This invention relates in general to furnace arch or roof constructions, and especially to refractory hanger blocks or tiles for furnace constructions.

The invention relates particularly to furnace arch or roof constructions in which the refractory members or tile exposed to the high furnace temperatures are supported from refractory hanger members which, in turn, are supported by or suspended from the main metal supporting structure. Thus, in the construction of the present invention the metal members are positioned more remote from the high temperature of the furnace than in constructions in which the main refractory members or tile are supported directly by metal members. As the refractory hanger members are able to withstand higher temperatures than the metal members previously used for this purpose, the construction of the present invention enables furnaces to be operated at higher temperatures than heretofore, or if operated at the usual temperatures, the construction of the present invention enables the furnaces to be operated for much longer periods without requiring repair and replacement.

Therefore, a principal object of the invention is the provision of relatively narrow, small refractory members or tile sections as hangers between the main refractory members or tile exposed to the high temperature of the furnace and the metal supporting structure, for the purpose of increasing the normal period of operation of the furnace and/or increasing the maximum temperature permissible in the furnace without adversely affecting the more remotely located metal supporting structure.

A further important object of the invention is to decrease the quantity of metal required in the supporting structure of the furnace wall of a high temperature furnace.

A further object is to reduce the cost of the furnace arch or roof construction by replacing the previously used metal supporting structure in part by less costly refractory hanger members or tile.

Another object of the invention is the provision of a suspension arch or roof for high temperature furnaces which have extremely low heat transfer characteristics.

A further more specific object of the invention is the provision of a furnace arch or roof construction permitting relatively complete insulation and also permitting effective control of the degree or thickness of insulation employed.

A further object of the invention is the provision of a suspension arch or roof which is easy to install and easy to repair with a minimum of labor.

Other objects and advantages of the invention will be apparent from the following detailed description, taken in conjunction with the accompanying drawings, which disclose a preferred embodiment of the invention.

In the accompanying drawings:

Figure 1 is a vertical section showing the improved furnace arch or roof construction of the present invention.

Figure 2 is a horizontal section taken along line 2—2 of Figure 1.

Figure 3 is a horizontal section taken along line 3—3 of Figure 4.

Figure 4 is a transverse vertical section of the improved furnace arch or roof construction of the present invention.

Figure 5 is a perspective view of the refractory hanger member or tile of the present invention.

Figure 6 is a side view of the refractory hanger member.

Figure 7 is a end view of the refractory hanger member.

Figure 8 is a horizontal section taken along line 8—8 of Figure 7.

Referring to Figures 1 to 4 inclusive, the embodiment of the invention disclosed therein is in respect of a furnace arch which is suspended from a series of I beams 10 which may rest upon the brick work forming the sides of the furnace, or may be supported in any other desired manner. Pairs of clip members or clamps 11 are provided for supporting cross beams 14 from the I beams 10 at predetermined desired locations. Each clip 11 has an upper projecting edge 34 adapted to be positioned in engagement with the lower flange of the I beam 10. Each clip 11 has lower turned flanges 13 adapted to contact the upper flange of a cross beam 14. Each clip also has projections or lugs 12 at the lower outer portion thereof adapted to fit into holes drilled in the cross beam 14.

With the use of the clip 11 of the present invention, the size of the flange of the I beam 10 and the spacing between I beams 10 is relatively
immaterial, since the holes in the beam 14, adapted to receive the projections or lugs 12 on the main I beams 10, can be bored or the job to suit the particular size of the lower flange of the I beam 10 and the spacing thereof. This, of course, greatly simplifies the work involved in supporting the cross beams 14 from the main I beams 10 and also makes it unnecessary to have a large number of the forgings or castings for relatively moderate variations in the sizes of I beams 10 employed. It will be understood of course that when the projections or lugs 12 of the clips 11 are seated in the holes of the cross beams 14, the cross beams 14 will be securely suspended from the main I beams 10.

Metal hanger members 16 are provided for the purpose of supporting the refractory hanger members or tile 21 from the cross beams 14. Each metal hanger member 16 has upper inturned flanges 17 adapted to seat upon the lower flange of the cross beam 14. One of the pairs of flanges 17 on each metal hanger member 16 has a stepped construction 20 to enable the hanger member to be easily applied over the lower flange of the beam 14 by tilting the member 16 relative to the flange of the cross beam 14 so that the first flange 17 of the hanger member 16 will be past the lower flange of the cross beam 14. The member 16 is then moved to its operative vertical position and both flanges 17 are brought into seating engagement with the lower flange of the cross beam 14. Each metal hanger member 16 has a metal wall intermediate the two ends thereof for connecting the two sides of the metal hanger member. The lower edges of the side walls of the metal hanger member have inturned flanges 18 which are adapted to cooperate with grooves in the refractory hanger member or tile 21 for supporting the tile from the metal hanger member.

