Nov. 28, 1950 M. PIRANI ET AL 2,532,190

REFRACTORY BRICK, BLOCKS, OR LIKE ELEMENTS

Filed Feb. 20, 1948

FIG. 1.

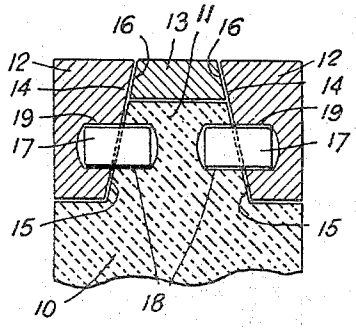


FIG. 3.

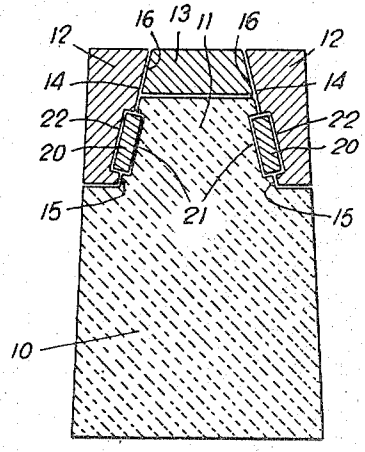


FIG. 2.

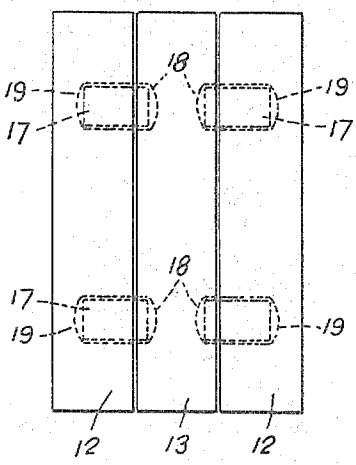
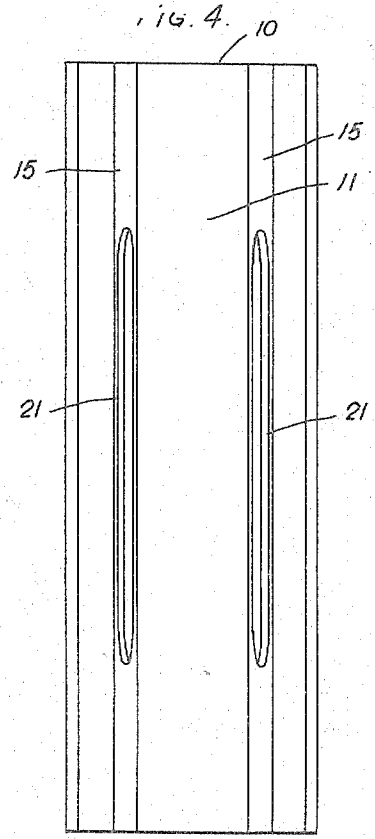


FIG. 4.



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REFRACTORY BRICK, BLOCKS, OR LIKE ELEMENTS

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9 Claims. (Cl. 72—35)

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This invention relates to refractory bricks, blocks or like elements for use in the construction of furnaces or other appliances which have to withstand high temperatures.

For many purposes it is desirable to construct such refractory elements in a composite form consisting of an outer facing of one refractory material upon an inner body portion of another refractory material. One advantage of such composite construction is that, in the interests of economy, an expensive refractory material having special properties, for example, especially high refractoriness or high resistance to chemical attack, need be used only for the facing, while the body portion may be composed of a less expensive refractory material. A further advantage is that the refractory materials can be selected with regard to different properties which may be desired in the facing and the body portion, respectively. Thus, for example, while a refractory material of zircon is very well suited for the facing, it may under certain conditions be less suitable for the body portion owing to its high density and comparatively high thermal conductivity, and hence a refractory material of lower density and lower thermal conductivity can be used for the body portion.

