concave heat-reflecting surface depending above the combustion chamber and arching toward the boiler opening.

15. In a furnace, a combustion chamber having a boiler opening at one side of the grate, refractories suspended above the grate with their lower end surfaces in merging relationship to form a top arch extending to the upper limit of the boiler opening, said top arch depending at an inclination over the portion of the grate opposite the boiler opening to afford a heat reflecting and radiating surface for directing heat through the boiler opening.

16. In a furnace, a combustion chamber

having a lateral boiler opening, refractories suspended in collateral association to form a roof arch for the combustion chamber, the portion of said roof arch at the side of the combustion chamber opposite the boiler opening sloping steeply downward with the lower ends of the refractories therein presented toward the boiler opening to afford a heat reflecting and radiating surface in front thereof.

17. In a furnace, a combustion chamber having a grate and a lateral boiler opening, refractories suspended above the grate in collateral association to form a roof arch, certain of said refractories being arranged to form a concave arch portion curving downwardly above the grate in front of the boiler opening.

In testimony whereof I have hereunto subscribed my name.

LOUIS H. HOSBEIN.

having a lateral boiler opening, refractories suspended in collateral association to form a roof arch for the combustion chamber, the portion of said roof arch at the side of the combustion chamber opposite the boiler opening sloping steeply downward with the lower ends of the refractories therein presented toward the boiler opening to afford a heat reflecting and radiating surface in front thereof.

17. In a furnace, a combustion chamber having a grate and a lateral boiler opening, refractories suspended above the grate in collateral association to form a roof arch, certain of said refractories being arranged to form a concave arch portion curving downwardly above the grate in front of the boiler opening.

In testimony whereof I have hereunto subscribed my name.

LOUIS H. HOSBEIN.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,540,069, granted June 2, 1925, upon the application of Louis H. Hosbein, of Chicago, Illinois, for an improvement in "Furnace Constructions," errors appear in the printed specification requiring correction as follows: Page 4, line 3, claim 5, for the word "roof" read *arch*, and line 5, for the word "arch" read *roof;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of July, A. D. 1925.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.

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It is hereby certified that in Letters Patent No. 1,540,069, granted June 2, 1925, upon the application of Louis H. Hosbein, of Chicago, Illinois, for an improvement in "Furnace Constructions," errors appear in the printed specification requiring correction as follows: Page 4, line 3, claim 5, for the word "roof" read *arch*, and line 5, for the word "arch" read *roof;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of July, A. D. 1925.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.