July 26, 1938. H. A. MORLOCK 2,125,193

CONSTRUCTION FOR FURNACES

Filed Dec. 24, 1937

Fig. 1.

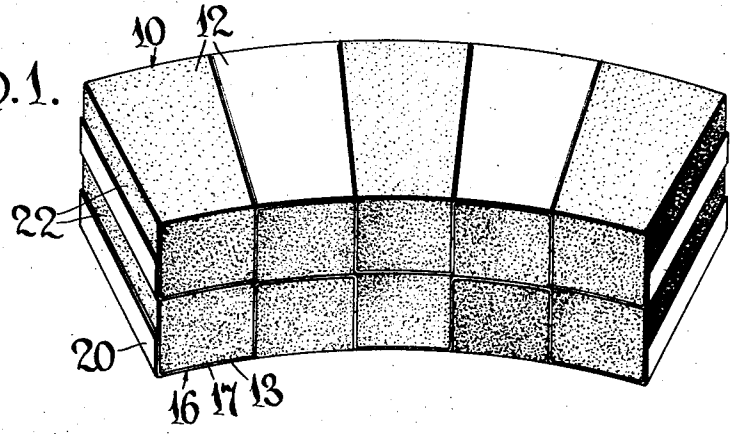


Fig. 2.

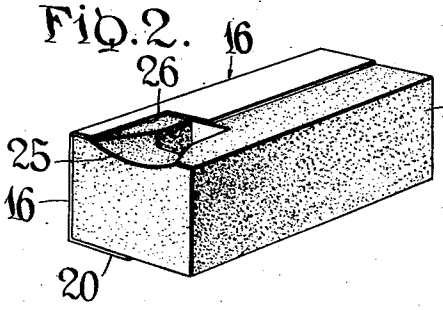


Fig. 7.

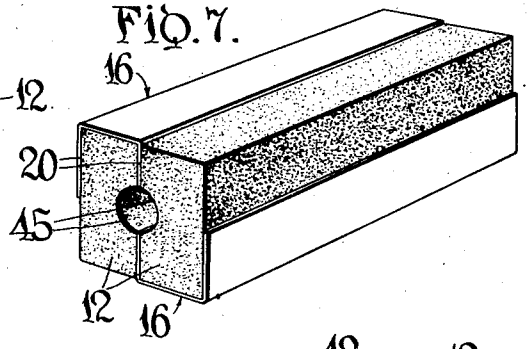


Fig. 3.

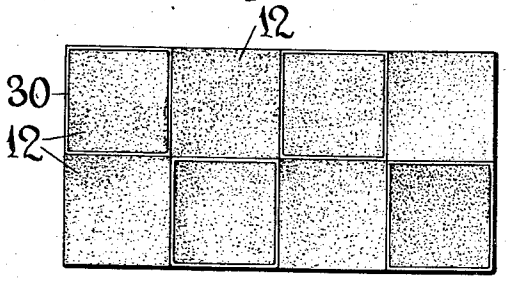


Fig. 6.

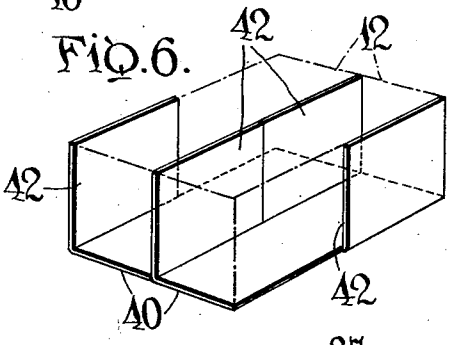


Fig. 4.

