

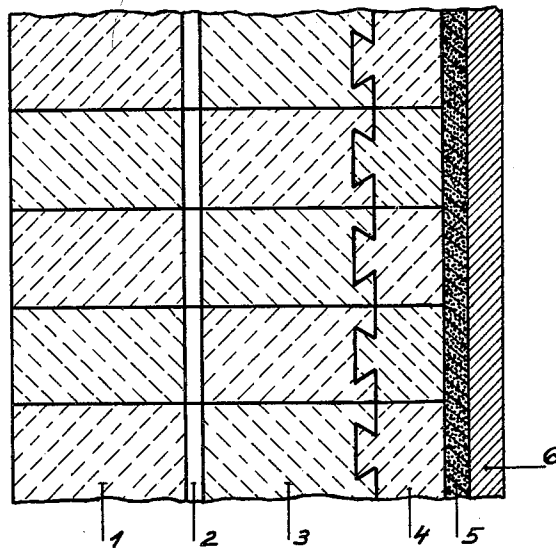
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H. HILBER

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REFRACTORY LINING

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REFRACTORY LINING

Helmut Hilber, Vienna, Austria, assignor to Veitscher Magnesitwerke Actien-Gesellschaft, Vienna, Austria, a corporation of Austria

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3 Claims. (Cl. 266-43)

This invention relates to a refractory lining structure as is used particularly in the combustion zone of shaft furnaces.

The refractory lining structure of shaft furnaces comprises generally a so-called permanent lining next to the shell of the furnace, and a working lining, which is directly exposed to the burning material and to the furnace atmosphere. The usual lining is constructed of magnesite quality in the zone which is subjected to the greatest thermal stresses and partly also to the greatest mechanical stresses whereas the permanent lining consists of suitable fireclay. To compensate the thermal expansion of the refractory bricks an annular gap filled with combustible materials such as cardboard or a space about 70-100 mm. wide and filled with ground fireclay is provided between the basic working lining and the permanent lining of fireclay.

In such a lining structure, the two linings, that is the working and the permanent linings, which are more or less directly in contact with each other just in the region of highest thermal stress consist of materials which give rise to chemical reactions at certain temperatures, whereby the adjoining layers of the lining may be destroyed. These reactions, termed contact reactions, occur between two different solid materials, which are unable to react with one another at room or even slightly elevated temperatures, when their temperature is raised to a very high value. The resulting reaction forms a low melting flux. For example, a basic material such as magnesium oxide and an acidic oxide such as alumina can and do often so react when heated to about 1500° C. These contact reactions are particularly dangerous when a further period of operation is begun after the working lining of magnesite has been consumed to a considerable extent, when lateral fires occur in the case of an irregular furnace operation or when the furnace must be overloaded at times. In these cases, the magnesite working lining will break down and the furnace must be shut down for repairs or relining; this involves a considerable loss of production. According to the invention these disadvantages are eliminated in that the permanent lining, which is spaced from the working lining only by the width of the expansion joint, consists also of basic or neutral shaped bodies and an additional heat-lagging layer is provided on the cold side. This measure enables the utilization of the working lining except for smallest residual thicknesses and a much increased safety of operation even when the working lining has been considerably consumed and the period of operation is to be prolonged. Another advantage of the invention is to be seen in that furnaces for intermittent operation, as are used, e.g. in the sugar industry, may be provided with working linings of lower thickness than was previously usual because the danger of breakdowns is practically eliminated. Another highly advantageous and important improvement afforded by the invention resides in that the heat-lagging layer consists also of shaped bodies, which suitably form compound blocks with the shaped bodies of the permanent lining lying before them. By making the permanent lining of compound blocks, consisting of an insulating layer and a basic or neutral layer, a substantial simplifi-

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cation of the lining operation is achieved, whereby the time required for the lining operation is reduced.

The accompanying drawing shows a sectional view of the entire lining for a portion of the furnace to show the several parts of the lining structure of a shaft furnace.

