April 23, 1963 N. W. ROUDABUSH 3,086,330

REFRACTORY BRICKS

Original Filed Oct. 28, 1959

FIG. 2

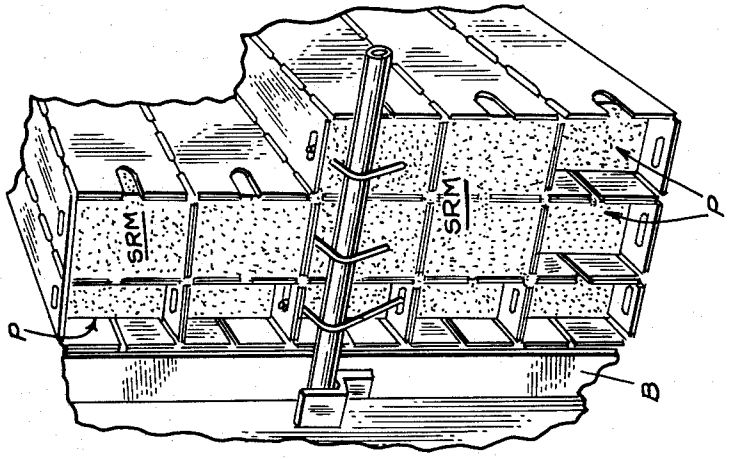
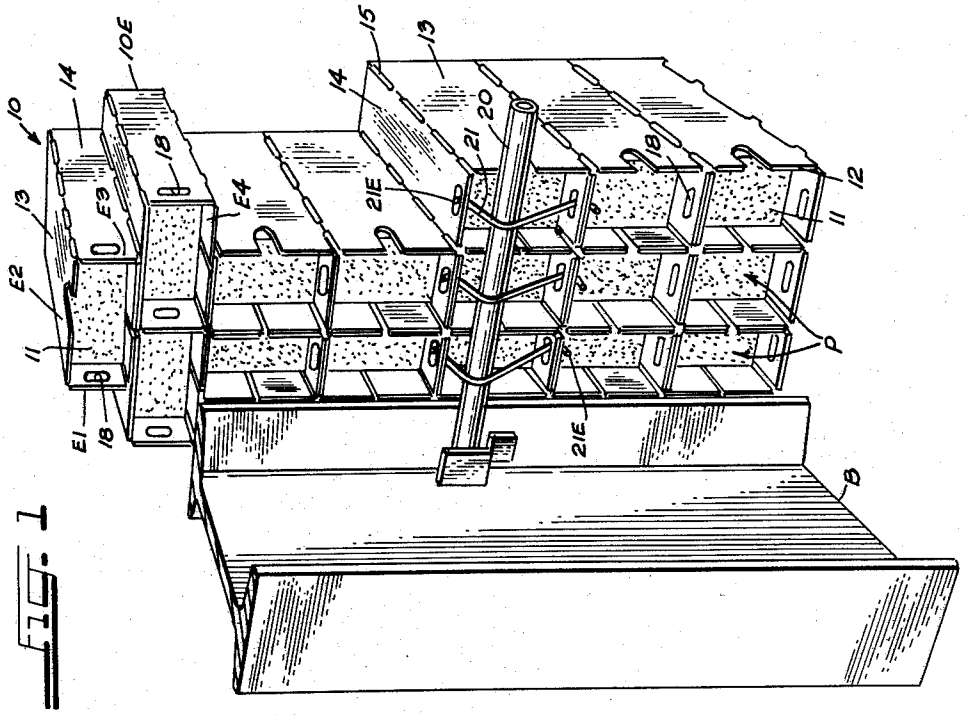


FIG. 1



INVENTOR.

NED W. ROUDABUSH

BY

Wallace and Cannon

ATTYS.

United States Patent Office

3,086,330
Patented Apr. 23, 1963

3,086,330
REFRACTORY BRICKS

Ned W. Roudabush, Pittsburgh, Pa., assignor to H. K. Porter Company, Inc., Pittsburgh, Pa., a corporation of Delaware

Continuation of application Ser. No. 849,283, Oct. 28, 1959. This application June 19, 1962, Ser. No. 205,482
2 Claims. (Cl. 50—395)

This invention relates to the construction of metallurgical and like furnaces and in particular to refractory bricks to be used in the construction thereof.

During continued use of a metallurgical furnace constructed from basic refractory bricks clad in metallic casings, or without metallic casings, the ends of the bricks that face inward of the furnace gradually wear away due of course to the extreme heat corroding conditions within the furnace. Eventually a state is reached where there is nothing more left than a thin-walled remnant or flake of variable extent and area, and various expedients have been resorted to as a temporary measure to in effect reinforce the thin remnant. For example, in a roof construction it is common practice to in effect dump or scatter loose refractory material over the back or cold side of the roof to alleviate the rapidly deteriorating condition. In some instances also, the roof bricks have large plates arranged at predetermined locations thereamong and which have projecting fins extended upwardly beyond the plane of the cold face of the roof. These fin parts serve as radiators which conduct heat out of the roof and into the ambient atmosphere thereby tending to prolong the life of the roof bricks.