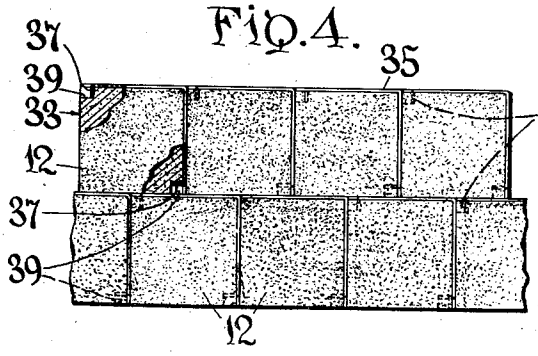
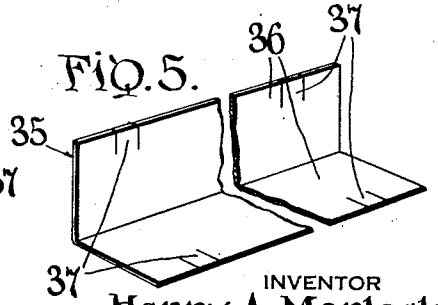


Fig. 5.



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CONSTRUCTION FOR FURNACES

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Application December 24, 1937, Serial No. 181,480

14 Claims. (Cl. 72—37)

This invention relates to furnace construction and it has particular relation to structure and arrangement of refractory elements or building blocks employed in building furnaces.

One object of the invention is to provide an improved furnace wall construction.

Another object of the invention is to provide an improved arrangement of compound building blocks in furnace construction.

Another object of the invention is to provide an improved combination of refractory element and metal covering for use in building either furnace walls or roofs.

Another object of the invention is to provide an improved combination of building blocks, metal joints and cementing or fluxing material in a furnace construction.

Another object of the invention is to provide a furnace construction which is provided with oxidized metallic joints between refractory blocks and in which a fluxing agent has been included to enhance the bonding of the elements of the furnace construction.

The invention is related to and constitutes improvements over the disclosures in my co-pending application Serial No. 164,898, filed September 21, 1937.

One feature of the invention involves the development of an improved arrangement for utilizing the advantages of the iron oxide joint while at the same time minimizing the deleterious features of crystalline growth and promoting economy in the manufacture of the components for so doing by providing for only a single thickness in all joints between adjacent and contacting tiles or masses in the furnace construction.

I have devised a method whereby the valuable efficiency of the metal-plate joint can be increased and also projected for use in lower temperature ranges than heretofore possible. To this end, a fluxing medium is applied to the surfaces of the metal covering which are in contact with the refractory tile. By the introduction of such flux, or third factor, the metal-plate refractory joint is made to follow the law of ternary compounds in respect to their temperature concentration equilibrium phenomena. In such combination, the oxidized metal plate, plus the added flux, combine with the refractory to form a ternary, reaction or fusion compound. The flux being of a relatively low fusion point tends to lower the fusion point of the ternary compound and, in any temperature range above the fusion point of the added flux, a liquid constituent of relatively low fusion point is formed. Such liquid constituent is in part dependent in amount on the amount of oxidized metal plate in the joint and upon the amount of the added flux. Such liquid constituent in penetrating the inter-crystalline interstices of the oxidized metal plate tends to become richer in iron-oxide and poorer in flux, and thus, its fusion point is raised to a point where freezing occurs. Such liquid as penetrates into the pore spaces of the refractory tile tends to dissolve and combine with the preponderating refractory at the same time its own concentration is diminished, and thus, there is an increase in fusion point with freezing resulting.

The physical result of these processes is a greater penetration of the fusion products into the refractory and ultimate solidification in the penetrated zone with greater strength of joint resulting therefrom.

A practical flux for this purpose is borax, although other substances such as silicate of sodium, sodium fluoride, etc., which will act as suitable fluxes, can be used. To expedite easy application of the fluxing medium and retention in proper placement during shipment or handling, the fluxing medium should be applied to the inner and outer surfaces of the metallic covering before such covering is applied to the tile. Such fluxes can be readily applied while dissolved or suspended in a suitable liquid vehicle. Linseed oil can be used as a suitable vehicle to place the flux, as an adhering film on the metallic plate surfaces. This invention, however, is not limited to the use of linseed oil as a vehicle for the added flux as any other suitable liquid or any other drying oil which will distribute and hold the flux as a film on the metallic surface can be used. It is not imperative that the flux-film application be made to the metallic covering, but it is less economical to apply such film to the tile surfaces. In application to the tile the high absorption into the pore spaces of the tile would require the consumption of a greater amount of the fluxing vehicle to produce the necessary flux film than is true when making the application to the non-porous metallic covering.