Each refractory hanger member or tile 21 comprises a block having grooves 22 and 23 extending along the side walls thereof adjacent the upper edge of the tile 21. The lower inturned flanges 18 of the metal hanger member 16 are adapted to be received in either groove 22 or 23 to support the tile thereon. In Figure 4 of the drawings the metal hanger member 16 is shown supporting the tile 21 by means of the inturned flanges 18 cooperating with the grooves 22 on the two side faces of the tile 21.

The lower portion of the tile 21 has recesses 24 in both side faces thereof for the purpose of supporting the main refractory members or tile 26 therefrom. Each main refractory member or tile 26 has grooves 28 along the side faces thereof with overlapping flanges 30 and 31 which are adapted to cooperate with the recesses 24 in the tile 21 and thus suspend the main tile members 28 from the hanger tile members 21.

The lower faces 27 of the main refractory members or tile 26 are exposed to the high temperatures within the furnace. Insulation 29 is provided over the top surfaces of the main refractory members or tile 26, and in those cases where the hanger tiles 21 are relatively narrow and small the insulation 29 covers substantially the entire upper surfaces of the main refractory members or tile 26.

The main refractory members or tile 26 are provided with a set of grooves and tongue means 32, 33 (Figures 9 to 11) around the four sides thereof, arranged to cooperate with corresponding groove and tongue means on adjacent main tile members 28 for heat sealing purposes. Also the adjacent rows of main tile members 26 suspended from the same hanger tile 21 are staggered with respect to each other, as shown in Figure 2, to further provide heat sealing means.

As shown in Figure 1, in the preferred embodiment of the invention, the refractory hanger members 21 are provided only in every second row of main hanger members 16, forming the same. This leaves the cavity 35 in alternate rows of assembled main refractory members 26, and such cavities 35 can, if desired, be filled with any suitable material to avoid heat losses.

As shown in Figures 5 to 8 inclusive, the hanger tile 21 has four recesses 24 of equal size two on each side wall thereof, and accordingly four main refractory members 26 are adapted to be suspended from a single hanger tile 21. The tile 21 shown in Figures 5 to 8 inclusive is of comparatively small dimensions, in the preferred construction the dimensions being 7/8 inches high, 5/8 inches wide and 2 3/4 inches thick. Also the grooved or recessed portions, that is, the grooves 22 and 23 and the recesses 24, are of a rather simple nature, each opening into the ends of the block so that these can be fixed on the hanger tile 21 with the minimum of expense. As a result, the relatively narrow and small hanger tile 21 of the present invention is very inexpensive, costing only a few cents, and is adapted to take the place of a substantial portion of the metal supporting structure (including the use of chrome alloy castings) of the usual furnace arch construction costing much more than the tile construction of the present invention.

As will be seen from Figures 5 to 8 inclusive, the recesses 24 in the lower portion of the hanger tile 21 correspond in size on both sides of the tile so that the tile can be reversed and will be equally operative in either position. The groove 23 in both sides of the tile 21 is shorter than the groove 22. The inner end of the longer groove 22 is positioned so that when the metal hanger member 16 is placed with the lower inturned flanges 18 in the groove 22 and abutting the inner end of this groove, the tile 21 will be centrally suspended from the metal hanger member 16, as shown in Figure 4. The length of the recess 22 is approximately one-half the width of a metal hanger member 16 so that, if desired, instead of supporting the tile from a centrally positioned metal member 26 in the groove 22, the tile could be supported by a pair of metal hanger members 16 at each end thereof, in the grooves 22 and 23. With the inturned flanges 18 in the groove 23, the hanger member 16 would extend only half way into this groove and the remainder of the metal hanger member 16 would be available for supporting the hanger tile next adjacent. In this way each metal hanger member 16 is adapted to cooperate with the grooves 22, 23 of a pair of adjacent hanger tile 21 and such construction would therefore employ the same number of metal hanger members 16 as in the construction using the metal hanger members 16 in the centrally located position shown in Figure 4. The hanger tile 21 is provided with the short and long grooves 23 and 22 respectively, as in some constructions it is more convenient to support the tile 21 from the edge portions thereof rather than from the central portion of the longer groove 22.

