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Flat separation floor between two superposed chambers in kilns, in particular roller-hearth kilns for ceramic tiles.

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References cited:
EP-A- 0 110 752
FR-A- 1 417 291
FR-A- 2 278 049
GB-A- 2 143 313
US-A- 2 656 717
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Description

This invention relates to the manufacture of kilns of the superposed chamber type, in particular roller-hearth kilns for ceramic tiles.

In said kilns it is important to provide effective thermal insulation between the superposed chambers to render them thermally independent.

For this purpose separation floors are currently used consisting of bending-stressed beams supporting an upper layer and a lower layer of insulating refractory material which both separate the two chambers thermally and protect the beams from heat.

However the beams remain inevitably subjected to the action of heat (normally reaching temperatures exceeding 1000°C), and because of this plus the fact that they support the entire weight of the floor under bending stress the floor has to be relatively light in order not to compromise the stability of the structure.

For this reason it is not possible in practice to construct a floor which satisfactorily separates the superposed chambers from each other because light and unfortunately poorly insulating materials and/or too small thicknesses have to be used for the insulating layer.

An object of the present invention is to provide a floor in which, other factors being equal, the load-bearing beams are stressed to a lesser extent so allowing for example the use of an insulating refractory layer of relatively greater weight (for example using better insulating material of greater specific gravity) and/or a layer of greater thickness.

By this means a floor can be provided which is able to thermally separate the superposed kiln chambers more efficiently.

This and further objects are attained by the floor of the present invention as characterised in the claims.

With the invention, by forming a more highly insulating layer a more effective insulation of the internal beams is also obtained so that these are less subject to the repeated temperature variations which occur in the kiln, for example when one or both the chambers are extinguished or ignited.

A further advantage of the invention is the ability to extract relatively easily from the kiln one or more of the component structural elements of the floor, for example in the case of wear or damage to the component blocks of the structural element.

A further advantage of the invention is the fact that the component blocks of the floor expand on heating, so undergoing mutual compression to improve the seal between the blocks.

The invention is described in detail hereinafter with reference to the accompanying figures, which show a preferred but not exclusive embodiment thereof.

Figure 1 is a section on a vertical transverse plane through the kiln to which the floor of the invention is applied.

Figure 2 is a section on the line II-II of Figure 1.

In said figures the reference numeral 1 indicates overall the floor according to the invention, while 2 indicates overall the kiln to which the floor 1 is applied.

The kiln 2 is illustrated only very diagrammatically as its details are not relevant.

Substantially, the kiln 2 comprises a lower chamber 21 and a higher chamber 22 which are insulated from each other by the floor 1 and the bounded laterally by two opposing vertical walls 23 and 24 respectively.

In the walls 23 and 24 there are provided holes 25 through which rollers (not shown) pass for conveying the objects within the chambers 21 and 22, and holes 26 through which the kiln burners are inserted.

The kiln base 27 is positioned below the chamber 21 and the roof 28 is positioned above the chamber 22.

The floor 1 comprises a plurality of structural elements 10 of elongated parallelepiped shape with their longitudinal axis horizontal, they being disposed parallel and adjacent to each other to form a flat horizontal structure supported by two opposing vertical walls.

Each element 10 comprises at least one internal beam 11, and specifically in this case two beams parallel to the axis of the element 10, and a plurality of identical thermal insulation blocks 12, also of parallelepiped shape and each provided with holes 13, one for each beam, by which they are mounted along the internal beams 11. The blocks 12 are typically of insulating refractory material and the holes 13 are of circular cross-section. The beam 11 is of corresponding tubular shape with its outer diameter slightly less than the diameter of the holes 13. The blocks 12 are axially slidable along the beams 11, means also being provided acting on the ends of the row of blocks 12 to compress the row in an axial direction so pressing the blocks 12 together.

In the illustrated embodiment, said means comprise strong elastic springs precompressed between one end of the row of blocks 12 and an element 4 rigid with a vertical wall 23 or 24 of the kiln, the other end of the row of blocks 12 being pressed against the opposite vertical wall 24 or 23 respectively.

The element 4 consists in particular of a plate secured by brackets 5 to a metal structure 6 provided on both the vertical walls 23 and 24 and fixed to their outside.

Between the plate 4 and the corresponding end of the row of blocks 12 there is disposed a pair of telescopic struts 7 in which the springs 3 are positioned to press on a plate 8 resting against the first block 12 of the row.

One end of the struts 7 is threaded and is fixed to the plate 4 by large nuts screwed onto it. By screw-
ing or unscrewing these nuts the precompression of the springs 3 can be adjusted in the sense that they press against the row of blocks 12 to a greater or lesser extent.