The same remnant condition is particularly acute at the side and end walls of a metallurgical or like furnace inasmuch as it is extremely difficult to be able to reinforce the remnant sections. This is so because any endeavor to add refractory packing such as used for the roof in the above-described manner must take into account the fact that gravity will tend to displace this material at the side and end walls. It has also heretofore been proposed to utilize horizontal spacer plates positioned at predetermined levels in the vertical extents of the bricks at the side and end walls of the furnace. These plates also have projecting fin ends which can be viewed as constituting shelves, and these shelves have been utilized as supports for refractory packing intended to reinforce the remnant state at the side or end wall. These same fins have had so-called tapping bars secured thereto, and the tapping bars are joined to the vertical I-beams or so-called buck stays which are the main furnace side supports. This arrangement including tapping bars joined to buck stays accounts for stability of the side and end walls of the furnace, and the fins also are radiators as in the instance described above in connection with roof fins.

The arrangement of the present invention in contrast to the foregoing is such that each brick for a side or end wall is clad in a metallic casing of over-sized dimension compared to the sides of the brick. This results in a metallic pocket or channel at the cold end of the brick which enables reinforcing refractories to be tightly compacted stably in large quantities therein and effectively anchored or reinforced against shifting or loss

by the walls which afford the pocket or channel extension. In other words, the arrangement of the present invention is one wherein each individual brick in effect is bucked up at its cold end behind the remnant or flake hot end. The present construction will account for a greater degree of radiation in comparison to the widely spaced plates as heretofore used, since each brick in effect has a plurality of heat radiating fins or ears. Moreover, the casing wall extensions are provided with exposed openings, and these enable the bricks to be conveniently anchored to ties in turn anchored to the buck stays in one way or another at the side and end walls of the furnace. The present invention is particularly useful in side and end wall constructions, because it makes possible the elimination of the need for individually located plates as aforesaid, and the numerous pockets afforded in accordance with the present invention will account for a honeycomb effect at the cold faces of the furnace side and end walls enabling more effective packing to be achieved. The honeycomb effect also results in a greatly stabilized condition when the refractory material has reached a flake or remnant state over a wide and expansive area where heretofore there has been a virtual collapse or falling in of wide sheets of remnants. This application is a continuation of application Serial No. 849,283, filed October 28, 1959.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

FIG. 1 is a fragmentary perspective view of a portion of a side wall of a furnace constructed from bricks in accordance with the present invention; and

FIG. 2 is a perspective view similar to FIG. 1 but showing the condition at the cold ends of the bricks after the same have been backed by loose refractory material in accordance with the present invention.

FIG. 1 of the drawings shows in perspective a portion of a side or end wall of an open hearth furnace constructed with bricks in accordance with the present invention, each such brick **10** being of identical construction throughout although the disposition when laid can vary as will be evident in FIG. 1. As is well known in the art, the side wall construction of such a furnace includes vertically oriented I-beams or so-called buck stays B, and these are used in accordance with the present invention to stabilize the bricks as will be explained hereinafter.

Each brick **10** includes a core **11** of basic refractory material, and each core is encased in a sixteen or twenty gauge plain carbon steel sleeve or casing **12** having four sides folded about the four side of the related refractory core. However, the ferrous metal casing is of greater length than the length of the core so as to afford open

pockets P at the cold end of each brick. Advantageously, the sleeves are coated with aluminum as a guard against excessive oxidation.

The ferrous metal sleeve encasing each refractory core is a one-piece member having a pair of parallel equidimensioned broad sides 13 and a like pair of narrow sides 14, and at each corner fold the metallic sleeve is formed with a plurality of elongated slits 15 so as to facilitate bending and folding of the casing about the related refractory core. The provision of such slits also enables the casing to be folded effectively into tight contact with the core even though there may be minor variations in dimension from one refractory core to the next as can be expected from the molding of such refractory cores. The abutting edges of a casing can be stapled or spot welded or otherwise secured together to complete the assembly.

In accordance with the present invention, one end of the metallic casing is substantially co-terminal with what will constitute the hot end of the brick, that is, the end 10E, FIG. 1, which will face inwardly of the furnace area, while on the other hand the opposite or cold end of the casing is of such length as to extend well beyond the outer or cold end of the core. Thus, each sleeve 12 at what constitutes the cold end has a plurality of integral extensions or ears E1, E2, E3 and E4 defining the pockets P, and opposed ones of the ears as E1 and E3 are provided with openings 18 for a purpose to be explained.

The bricks 10 are laid in accordance with standard practices to afford the side wall of the furnace as typically shown in FIG. 1 and in such a manner that the open pockets P afforded by the extended ears described above face to the outside.

One feature of the present invention is that the side or end wall construction thus afforded can be effectively stabilized by associating stabilized hook elements with the openings 18. Thus, as shown in FIG. 1, a tapping bar or tube 20 is anchored to an adjacent buck stay 11. These bars extend for the full length of the wall, and in actual practice will be located at strategic elevations so as to enable unitary stabilizers or fasteners in the form of hook elements 21 to be anchored thereto at points corresponding to every vertical row of bricks. Each fastener is used to anchor three bricks. Thus, each member 21 has a pair of bent ends 21E, and each of these is inserted into the aligned openings 18 of a pair of bricks as shown in FIG. 1, and these ends are then twisted or otherwise secured in place to anchor and stabilize the three related bricks.

