United States Patent [19]

Potocnik et al.

[11] **3,762,123**

[45] **Oct. 2, 1973**

[54] **REFRACTORY BURNED BRICK ASSEMBLY FOR SUSPENDED ROOFS OF FURNACES**

[75] Inventors: **Kurt Potocnik; Gunther Haubold,** both of Wiesbaden, Germany

[73] Assignee: **Didier-Werke A.G,** Wiesbaden, Germany

[22] Filed: **Nov. 22, 1971**

[21] Appl. No.: **200,891**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 888,487, Dec. 29, 1969, abandoned.

[30] **Foreign Application Priority Data**

Jan. 10, 1969 Germany ..... P 19 01 025.4

[52] **U.S. Cl.** ..... **52/509,** 52/596, 110/99 R

[51] **Int. Cl.** **E04b 1/38**

[58] **Field of Search** ..... 110/99 R, 99 A; 52/596, 509

[56] **References Cited**

UNITED STATES PATENTS

3,251,324	5/1966	Vassiliou	110/99 A
1,197,842	9/1916	Meier	52/509
2,433,175	12/1947	Urmetz	52/509 X
2,840,017	6/1958	Wolf	110/99 A
3,292,333	12/1966	Sandmeyer et al.	52/509

FOREIGN PATENTS OR APPLICATIONS

1,178,166	9/1964	Germany	52/509
1,019,335	2/1966	Great Britain	52/484

Primary Examiner—Alfred C. Perham
Attorney—E. F. Wenderoth et al.

[57] **ABSTRACT**

A prefabricated refractory brick and hanger strap assembly of the burned or ceramically fired type useable particularly in the construction of suspension ceilings of a furnace. The brick is provided with a generally trapezoidal shaped recess formed and opening at an intersection of a long and short side, and on the interface side most remote from the heat of the furnace. A brick suspension plate is partially embedded in the recess after the brick is fired, and is covered by a cementious motar-like refractory material in a manner preferably flush with the adjacent interface sides, which material, when set, provides an airtight and heat protective coating for the suspension plate. The latter plate is provided with an aperture in the upright projecting part thereof for suspension during construction of the furnace. In another form, the suspension plate is provided at one end with a preformed refractory material corresponding generally to that of the brick material and of a complemental size and trapezoidal or other desired shape to be bonded to the brick to form a permanent connection of the hanger or support plate within the brick recess.

10 Claims, 6 Drawing Figures

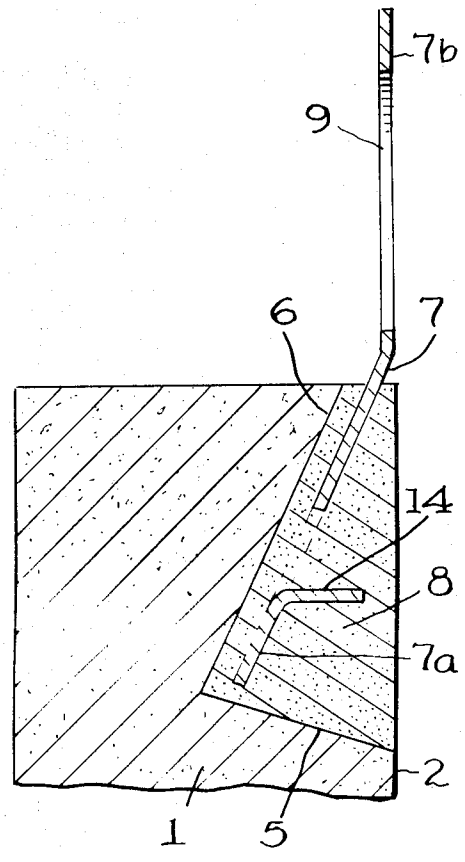


FIG. 1.