Owing to differences in the coefficients of expansion of the materials of which the facing and the body portion are composed, it is desirable that the facing and body portion should be secured together in such manner that they are free to expand and contract in use without setting up undesirable stresses. For this purpose it has been proposed, for example, to make the inner surface of the facing interlock with the outer surface of the body portion by the provision of a projection on one surface which loosely interlocks with a recess on the other surfaces in the manner of a dovetail joint so as to secure the facing against movement outwards from the surface of the body portion. However, the relatively thin protruding edges of the projections and recesses of such interlocking connections are very liable to become broken during the manufacture or use of such composite refractory elements.

According to this invention the facing is formed of separate sections comprising two lateral sections disposed one on each of the opposite sides of a raised part of the outer surface of the body portion and an intermediate section disposed on the raised part of the body portion between the lateral sections, and the sections are secured against movement outwards from the body portion in the case of each lateral section by means

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of a key or keys fitting loosely within opposed recesses formed in the side of the said raised part of the body portion and in the adjoining surface of the lateral section, and in the case of the intermediate section by its fitting loosely within an outwardly narrowing recess formed by the surfaces of the lateral sections between which the intermediate section is disposed.

The keys may take the form of pins arranged with their longitudinal axes extending across the adjoining sides of the lateral sections and of the raised part of the body portion, and fitting within correspondingly shaped holes formed in the said adjoining sides. Alternatively, the keys may be in the form of bars bridging the said adjoining sides in the direction of the width of the bars and arranged with their longitudinal axes substantially parallel with the outer surface of the facing, and fitting within correspondingly shaped slots formed in the said adjoining sides.

It will be understood that the holes, slots or other recesses formed in the body portion and lateral sections will be so dimensioned as to avoid any undesirable weakening of these parts. The recesses may be formed in the body portion or the lateral sections prior to the firing operation, for example, when the parts are moulded, or subsequent to the firing operation, for example, by means of drills, grinding wheels or other tools.

In order to keep the facing sections and body portion united for convenient handling of the composite elements before they are built up into the structure they are to form, the adjoining surfaces of the facing sections and body portion, and if desired also of the keys and recesses, may be temporarily united by means of an adhesive material, for example, a thin layer of a cement, which will crack or otherwise cease to unite the said surfaces under the conditions of temperature to which the refractory elements are exposed during use, and thus permit unequal expansion or contraction of the parts to take place without deformation.

In the case of different refractory materials which are liable to react with one another under the conditions of use so as to form a compound which melts at a lower temperature than either of the refractory materials themselves, as, for example, when zircon is used for the facing and sillimanite for the body portion, it is necessary to provide protective means between the opposing surfaces, for example, an intermediate layer of a suitably inert refractory material. When the protective intermediate layer is applied as a cement or adhesive it will serve also as a temporary

cement or adhesive for the purpose described above. Thus, for example, with a facing of zircon and a body portion of sillimanite an intermediate layer of alumina, applied to one or both of the opposing surfaces, affords the necessary protection against interaction; and by applying the alumina as a cement it serves also for the temporary adhesion of the facing to the body portion. In this case also the keys may be of alumina.

Examples of composite refractory bricks constructed in accordance with the invention are illustrated in the drawings, in which drawings

Figure 1 is a vertical cross section of one form of brick,

Figure 2 is a plan view of the brick shown in Figure 1,

Figure 3 is a vertical cross section of a brick of slightly modified construction, and

Figure 4 is a plan view of the body portion of the brick shown in Figure 3 with the facing removed.

In all the figures the brick comprises a body portion 10 having a raised part 11, and a facing consisting of two lateral sections 12 with an intermediate section 13 disposed between them. The inner side 14 of each lateral section is inclined parallel with the inclined surface formed by the side 15 of the raised part 11 and the side 16 of the intermediate section 13. The portions of the inner sides 14 of the lateral sections between which the intermediate section 13 is disposed thus form an outwardly narrowing recess in which the intermediate section is loosely held on the outer surface of the raised part 11.

In the construction shown in Figures 1 and 2 the lateral sections 12 are secured against movement outwards from the body portion 10 by means of pins 17 which fit loosely within recesses 18 and 19 formed in the adjoining surface of the sides 15 of the body portion and the sides 14 of the lateral sections, respectively. Two pins 17 fitting into corresponding recesses 18, 19 are provided for each lateral section.