In the drawing:

Fig. 1 is a perspective of a section of furnace construction in which the invention has been incorporated;

Fig. 2 is a perspective of a compound refractory and metal block for building furnaces;

Fig. 3 is an elevation of a section of furnace construction in which alternate forms of encased and unencased refractory blocks are provided;

Fig. 4 is an elevation of a section of furnace construction in which substantially one-half of each refractory block is encased in metal;

Fig. 5 is a perspective of a form of metal casing or covering employed in the construction shown in Fig. 4;

Fig. 6 is a perspective of another form of metal plating or covering for refractories; and

Fig. 7 is a perspective of an arrangement of a compound refractory and metal block construction for accommodation of tuyères.

In one form of the invention shown in Fig. 1, a section of furnace construction 10 is composed of refractory blocks 12 of tile or brick, each of which receives a web 15 of an angular plate 16 of oxidizable metal arranged to lie against and cover one side 17 thereof. Opposite legs 20 of the plate extend approximately one-half the distance along opposite sides 22 of each refractory block. Hence, one-half of the contacting side surfaces of each block is plated, leaving proportionate side surface portions of the block unplated. These blocks of refractory material are oblong in form and their end surfaces are not necessarily plated.

The several blocks are laid in such manner in the furnace construction that the legs 20 of the U-shaped plates 16 extend alternately in opposite directions, and hence, the web 15 of one plate contacts directly along the bare or unplated surface of an adjacent block, while the legs 20 of adjacent plates serve to cover or plate substantially the entire side surfaces adjacent those covered by the webs 15. Accordingly in all of the joints among the several compound refractory and metal blocks, there is provided a single uniform thickness of metal. Undesirable overlapping of the plates is effectively obviated.

After the blocks have been built into a furnace construction and subjected to heat in a conventional manner, the plates oxidize and bind the surfaces of the several refractory blocks into substantially monolithic form. Since a single thickness of oxidizable metal is employed, a very uniform and efficient furnace construction is provided.

In the form shown in Fig. 2, the refractory block 12 is of such character as to be suitable for certain types of furnace roof construction in which the blocks are recessed, as indicated at 25, to facilitate its suspension in roof supporting structure (not shown). A part of the U-shaped plate 16 is cut away, as indicated at 26, to provide proper space for the recessed portion. In building a furnace incorporating this form of plated refractory, the structure is assembled in substantially the same manner as that shown in Fig. 1, although it may be of different contour.

Referring to the arrangement shown in Fig. 3, a four sided plate casing 30 is applied to one refractory block 12 while an adjacent refractory block remains unplated. By alternately laying encased or plated blocks and unplated blocks, a single thickness of metal is insured among the joints of the masonry structure. Intermediate side portions of the casing 30 are sprung inwardly and the refractory blocks 12 are forced therein, whereby the resiliency of the sides provides for the latter securely gripping the blocks.

In Figs. 4 and 5, there is shown a section of furnace construction 33 in which each of the refractory blocks 12 is provided with an angular metal plate 35 having its sides 36 covering adjacent sides of the block from end to end of the latter. Both of the plate sides 36 along their outer marginal portions are provided with tongues 37 which can be bent into engagement with recesses 39 formed in the refractory blocks 12. In an arrangement of this kind, the plates 35 are securely fixed upon and cover two adjacent sides of the block while the other adjoining block sides remain unplated. Hence, in laying the plated blocks, as shown in Fig. 4, uniform single thickness of metal is provided in the masonry joints.

Referring to Fig. 6, one side of a refractory block 12 is covered with a plate side 40 of similar extent, and flanges 42 extend from opposite edge portions of this side 40. These flanges 42 are disposed at opposite end portions of the plate side 40 and are arranged in alternate relation in the furnace construction. Therefore, a flange 42 partially plating one side of a block constitutes substantially a continuation of a similar flange on an adjacent block, and a single uniform thickness of metal is thus provided in the joints of the masonry.