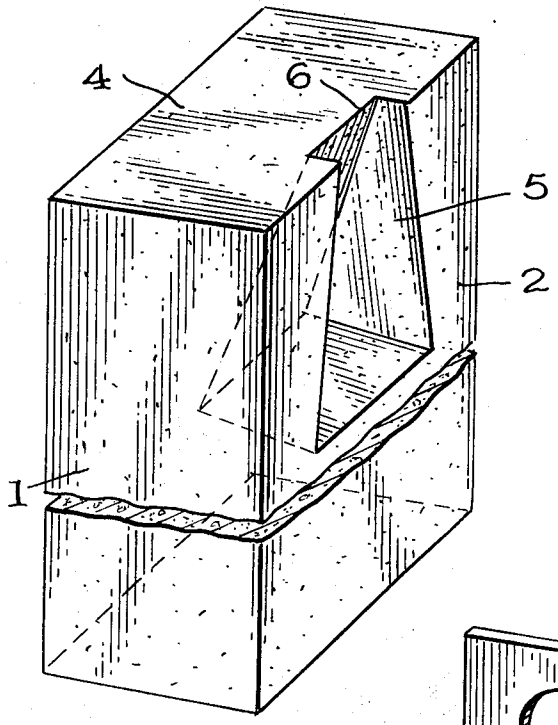


FIG. 2.

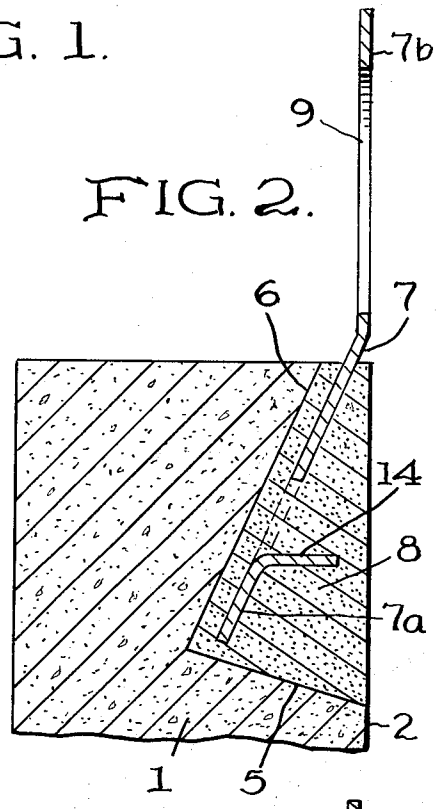


FIG. 3.

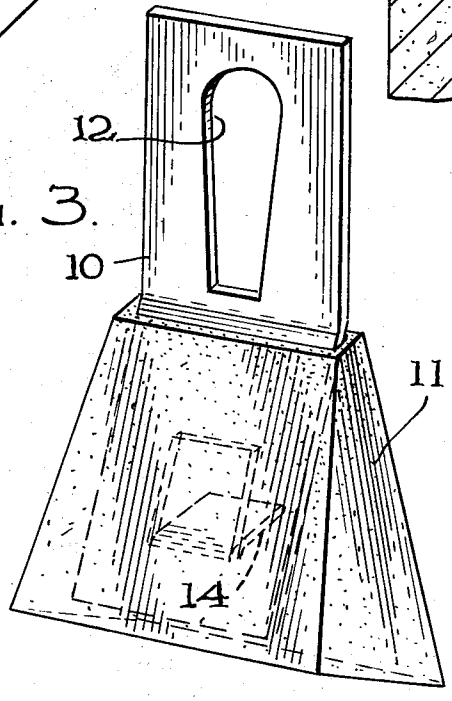


FIG. 5.

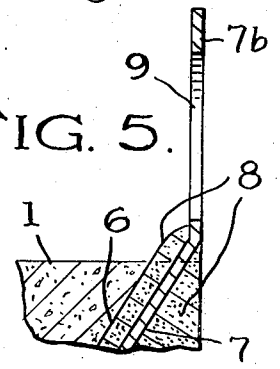


FIG. 4.