After prolonged use of a furnace of the kind under consideration, the hot ends of the bricks are found to be severely deteriorated as shown in FIG. 2, and eventually reach a state where large sections spall off and fall into the furnace cavity. In accordance with the present invention, the bricks are in effect revived for further extended use by blowing or otherwise filling the pockets P mentioned above with supplemental refractory material SRM as shown in FIG. 2, thereby contributing further to the life of the furnace. I prefer to have the ears or fins E project at least about five percent beyond the cold end of the core, measured in terms of the over-all length of the refractory core. Thus, for a 3 x 3 x 9 so-called straight brick, the ears as E1 and so on are 1¼" long, and this same amount of projection can be used for a 3 x 3 x 18 straight brick. It will be realized that the ears as E1 and so on afford a great deal of heat radiating capacity tending to prevent that much over-heating of the refractory cores. Further, the four-sided pockets P present a honeycomb effect assuring firm anchorage of the supplemental refractory material SRM.

It will be seen from the foregoing that under the present invention metallic encased bricks are afforded for metallurgical and like furnaces, and the casings are so constructed as to have fins or ears serving to back up and reinforce loose refractory material that is to be added to the bricks at a late stage of furnace operation wherein the hot ends of the bricks have been deteriorated and worn away. The aforesaid fins are provided with openings enabling each brick to be effectively stabilized when used in a side or end wall of the furnace.

It will also be realized from the foregoing that the metallic casing embraces selected sides of the refractory core so that extensions or fins at the cold ends of the bricks, free of the refractory brick core, are so arranged in the initial wall construction as to cooperate one with another to define the desired cubical spaces bounded on four sides by four such fins or ear-like extensions which serve to stabilize and support the supplemental refractory SRM when it is added.

Hence, while I have illustrated and described a preferred embodiment of the present invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A side wall construction for a metallurgical or like furnace and comprising rows of elongated bricks each having a core of refractory material, each such core being of generally uniform rectangular cross section throughout its length and having substantially flat sides and end faces, each such brick having a four-sided metallic casing extended about the four sides thereof and extending from one end face of the related core to well beyond the opposite face to thereby afford four fin-like extensions of the casing in each brick projecting well beyond said opposite end face of the related refractory core, an opposed pair of said extensions in each brick having openings therein, said bricks being laid one atop another and one aside another in generally horizontal attitudes in the side wall of the furnace with said casing fins disposed outermost in the side wall and aligned one with another to afford a honeycomb network of open-ended pockets at the outerside of the furnace side wall adapted to receive and hold supplementary refractory material packed into the honeycomb at a stage of furnace operation where the inner ends of the bricks have been substantially eroded, said openings in the casing fins of adjacent bricks being aligned and registered one with another, said wall construction including at the outer side thereof horizontally spaced apart vertically disposed buck-stay columns, horizontal bars supported at their ends by and extended between said columns and disposed outward of the fin ends of said bricks, and unitary wire-like fasteners anchored to said horizontal bars and having bent free ends entered in and hooked into said aligned openings in the brick fins to anchor and stabilize a plurality of the bricks.

2. A vertical wall construction for a metallurgical or like furnace and comprising rows of elongated bricks each having a core of refractory material, each such core being of generally uniform rectangular cross-section throughout its length and having substantially flat sides and end faces, each such brick having a metallic casing extended about selected sides thereof and extending from one end face of the related core to well beyond the opposite face to thereby afford fin-like extensions of the casing in each brick projecting well beyond said opposite end face of the related refractory core, an opposed pair of said extensions having openings therein, said bricks being laid one atop another and one aside another in generally horizontal attitudes in the side wall of the furnace with said casing fins disposed outermost in the side wall and aligned one with another to afford a honeycomb network of open-ended four-sided metal pockets at the outer side of the furnace side wall adapted to receive and hold supplementary refractory material packed into the honeycomb at a stage of furnace operation where the inner ends of the bricks have been substantially

eroded, said openings in the casing fins of adjacent bricks being aligned and registered one with another, said wall construction including at the outer side thereof horizontally spaced apart vertically disposed buck-stay columns, horizontal bars supported at their ends by and extended between said columns and disposed outward of the fin ends of said bricks, and unitary wire-like fasteners anchored to said horizontal bars and having free ends entered in and hooked into said aligned openings in the brick fins to anchor and stabilize a plurality of the bricks.

References Cited in the file of this patent

UNITED STATES PATENTS

2,114,960	Beall	Apr. 19, 1938
2,158,759	Morlock	May 16, 1939
2,187,669	Stewart	Jan. 16, 1940
2,781,006	Heuer	Feb. 12, 1957
2,927,454	Reintjes	Mar. 8, 1960

FOREIGN PATENTS

638,767	Great Britain	June 14, 1950