In Fig. 7 the arrangement of the refractory blocks 12 and metal plating 16 is similar to that shown in Figs. 1 and 2, with the exception that recessed portions 45 extending from end to end of the blocks provide suitable tuyère openings; for example, the type conventionally employed in copper bessemerizing converters. The legs 20 on the sides of the blocks in which the recesses are formed are terminated at the opening.

In the forms of structure shown in Figs. 1 to 3, 6 and 7, the metal plate coverings 16, 30 and 40 are resilient and are sprung upon the blocks 12. In construction shown in Figs. 1, 2 and 7 the legs or flange sides or legs 20 are sprung and tightly grip the blocks, and in the construction shown in Fig. 6, a similar action is insured by springing the legs or sides 42 upon the blocks 12. In the arrangement shown in Fig. 3 the sides of the metal containers 30 are first sprung inwardly and then are forced outwardly and remain under tension in their normal block engaging shape, as shown.

In all of the forms of the structure shown and described, it should be understood that suitable fluxing agent is applicable in the joints and in the manner above described, either by applying such agent directly to the inner and outer sides of the plating, or, if found practicable, to the surfaces of the refractory blocks. Then upon application of heat incidental to the use of the furnace, the oxidation of the metallic plates and bonding of the refractory surfaces is effected to provide for improved unitary furnace construction.

From the foregoing description it will be apparent that the invention is applicable to various types of refractories employed in furnace or like structures embodying square or straight forms, arches, wedges, keys, etc. In the various forms available for the application of the invention the amount of metal required for proper oxidation and cementing in the masonry joints is reduced to a minimum in the single uniform thickness of metal provided therein. Hence, undesirable grain growth or crystalline growth is minimized, and because of the uniformity of distribution of the metal or iron oxide in all joints, unavoidable stresses in the furnace construction are likewise uniformly distributed. These advantages enhance the durability of the furnace construction and provide for improvement in the operation thereof.

Although several forms of the invention are shown and described in detail, it will be apparent to those skilled in the art that the invention is not so limited, but that various changes can be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. In a furnace construction, a section of masonry including a plurality of refractory blocks, each block having a corner portion extending from end to end thereof and having plated portions on the block sides adjoining said corner portion, said plated portions including oxidizable metal, and companion refractory blocks having corner portions running from end to end thereof and having unplated side portions adjoining said corner portions, plated portions of the first plurality of blocks being abutted against unplated portions of said companion blocks whereby a single thickness of metal plating is provided in the joints of the masonry.

2. In a furnace construction, a section of masonry including a plurality of refractory blocks, each block having a corner portion extending from end to end thereof and having plated portions on the block sides adjoining said corner portion, said plated portions including oxidizable metal, and companion refractory blocks having corner portions running from end to end thereof and having unplated side portions adjoining said corner portions, plated portions of the first plurality of blocks being abutted against unplated portions of said companion blocks, said plated portions and unplated portions being alternately arranged to provide substantially continuous and uniform distribution of a single thickness of metal plating in the masonry joints.

3. In a furnace construction, a section of masonry including a plurality of refractory blocks having plated side portions extending from end to end thereof, said plated portions including oxidizable metal, companion refractory blocks having unplated side portions running from end to end thereof, plated portions of the first plurality of blocks being abutted against unplated portions of said companion blocks whereby a single thickness of metal plating is provided in the joints of the masonry.

4. In a furnace construction, a section of masonry including a plurality of refractory blocks, metal plating covering one side of each block, said metal plating having flanges formed along opposite marginal portions thereof and extending along portions of the sides of the block adjoining opposite edges of said one side of the block, portions of each block remaining unplated, plated portions of the blocks being abutted against unplated portions of adjacent blocks whereby a single thickness of metal plating is provided in the joints of the masonry.

5. In a furnace construction, a section of masonry including a plurality of refractory blocks, U-shaped metal plating extending approximately from end to end of each block and covering approximately one-half the side surfaces thereof with unplated side surfaces of the block projecting from the plating, plated and unplated sides of the several blocks fitting in alternate relation and providing substantially continuous and uniform single thickness of metal plating in the joints of masonry.