In the construction shown in Figures 3 and 4 the lateral sections 12 are secured by means of bars 20, which extend in the direction of their longitudinal axes parallel with the outer surface of the facing, and which bridge the adjoining sides 14 and 15 of the lateral sections and of the raised part 11 respectively, in the direction of the width of the bars. The bars 20 fit loosely within correspondingly shaped slots 21 and 22 formed in the adjoining sides 15 and 14, respectively, one bar serving to secure each lateral section.

The facing sections 12 and 13 may be composed of zircon and the body portion 10 of sillimanite. The pins 17 and bars 20 may be composed of sintered alumina. In order to unite the parts temporarily for convenient handling, and to provide a protective intermediate layer between the opposing zircon and sillimanite surfaces, the facing sections may be secured together and to the body portion, and the pins or bars secured within their recesses, by applying a layer of alumina cement between all the adjoining surfaces, the thickness of this layer being about 2 millimetres. In order to afford efficient protection at high temperatures it is desirable that the alumina used should contain not less than 98 per cent of Al_2O_3, and that its particle size distribution should be such that 60 to 70 per cent thereof ranges from minus 40 to plus 80 mesh B. S. S. and about 10 per cent is of minus 240 mesh B. S. S.

To prepare the cement the alumina powder may be added to and thoroughly mixed with an aqueous suspension of an organic gel-forming substance of the kind used as a temporary binding agent in refractory cements, until the consistency of the cement is smooth and creamy. The cement is then applied to the surfaces in the usual manner.

The composite refractory elements of the invention may be built into a furnace or other structure with their faced surfaces facing in any direction. Thus, for example, they may be built to form a side wall with the facings directed laterally or a roof with the facings directed downwardly. By suitably tapering the sides of the elements, for example, as shown in Figure 3, they may be used for the construction of curved side walls or arched roofs.

We claim:

1. A refractory element having an outer facing of one refractory material located upon an inner body portion of a different refractory material, wherein the body portion has an elevation on its outer surface, the facing is formed of separate sections comprising two lateral sections located one on each of the opposite sides of and extending outwardly beyond the said elevation and an intermediate section located upon the said elevation and fitting loosely in the space between the lateral sections, means to secure each lateral section against movement outwards from the body portion is provided consisting of at least one key fitting loosely within opposed recesses formed in the side of the said elevation and in the opposing side of the lateral section, and the sides of the lateral sections extending outwardly beyond the sides of the said elevation converge towards one another to form an outwardly narrowing space between them whereby the intermediate section is secured against movement outwards from the body portion.

2. A refractory element as claimed in claim 1, wherein the key takes the form of a pin fitting loosely within the said opposed recesses with its longitudinal axis extending across the opposing sides of lateral section and elevation.

3. A refractory element as claimed in claim 1, wherein the key takes the form of a bar bridging in the direction of its width the opposing sides of the lateral section and elevation, arranged with its longitudinal axis substantially parallel with the outer surface of the facing, and fitting loosely within correspondingly shaped slots formed in the said opposing sides.

4. A refractory element as claimed in claim 1, wherein the separate parts of the assembly are temporarily united by means of an adhesive material applied between at least some of the opposing surfaces and capable of releasing the said surfaces under the action of heat.

5. A refractory element as claimed in claim 1, wherein the facing and the body portion are composed of different refractory materials capable of reacting with one another at high temperatures to form a compound melting at a lower temperature than either of the said materials, and protective means is provided between the opposing surfaces of the facing and the body portion.

6. A refractory element as claimed in claim 5, wherein the protective means consists of an intermediate layer of non-reactive refractory material.

7. A refractory element as claimed in claim 1, wherein the facing is composed of zircon.

8. A refractory element as claimed in claim 1, wherein the body portion is composed of sillimanite.

9. A refractory element as claimed in claim 5, wherein the facing is composed of zircon and the body portion of sillimanite and the protective means consists of a layer of alumina between the opposing surfaces of the facing and the body portion.

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