As indicated above, the dimensions of the hanger tile 21 are such that the tile is relatively narrow and small. This is important for the reason that when the insulation 29 is applied to the upper
surface of the main tile members 26, such insu-
lulation covers practically the entire upper sur-
face of the main tile members 26 except for the
space occupied by the relatively narrow hanger
tile members 21. Accordingly, the insulation ap-
p lied to the construction of the furnace arch of
the present invention is much more effective in
preventing heat losses, than in prior construc-
tions in which relatively large blocks have been
emplaced without the use of any insulation, or
so arranged that insulation, if employed, would
be relatively ineffective. Moreover the present
construction enables the thickness of the insula-
tion 29 to be varied to a considerable extent be-
fore the insulation approaches the lower flanges
18 of the metal hanger members 18. Accord-
ingly, all of the metal supporting structure can be
well insulated from the high temperatures with-
in the furnace, and the thickness of the insula-
tion can be accurately determined, depending
upon the temperatures at which the furnace is to
be operated.

Attention is also directed to the fact that the
use of hanger tile members 21 of the present
invention greatly increases the normal life of
the furnace. Thus, even if the lower portion of
the main tile members 25 is burned away dur-
ing the operation of the furnace, the tile hanger
members 21 are equally able to withstand the
high temperatures within the furnace, and ac-
cordingly the furnace is able to continue in oper-
ation for some time thereafter. In prior con-
structions in which metal hanger members were
employed for the purpose of supporting the main
tile members 26 directly therefrom, as soon as
the main tile members 26 were in part burned
away so that the higher temperatures would be
directly effective in weakening the metal mem-
bers, the furnace wall had to be repaired imme-
diately. In the present construction all of the
metal supporting structure is much farther re-
moved from and remote to the high temperatures
within the furnace and the tile hanger mem-
bers 21 are able to withstand the same high tem-
peratures as the main tile members 26. Thus, the
tile hanger members are able to withstand tem-
peratures of approximately 2200° F. to 2500° F.
whereas it is considered relatively unsafe to ex-
pose the metal hanger structure to temperatures
exceeding approximately 1500° F. It will there-
fore be appreciated that with the present con-
struction the furnace can be operated at much
higher temperatures than heretofore, or, if the
furnace is operated at lower temperatures, the
construction will deteriorate less rapidly than the
prior constructions, and accordingly can remain
in operation for much longer periods.

In connection with the repair of the furnace,
the will be apparent that the tile hanger mem-
bers 21 can be easily removed and replaced with-
out disturbing any substantial portion of the
furnace arch or any substantial portion of the
metal supporting structure. In many prior con-
structions where it becomes necessary to replace
hanger members, a considerable portion of the
metal supporting structure must be removed to
permit such replacement. In the present case
with the present invention and/or the members 26
can be simply, quickly and easily replaced with
minimum of labor and expense and without dis-
turbing any substantial portion of the metal sup-
porting structure.

We have therefore provided an improved fur-
nace arch or roof construction which eliminates
considerable metal, replaces such metal with rela-
tively inexpensive tile hanger members, and pro-
vides a furnace arch construction which is capa-
ble of operating under intense heat require-
ments for longer periods of time, while at the same
time greatly simplifying replacement and repair
and when this may become necessary.

It will, of course, be evident to those skilled in
this art that the hanger refractories or tile of
the present invention can also be used in the
same manner, as retainer refractories or tile, for
retaining the side walls of a furnace in align-
ment.

It will be apparent that various changes may
be made in the form, construction and arrange-
ment of the parts of this invention without de-
parting from the scope of the invention as here-
in described and without sacrificing any of its
important advantages, the form of the invention
hereinbefore described being merely a preferred
embodiment thereof.

This application is a division of our copending
application Serial No. 458,592, filed September 16,
1942.

We claim:
1. A hanger tile member for furnace construc-
tion, comprising a refractory block having oppos-
teley disposed end faces, and oppositely disposed
top and bottom faces, a pair of grooves in each of said side faces
adjacent the upper portion of said block, the
grooves of each pair lying in the same horizontal
plane, and the block having a solid portion sepa-
rating the adjacent ends of said grooves, and
recesses in said side faces adjacent the lower por-
tion of said block, said grooves and recesses com-
municating respectively with said end faces.

2. A hanger tile member for furnace construc-
tion, comprising a refractory block having oppos-
teley disposed end faces, oppositely disposed side
faces and oppositely disposed top and bottom
faces, a pair of grooves in each of the side faces
adjacent the upper portion of said block, the
grooves of each pair lying in the same horizontal
plane, one of said pair of grooves on each side
face being longer than the other groove on each
of said side faces, and recesses in said side faces
adjacent the lower portion of said block, said
grooves and recesses communicating respectively
with said end faces.