The walls 23 and 24 are provided with through holes 29 through which the structural elements 10 pass as an exact fit (the cross-section of the holes 29 is therefore similar to but slightly larger than the cross-section of the blocks 12) and in which the blocks 12 lying in proximity to the spring 3 rest.

In the opposite wall 24 or 23 respectively, on the axis of each hole 29, there is provided an identical hole 31 in which a few blocks 15 identical to the blocks 12 are placed and are secured rigidly to the wall to form an integral part of it. Within each element 10 the internal beams 11 traverse all the blocks 12 and 15 to project slightly from both sides of the kiln where they emerge from the row of blocks 12 and 15.

The end portions of the beams 11 are supported within the holes of the blocks 15 and within the holes of these blocks 12 which rest in the hole 29.

The blocks 12 disposed within the kiln are supported by the beam 11, which is thus subjected to bending stress by the weight of the blocks.

However, the action of the precompressed springs 1 combined with the reaction of the fixed blocks 15 compresses the row of blocks 12 in an axial direction so pressing them against each other. This compression action counteracts the flexural deformation of the row of blocks 12 and tends to keep the axis of the row straight so that this becomes at least partly self-supporting to at least partly discharge the load acting on the internal beams 11 caused by the weight of the blocks 12.

This action, which is favourable for the beam, therefore increases with increasing kiln temperature as the blocks 12 expand as their temperature increases, to increase the total length of the row and thus the compression of the springs 3.

As the beams are stressed to a relatively lesser extent than when in the situation in which the weight of the blocks is completely discharged onto the beams, it is possible to use relatively heavier rows of blocks 12, for example by increasing the thickness of the blocks 12 in the vertical direction or by using materials of higher specific gravity, so as to increase the insulating action of the floor 11 and also increase the mechanical hardness of the floor, this being particularly useful because of the impact on the floor by objects which fall from the conveying rollers.

The various rows of blocks 12 are positioned side by side and adjacent to each other to form a single horizontal flat floor.

The holes 29 are advantageously provided alternately in the wall 23 and in the wall 24 and, vice versa, the holes 31 are provided alternately in the wall 24 and in the wall 23, so that in each wall 23 and 24 there holes 29 through which the blocks 12 are inserted and extracted, alternating with holes 31 which are closed by the blocks 15.

Between those mutually contacting surfaces which undergo relative movement due to expansion there are obviously provided suitable layers of gasket material, for example between one element 10 and the next and between the internal surface of the holes 29 and the blocks 12 resting within these latter holes.

A thin layer 34 can also be provided on the upper surface of the floor 1 to provide mechanical protection for the blocks 12.

In addition to the described advantage of relatively lower stressing of the internal beams 11, the present invention also has the advantage that the structural elements 10 can be relatively easily extracted through the holes 29, for example to change worn or broken blocks 12.

Furthermore, an excellent seal is obtained between the blocks of each row because of the opposition to the high-temperature expansion of the blocks provided by the thrust of the springs 3.

In addition, the beams 11 are effectively insulated within the rows of blocks 12, so being less exposed to the temperature variations which occur when the kiln is extinguished or re-ignited and not subjected to the atmosphere within the kiln, which is chemically corrosive.

In a different embodiment of the invention, not shown in the figures, the reaction to the compression produced by the springs 3 is provided by the internal beams 11, which are thus subjected to tension, by making the plate 4 rigid with one end of the beams 11 and providing a further plate rigid with the other end of the beams 11 and against which the corresponding end of the roof blocks 12 rests. In this case the blocks 15 are not fixed to the respective vertical wall 23 or 24, and act as the blocks 12.

Claims

1. A separation floor between two superposed chambers in kilns, in particular in roller-hearth kilns for ceramic tiles, comprising a plurality of structural elements (10) of rectilinear elongated shape and disposed parallel and adjacent to each other to form a flat horizontal structure supported by two opposing vertical walls (23) and (24), each said structural element (10) comprising:

   - at least one internal beam (11) parallel to the axis of said element;
   - a plurality of thermal insulation blocks (12) each provided with through holes (13), one for each beam (11), and mounted along the internal beam (11), said blocks (12) being slidable along the internal beam (11);
   - means acting on the ends of the row of said blocks to compress the row in an axial direc-
tion so pressing the blocks (12) together.

2. A floor as claimed in claim 1, characterised in that said means which compress the row of blocks (12) comprise elastic means (3) precompressed between one end of row of blocks (12) and an element (4) rigid with a vertical wall of the kiln, the other end of the row of blocks (12) being pressed against the opposite vertical wall of the kiln.

3. A floor as claimed in claim 2, characterised in that the vertical walls of the kiln are provided with through holes (29) through which the structural elements (10) pass and in which the end blocks (12) of the row rest.

4. A floor as claimed in claim 3, characterised in that one hole (29) is provided for each structural element (10), said holes (29) being disposed alternately in one and in the other vertical wall of the kiln.