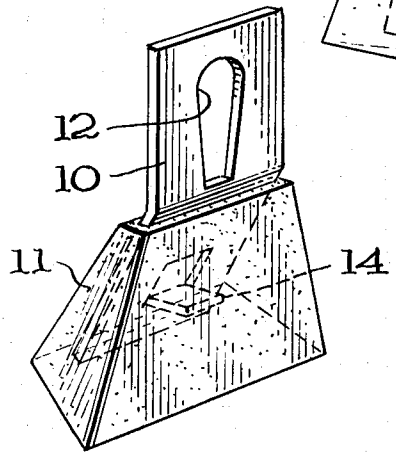
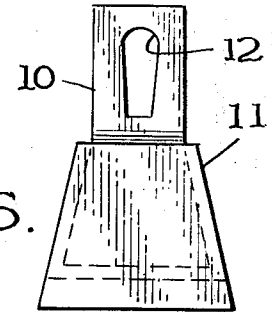


FIG. 6.



INVENTORS
KURT POTOCNIK
GÜNTER HAUBOLD
BY Wenderoth, Lind & Ponack
ATTORNEYS

REFRACTORY BURNED BRICK ASSEMBLY FOR SUSPENDED ROOFS OF FURNACES

This application is a continuation-in-part of applicants' copending application Ser. No. 888,487 filed Dec. 29, 1969 now abandoned.

The invention relates to an improved refractory brick and hanger plate assembly for use in constructing furnace suspended roofs, and which bricks are of the burned or ceramically fired type and provided with a recess to receive a supporting member therein.

Supporting members in conjunction with burned type bricks of this type are known in different forms, for instance, as cover plate bricks whereby sheet iron linings or cover plates are put onto the brick after the firing of the brick, such as disclosed in U.S. Pat Nos. 3,029,755; 3,282,231 and 3,374,594. In such bricks there are always small free spaces or recesses left between the brick material and the sheet iron cover plate, and the hanger plate or member is not embedded in and covered by a refractory material, and thereby often results in a relatively rapid scaling of the metal sheet iron at least up to the cover plate,which almost always produces a premature falling off of brick parts of the roof.

Lately, the so-called "pin-type" suspension plate and the "enclosed cover" type of bricks or blocks have been the most commonly used, which, when combined with a rigid, tightly packed suspension, can give reasonably satisfactory operating results.

A "pin-type" plate refers generally to a straight, flat sheet metal band provided with a suspension eye on one end and a borehole on the other. Such a support plate is interposed between two bricks which, adjacent their interface which is remote from the furnace, have transversely disposed boreholes for cooperation with a pin which traverses these boreholes and the corresponding boreholes of the cover plate, much on the order of that disclosed in U.S. Pat. No. 1,197,842, and also as discussed in the German Auslegeschrift (printed application) No. 1,901,025 in the fourth paragraph of column 1. In this type of suspension, where the bricks may be further provided with or left without sheet iron cover lining or casing, the suspension strip or plate is confined largely between the bricks and is, therefore, somewhat protected against premature scaling. Nevertheless, in instances where the sheet iron lining is used, it and/or the suspension strip is progressively oxidized and prematurely worn away to the extent that many break during the last wearing period of the brick, when actually a significant useable portion of approximately 200 mm of the brick still remains. This phenomenon is caused by excessive heat transfer through the partially worn-away brick, so that the suspension plate during the wear period of the remaining 200 mm is subjected to considerably hotter than the 800°C at which temperature even high-grade chrome-nickel steels tend to scale.

Similar scaling phenomenon occur with so-called "enclosed cover" plates, such as the type of the Tate U.S. Pat. No. 3,374,594 and the Crichton U.S. Pat. No. 3,029,755, which, in addition to the individual suspension of bricks by a sheet iron strip forming the suspension eye and an opposite end portion extended into a recess on one of the large area interfaces of the brick, also provides for a surrounding iron band, casing or lining which helps keep the cover or support plate in its place. The above-mentioned scaling phenomenon also occurs with the "enclosed cover" type plates, and to an

even higher degree when two different steels are used for the manufacture of the cover plates, such as during or in the welding thereof, wherein the two fusing layers suffer from reciprocably adverse chemical reaction.

The present invention consists of an improved support plate arrangement for ceramically fired or burned type bricks in order to reduce the scaling of the suspension plate for the bricks to a minimum amount, and to make them commensurate to cold set or chemically formed bricks, the latter of which have the suspension plate usually integrally molded into the brick material.