In the drawing, 1 is the working lining, which consists of basic or neutral bricks, e.g. magnesite bricks, and which is adjoined on the side facing the shell 6 of the furnace by an expansion joint 2 for compensating the thermal expansion of the refractory material. This joint is filled with combustible material when the lining is being prepared. 3 is the permanent lining, in which basic or neutral material, as in the working lining, is used according to the invention. The permanent lining 3 is adjoined by the heat-lagging layer 4 of high-grade insulating material. The drawing shows the permanent lining 3 and the heat-lagging layer 4 combined in the form of compound blocks. An additional thin insulating layer 5, e.g. of Fibrosilex, is used in most cases between the sheet metal shell 6 on the one hand, and the permanent lining 3 and the insulating layer 4, on the other hand.

The arrangement according to the invention enables the operation of the furnace until the working lining has been worked down to smallest thicknesses, even while a portion of the permanent lining is directly exposed to the heat of the furnace, without endangering the safety of operation of the furnace. When a part of the permanent lining has been worn for certain reasons during the furnace campaign, this can be simply repaired with the aid of refractory materials when the working lining is renewed whereas the former arrangement of permanent and working linings is retained.

Example 1

- (a) Working lining (1), 230 mm., of magnesite brick.
- (b) Air gap (2), 10 mm., to take up the thermal expansion.
- (c) Permanent lining (3), 125 mm., of chromite brick.
- (d) Heat lagging layer (4), 125 mm., of porous bricks obtained, for example, according to the Austrian Patent No. 175,535. In that patent the porous brick is formed by mixing a raw carbonate, for example, magnesite, with the heat-resisting material before the mass is fired. The carbonate upon heating loses carbon dioxide which is entrapped and lends porosity to the resulting brick. A carbonate is chosen which when heated will yield an oxide of high refractoriness. The heat-lagging layer (4) is preferably porous sintered magnesite.
- (e) Additional heat-lagging layer between sheet metal shell and (4); this layer consists of a fill of ground fireclay.

Example 2

- (a) Working lining (1), 230 mm., of magnesite brick.
- (b) Air gap (2), 10 mm., for taking up the thermal expansion.
- (c) Permanent lining (3) + heat-lagging layer (4) in the form of compound blocks, (3) consisting of a chromite brick and (4) of an insulating brick according to (d) above.
- (d) Like (e) in Example 1.

The magnesite bricks referred to above may have, e.g., the following composition:

Component	Particle Size, mm.	Proportion, percent
Chromite.....	0-1.7	15
Sintered magnesite.....	0-2.5	60
Do.....	0-1.7	10
Finely-ground sintered magnesite.....	0-0.15	15

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The chromite brick referred to above may have, e.g., the following composition:

Component	Particle Size, mm.	Pro-portion, Percent
Chromite.....	0-1.7	45
Do.....	1.7-4.0	30
Sintered magnesite.....	0-1.7	20
Finely-ground sintered magnesite.....	0-0.15	5

What is claimed is:

1. In a shaft furnace for burning mineral material, a refractory lining structure which comprises a working lining of magnesite bricks, a permanent lining of chromite bricks spaced from said working lining, and a heat-lagging layer of non-acid shaped bodies adjacent the side of said permanent lining which is remote from said working lining.

2. In a shaft furnace for burning mineral material, a refractory lining structure which comprises a working lining of magnesite bricks, a permanent lining of chromite

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bricks spaced from said working lining, and a heat-lagging layer of porous magnesite bricks adjacent the side of said permanent lining which is remote from said working lining.

5 3. In a shaft furnace for burning mineral material, a refractory lining structure which comprises a working lining of magnesite bricks, a permanent lining of chromite bricks spaced from said working lining, and a heat-lagging layer of porous magnesite bricks adjacent the side of said permanent lining which is remote from said working lining, said permanent lining and heat-lagging layer being in the form of a compound brick.

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References Cited in the file of this patent

UNITED STATES PATENTS

1,410,739 Balz ----- Mar. 28, 1922
2,230,141 Heuer ----- Jan. 28, 1941
2,683,032 Hartman ----- July 6, 1954

20

FOREIGN PATENTS

448,663 Great Britain ----- June 12, 1936