6. In a furnace construction, a section of masonry including a plurality of refractory blocks laid in courses, the refractory blocks in one course being alternately metal plated and unplated, the metal plating entirely surrounding the blocks upon which it is applied from end to end thereof, the refractory blocks in a course adjacent said one course also being alternately metal plated and unplated, the metal plated blocks of one course being abutted against the unplated blocks of the other course whereby a substantially continuous and uniform single thickness of metal plating is provided in the joints of the masonry section.

7. In a furnace construction, a section of masonry including a plurality of refractory blocks, an angular metal plate disposed along two adjacent sides of each block from end to end of the latter, two other similar sides of the block remaining unplated, said refractory blocks being laid in courses, unplated sides of the blocks of one course abutting plated sides of the blocks of an adjacent course, unplated sides of blocks in each course being abutted against plated sides of other blocks.

8. In a furnace construction, a section of masonry including a plurality of refractory blocks, an angular metal plate disposed along two adjacent sides of each block from end to end of the latter, two other similar sides of the block remaining unplated, said refractory blocks being laid in courses, unplated sides of the blocks in one course abutting plated sides of the blocks of an adjacent course, and unplated sides of blocks in each course being abutted against plated sides of other blocks, portions of each block having recesses therein, and angular projections on each metal plate engaging in the recesses to secure the plate upon each refractory block.

9. In a furnace construction, a section of masonry including a plurality of refractory blocks having plated side portions extending from end to end thereof, said plated portions including oxidizable metal, companion refractory blocks having unplated side portions running from end to end thereof, plated portions of the first plurality of blocks being abutted against unplated portions of said companion blocks and providing a single thickness of metal plating throughout the joints of the masonry, said oxidizable metal being resilient and sprung upon the blocks in gripping relation.

10. In a furnace construction, a section of masonry including a plurality of refractory blocks, U-shaped metal plating extending approximately from end to end of each block and covering approximately one-half of the area of the side surfaces thereof with unplated side surfaces of the block projecting from the plating, each leg of the U-shaped metal plating of each block covering approximately one-half the block side it contacts, plated and unplated sides of the several blocks fitting in alternate relation and providing substantially continuous and uniform single thickness of metal plating throughout the joints of the masonry.

11. In a furnace construction, a section of masonry including a plurality of refractory blocks, U-shaped metal plating extending approximately from end to end of each block and covering approximately one-half of the area of the side surfaces thereof with unplated side surfaces of the block projecting from the plating, each leg of the U-shaped metal plating of each block covering approximately one-half of the block side it contacts, the legs of the U-shaped metal plating of each block being resilient and sprung in gripping relation upon each block to prevent separation of plating and block, plated and unplated

sides of the several blocks fitting in alternate relation and providing substantially continuous and uniform single thickness of metal plating throughout the joints of the masonry.

12. In a furnace construction, a section of masonry including a plurality of refractory blocks having plated side portions extending from end to end thereof, said plated side portions including oxidizable metal, companion refractory blocks having unplated side portions running from end to end thereof, plated portions of the first plurality of blocks being abutted against unplated side portions of said companion block and providing a single thickness of metal plating throughout the joints of the masonry, and a fluxing agent in the joints of said masonry and responsive to heat in the furnace to facilitate the oxidation of the metal and the resulting bonding of the surfaces in the joints.

13. In a furnace construction, a section of masonry including a plurality of refractory blocks having plated side portions extending from end to end thereof, said plated side portions including oxidizable metal, companion refractory blocks having unplated side portions running from end to end thereof, plated portions of the first plurality of blocks being abutted against unplated portions of said companion blocks and providing a single thickness of metal plating throughout the joints of the masonry, said metal including a fluxing agent applied to all surfaces thereof and responsive to action of heat in the furnace to facilitate the oxidation of the metal and chemical reaction between the refractory surfaces and metal.

14. In a furnace construction, a section of masonry including a plurality of refractory blocks having opposed faces defining masonry joints, single thickness of metal disposed in each joint between opposed faces of the blocks, and a fluxing agent in all the joints and having combining affinity with both the metal and refractory blocks and responsive to heat in the furnace to facilitate oxidation of the metal and resulting bonding of the surfaces in the several joints of the masonry.

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