An object of the invention is to provide for an improved brick assembly in which the brick is a burned type brick having the recess of the brick into which the supporting member engages open partially or entirely onto the interface and sides of the brick which are remotely opposite to the hotest part of the furnace, and to accommodate and embed the supporting member at least to the level of this interface by covering the part set in the recess with a refractory and airtight material. Thus, the oxygen is kept away from this part of the suspension or plate cover which is exposed to the greatest amount of heat, and therefore greatly reduces the potential scaling of the steel, which in turn allows an almost complete consumption of the brick commencing with the furnace side and wearing through to the side of the supporting member without fear of premature dropping of the bricks. Therefore, suspended furnace ceilings made of bricks with this new type of suspension last longer and have a greater operating reliability, and are less expensive in overall constructional costs.

It is advantageous if the recess which is formed into a large surface brick side widens downwardly and inwardly, and one end of the supporting member, which is to extend into the recess, is correspondingly bent towards the center of the brick commencing in the area of the interface edge, and the other end of the supporting member protrudes from the interface side in a manner generally coplanar to the side surface of the brick. This is a simple construction which provides for a solid connection between the brick and the support plate.

A further object is to provide a brick in which one end of the supporting member may be entirely surrounded by refractory and air-tight material in the area highly exposed to thermal stress, whereby the material in the form of a settable cementious layer can be applied on and around that portion of the supporting member, which together are set into the recess of the brick, and when the cementious refractory material hardens securely fastens the strap to it. In this advantageous construction, the supporting member in the recess is covered at least flush with the interface sides with the filled refractory material, and the other end of the support plate or member projects outwardly away from the interface of the brick. This same general result can be obtained when enclosing the corresponding embedable end of the supporting member with a molded form preshaped to complementally correspond to that of the recess at the back or interface side of the brick, which subsequently can be set and bonded into the recess of the brick also before commencing furnace construction. In other words, the supporting member is first molded into a form preshaped to that of the recess, and is then set and preferably bonded into a correspondingly shaped recess of the brick.

The present invention represents a further needed improvement over the known prior art, including the

particular constructional materials and method disclosed in the aforementioned Meier U.S. Pat. No. 1,197,842. In Meier the furnace is constructed by blocks and utilize suspension members in the form of crossbolts **8** and hooks **7** therein, which hooks are embedded in the slight recesses of the brick by means of mortar during the actual constructional lining of the boiler furnaces hereof. Therefore, it does not disclose, teach or suggest ready made combined brick and suspension plate; i.e., it does not contemplate the provision of a unitary brick with a suspension member integrated therewith as a unitary assembly prior to the fabrication of the furnace. Accordingly, it is apparent that applicants' present invention provides a marked improvement, the use of which enables a less costly overall expenditure for a ceiling roof installation by the considerable reduction in time and labor which is necessary in modern construction techniques.

The foregoing and other objects and advantages will become apparent from the following detailed description taken in conjunction with two preferred forms of the invention as shown in the illustrative drawings, in which:

FIG. **1** is a perspective view of a brick provided with a recess;

FIG. **2** is a fragmentary vertical longitudinal section of a brick taken through the brick having a supporting member shown embedded with refractory material within the recess;

FIG. **3** is a perspective view on an enlarged scale of an alternate and prefabricated form of hanger or supporting member which is preferably bonded firmly with the recess of a brick;

FIG. **4** is a perspective view on a smaller scale of the hanger of FIG. **3**, but viewed from the opposite side thereof;

FIG. **5** is a fragmentary cross-sectional view similar to the upper part of FIG. **2** of a slightly modified form thereof; and

FIG. **6** is an elevational view on a smaller scale of the combined brick and a further modified form of suspension plate.