5. A floor as claimed in claim 1, characterised in that said blocks (12) are of parallelepipeds shape and are provided with through holes (13), one for each beam (11), said internal beams (11) being of circular tubular form with their outer diameter slightly less than the diameter of the holes (13).

Patentansprüche

1. Trennboden zwischen zwei übereinanderliegenden Kammern in Brennofen, insbesondere für Rollenherdöfen für keramische Ziegel (Fliesen), der eine Vielzahl von Bauelementen (10) von geradliniger Längsrichtung umfaßt, die parallel und aneinandergrenzend angeordnet sind, um ein flaches waagerechtes Gefüge zu bilden, das von zwei einander gegenüberliegenden senkrechten Wänden (23) und (24) getragen ist, wobei jedes Bauelement (10) umfaßt:
   - wenigstens einen Innenträger (11) parallel zur Achse des Elements;
   - eine Vielzahl thermischer Isolierungsblöcke (12), jeder versehen mit Durchgangsöffnungen (13), eine für jeden Träger (11), und entlang des Innenträgers (11) befestigt, wobei die Blöcke (12) entlang des Innenträgers (11) verschobbar sind;
   - eine Einrichtung, die an den Enden der Reihen der Blöcke zum Zusammendrücken der Reihe in axialer Richtung wirkt, um dadurch die Blöcke (12) zusammenzupressen.

2. Trennboden gemäß Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung, die die Blockreihen (12) zusammendrückt, eine elastische Einrichtung (3) enthält, die zwischen einem Ende der Blockreihe (12) und einem Element (4) vorgespannt ist, welches mit einer senkrechten Wand des Ofens fest verbunden ist, während das andere Ende der Blockreihe (12) gegen die gegenüberliegende senkrechte Wand des Ofens gepreßt ist.

3. Trennboden gemäß Anspruch 2, dadurch gekennzeichnet, daß die senkrechten Wände des Ofens mit Durchgangsöffnungen (29) versehen sind, durch die die Bauelemente (10) hindurchgehen und in denen die Endblöcke (12) der Reihe ruhen.

4. Trennboden gemäß Anspruch 3, dadurch gekennzeichnet, daß ein Öffnung (29) für jedes Bauelement (10) vorgesehen ist, wobei die Bohrungen (29) abwechselnd in der einen und in der anderen senkrechten Wand des Ofens anordnet sind.

5. Trennboden gemäß Anspruch 1, dadurch gekennzeichnet, daß die Blöcke (12) quadratisch und mit Durchgangsöffnungen (13) versehen sind, und zwar eine für jeden Träger (11), wobei die Innenträger (11) von Rundrohrform sind, deren Außendurchmesser geringfügig kleiner ist als der Durchmesser der Öffnungen (13).

Revendications

1. Un plancher de séparation entre deux chambres de four superposées, en particulier pour fours avec foyers à rouleaux pour carreaux en céramique, comprenant une série d'éléments structuraux (10) de forme rectiligne allongée et disposés parallèlement et proches les uns des autres de façon à former une structure plane horizontale soutenue par deux parois verticales opposées (23) et (24), chacun des éléments structurels (10) comprenant:
   - au moins une poutre interne (11) parallèle à l'axe de l'élément même;
   - une série de blocs d'isolation thermique (12), chacun percé de trous passants (13), un pour chaque poutre (11), et montés le long de la poutre interne (11); ces blocs (12) pouvant coulisser le long de la poutre interne (11);
   - des éléments disposés aux extrémités de la rangée des blocs sus-dits de façon à comprimer axialement la rangée et par conséquent maintenir les blocs (12) unis entre eux.

2. Un plancher comme dans la revendication 1, caractérisé par le fait que ces éléments qui compri-
ment la rangée de blocs (12) comprennent des éléments élastiques (3) précompressés entre une des extrémités de la rangée des blocs (12) et un élément rigide (4) par une paroi verticale du four, alors que l'autre extrémité de la rangée des blocs (12) est comprimée contre le mur vertical opposé du four.

3. Un plancher comme dans la revendication 2, caractérisé par le fait que les parois verticales du four sont percées par des trous passants (29) à travers lesquels passent les éléments structuraux (10) sur lesquels reposent les blocs de fin de rangée (12).

4. Un plancher comme dans la revendication 3, caractérisé par le fait qu'un trou (29) est prévu pour chaque élément structural (10) et que ces trous (29) sont disposés alternativement dans l'une et dans l'autre paroi verticale du four.

5. Un plancher comme dans la revendication 1, caractérisé par le fait que ces blocs (12) ont une forme de parallélépipède et sont percés de trous (13) passants, un pour chaque poutre (11) et que ces poutres (11) internes ont une forme tubulaire avec un diamètre extérieur légèrement inférieur au diamètre des trous (13).