3. A hanger tile member for furnace construc-
tion, comprising a refractory block having oppos-
teley disposed end faces, oppositely disposed side
faces and oppositely disposed top and bottom
faces, a pair of grooves in each of the side faces
adjacent the upper portion of said block, the
grooves of each pair lying in the same horizontal
plane, and a pair of recesses on each side
face of the block adjacent the lower portion
thereof, all of said recesses being of equal size,
the block having a solid portion between the ad-
jacent ends of each pair of recesses, the recesses
and grooves communicating respectively with
said end faces.

4. A refractory member for furnace construc-
tion, comprising a refractory block having oppos-
teley disposed end faces, oppositely disposed side
faces, and oppositely disposed top and bottom
faces, a pair of grooves in each of said side
faces adjacent the upper portion of said block, the
grooves of each pair lying in the same horizontal
plane, one of said pair of grooves on each side
face being longer than the other groove on each
of said side faces, said grooves being in line with
each other, and the recesses in said side faces
adjacent the lower portion of said block, said
grooves and recesses communicating respectively with said end faces.

5. A refractory member for furnace construction, comprising a refractory block having oppositely disposed end faces, oppositely disposed side faces, and oppositely disposed top and bottom faces, a pair of grooves in each of the side faces adjacent the upper portion of said block, the grooves of each pair lying in the same horizontal plane, one of said pair of grooves on each side face extending beyond the center line of the block, and recesses in said side faces adjacent the lower portion of said block, said grooves and recesses communicating respectively with said end faces.

6. A refractory member for furnace construction, comprising a refractory block having oppositely disposed end faces, oppositely disposed side faces, and oppositely disposed top and bottom faces, a pair of grooves in each of the side faces adjacent the upper portion of said block, the grooves of each pair lying in the same horizontal plane, one of said pair of grooves on each side face extending beyond the center line of the block, said grooves being in line with each other, and recesses in said side faces adjacent the lower portion of said block, said grooves and recesses communicating respectively with said end faces.

7. A refractory member for furnace construction, comprising a refractory block having oppositely disposed end faces, oppositely disposed side faces, and oppositely disposed top and bottom faces, a pair of grooves in each of the side faces adjacent the upper portion of said block, the grooves of each pair lying in the same horizontal plane, one of said pair of grooves on each side face being longer than the other groove on each of said side faces, and recesses in said side faces adjacent the lower portion of said block, all of said recesses being of equal size.

8. A hanger refractory member for furnace construction, comprising a refractory block having oppositely disposed end faces, oppositely disposed side faces, and oppositely disposed top and bottom faces, and a pair of recesses in each of said side faces adjacent the lower portion of said block, the recesses of each pair lying in the same horizontal plane, said recesses being capable of interlocking cooperation with main refractories for supporting the main refractories from the grooves and recesses of the adjacent ends of each pair of recesses being separated by a web portion of the block which is at least as deep as the recesses.

9. A hanger refractory member for furnace construction, comprising a refractory block having oppositely disposed end faces, oppositely disposed side faces, and oppositely disposed top and bottom faces, a pair of grooves in each of said side faces adjacent the upper portion of said block, the grooves of each pair lying in the same horizontal plane, and recesses in said side faces adjacent the lower portion of said block, said grooves being capable of interlocking cooperation with supporting or retaining members, and the block having a solid web portion separating the adjacent ends of each pair of grooves, the web portion being at least as deep as the grooves.

10. A hanger refractory member for furnace construction, comprising a refractory block having oppositely disposed end faces, oppositely disposed side faces, and oppositely disposed top and bottom faces, grooves in said side faces adjacent the upper portion of said block, the block having a portion of full thickness extending vertically between the grooves, said grooves being capable of interlocking cooperation with supporting or retaining members, and a pair of recesses in each of said side faces adjacent the lower portion of said block, the recesses of each pair lying in the same horizontal plane, said recesses being capable of interlocking cooperation with main refractories for supporting the main refractories from the hanger refractory.

11. A hanger tile member for a furnace construction comprising a refractory block having rectangular top and bottom faces, substantially parallel rectangular side faces and substantially parallel end faces whereby such blocks can be stacked in close juxtaposition, said block having oppositely disposed grooves in the side faces near the top, and oppositely disposed recesses in the side faces near the bottom, said block having vertically extending portions extending from one side face to the other side face horizontally in line with the grooves and recesses, which portions are as thick as the width of the top and bottom faces.

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