In FIGS. **1** and **2**, a refractory brick **1** has formed at the intersection of a large surface side **2** of the brick and the interface **4** opposite the furnace side, a recess **5** which has a generally trapezoidal cross-section with the small aperture **6** oriented toward the interface **4**. The recess **5** widens downwardly toward the center of the brick. Within the recess **5** one end **7***a* of a supporting plate **7** is embedded within a quick-hardening refractory mortar or similar acting substance **8**, which is sealed smoothly and adheres strongly to the sides of the brick when it sets, as well as to the support plate. To assure a more secure anchoring in material **8**, the support plate **7** is bent angularly approximately at its middle with the embeddable end **7***a* angularly projecting into the recess and with the opposite end **7***b* projecting upwardly out of the narrow portion **6** of the longitudinally extended recess **5**, and in a manner substantially coplanar with the large surface side **2**. The embedded end **7***a* may be laterally flared to correspond with the wedge shape, as per FIG. **6**, and/or it may have a flap **14** struck out from the body, as per FIGS. **2**, **3** and **4**, to act as an anchoring aid. The upwardly projecting free end **7***b* is provided with an eye **9** formed therein to facilitate suspending of the brick in a known manner.

Referring now to FIGS. **3** and **4**, a supporting plate **10**, similar to plate **7**, is embedded into a separately molded refractory body or shape **11** which corresponds complementally to the three-dimensional trapezoidal or other predetermined shape of the brick recess. This form is manufactured separately and is adapted to be set and preferably bonded, as by a suitable refractory type adhesive, into the correspondingly shaped brick recess. The refractory material of the premolded body **11** preferably extends almost to the suspension eye **12** of the upwardly projecting portion of the cover plate, which, as in the first-described embodiment, is adapted to project above the interface in a manner as to be coplanar with the surface **2** of the brick.

Accordingly, an improved brick and suspension plate sub-assembly or combination has been evolved which achieves all the objects and advantages set forth in the beginning and other portions of this application, and reference should be made to the appended claims for a definition of the claimed invention.

What is claimed is:

1. A refractory brick assembly useable in construction of suspension ceilings for high temperature furnaces heated to temperatures considerably in excess of 800°C., said assembly comprising a refractory brick of the burned or ceramically fired type made of a first refractory material and having four interconnected side faces and respectively adjoining top and bottom faces; a non-rectangularly shaped recess having a widest portion extending inwardly generally toward the center of the brick, said recess commonly opening at an intersection of only one of said side faces with the adjoining top face, and said recess having a narrowest portion opening at said top face which constitutes the interface of said brick disposed most remotely from the heat of the furnace; a support member of generally flat plate heat-durable material having one end extended into said recess but spaced from the walls thereof; said one end of said support member having a rigid covering of a second refractory material, said second refractory material being of a type which hardens more quickly than said first refractory material and fully enclosing said end in an air-tight, heat protective manner so as to substantially fill said recess at least substantially flush with adjacent faces of said brick and prior to construction placement in said furnace.

2. A brick assembly as defined in claim **1** wherein said rigid refractory covering the end of said support member extended into said recess is initially a relatively quick-setting cementious mortar material applied to rigidly secure said support member to said brick prior to the constructional assembly of said brick in the furnace.

3. A brick assembly as defined in claim **1** wherein said support member is fabricated of a steel alloy capable of withstanding furnace temperatures in excess of 800°C.

4. A brick assembly as defined in claim **1** wherein said rigid refractory covering the end of said support member extended into said recess is of pre-molded form corresponding in size and shape to complementally fit within said recess.

5. A brick assembly as defined in claim **4** further having means bonding said pre-molded form permanently to said brick within said recess.

6. A brick assembly as defined in claim **1** wherein said support member has opposite end portions and is

bent angularly about a bend in the generally medial area thereof, said support member disposed with said bend positioned closely adjacent to the narrowest portion of the recess opening of said brick interface, and with the end of the support member not covered by said refractory material projecting upwardly from said top face and essentially coplanar with said side face of the brick in which said recess opens.

7. A brick assembly as defined in claim **1** wherein said support member end extending inwardly of the brick is provided with an anchor flap projecting in an offset manner from the plane of said support member end part.

8. A brick assembly as defined in claim **1** wherein said support member end extending inwardly of the brick is formed to be laterally wider at the lowermost portion corresponding generally to that of the widest portion of said recess.

9. A brick assembly as defined in claim **1** wherein said recess is of generally trapezoidal shape in both vertical longitudinal and transverse cross-section to provide a more secure anchoring of said support member.

10. A brick assembly as defined in claim **9** wherein said end of the support member extending inwardly of the brick is provided with oppositely and divergingly flared side edges corresponding generally to the shape of the recess.

* * * * *