



(11) Publication number: **0 430 423 A1**

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **90311519.4**

(51) Int. Cl.⁵: **F27D 3/12, F27D 5/00**

(22) Date of filing: **19.10.90**

(30) Priority: **28.11.89 GB 8926805**

(43) Date of publication of application:
05.06.91 Bulletin 91/23

(84) Designated Contracting States:
DE ES FR GB IT Bulletin 2

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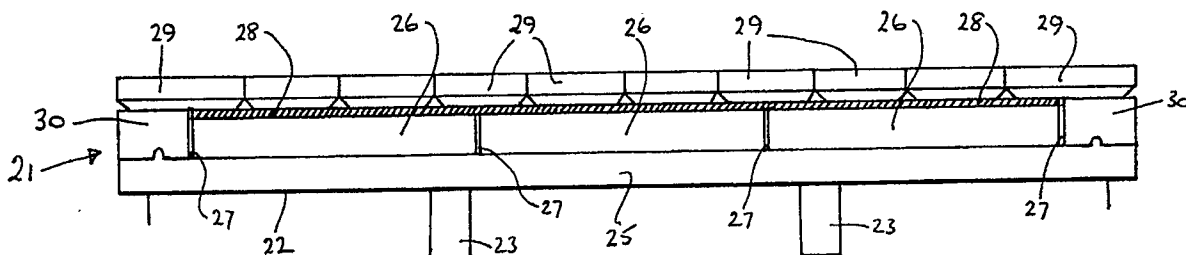
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(54) **Kiln car.**

(57) Kiln car having a frame with a base on which are supported a lower layer (25,26) of heat-insulating material and an upper layer (29) of refractory, heat-resistant material, separated by a layer (28) of

homogenously bound ceramic fibre board. The layers must be able to withstand heavy loads.

FIGURE 2.



KILN CAR

This invention relates to a kiln car such as is used to transport ceramic wares through a kiln or furnace where they are fired.

Conventionally, kiln cars have been made having a basic construction of a wheeled trolley, having a metal frame, which supports at least two further layers. The upper layer, on which the ceramic ware is placed, is of refractory, heat-resistant material and the lower base layer is of heat-insulating material to protect the metal frame and wheels.

Many variants of this basic construction have been proposed including the provision of additional intermediate or surface layers. Moreover, various materials have been proposed and/or used for the layers with the objective of providing an overall construction that gives satisfactory protection to the frame from the heat of the furnace but does not absorb large amounts of heat, thereby reducing the thermal efficiency of the firing cycle. Moreover, the construction must be capable of withstanding the weight of the articles to be fired, which can be quite high particularly if, for example, they are bricks, tiles or pipes. A typical load of articles to be fired could, for example, be up to 10 tonnes but might be as high as 30 tonnes.

It will be appreciated, therefore, that the requirements for the properties of the various layers are to a degree mutually exclusive and it is an object of the present invention to provide a novel construction that gives a better optimisation of the desired properties than has hitherto been possible.

Accordingly, the invention provides a kiln car having a frame including a base on which lie a lower layer of heat-insulating material and an upper layer of refractory, heat-resistant material, these layers being separated by an intermediate layer of homogeneously-bound ceramic fibre board.

By 'homogeneously-bound ceramic fibre' in this specification is meant that the distribution of binder throughout the fibres in the set product is substantially uniform.

The fibre of the intermediate layer may be any suitable ceramic fibres, e.g. alumina or aluminosilicate fibres. The alumina fibres may be so-called 'high alumina' fibres, i.e. of more than about 60% alumina content. Where aluminosilicate fibres are used, they may optionally contain up to 20% by weight of zirconia. Also the aluminosilicate fibres may, if desired, be blended with up to 50% by weight of high alumina fibres.

The binder may be a colloidal silica and/or colloidal alumina and the formulation of fibres and binder may optionally include a refractory particulate filler. Where such a filler is used, it is preferably alumina but may be, for example, zircon,

zirconium oxide, silicon carbide, silicon nitride, aluminosilicate, fused silica or boron nitride.

The binder, which is preferably colloidal silica, may be present in an amount of up to 30% by weight of the eventual product, preferably being in the range of 10 to 15% by weight.

If a particulate refractory filler is used it is preferably of size no more than 75 microns and is present in an amount of up to 50% by weight of the eventual product.

We have surprisingly found that ceramic fibre boards as used in the present invention can withstand considerable loads without fracture or deterioration and it is believed that this effect is due to the homogeneous distribution of the binder within the matrix of the fibres.

This homogeneity can be achieved by a variety of means. The boards will normally be made by forming an aqueous slurry of the ceramic fibres and binder with any other desired ingredients and then forming, e.g. by vacuum-forming, the shaped board which is then dried by heating. In order to achieve the desired homogeneity, a chemical gelling process may be used or the pH of the system may be modified to fix the binder in position. Alternatively, a flocculent, e.g. starch, may be used to deposit the binder on the fibres and thereby chemically or physically prevent migration of the binder during the subsequent drying stage. Another means is to rapidly heat the slurry, e.g. by microwave or I.R., which causes gellation of the binder before it can migrate in the water.

The use of an intermediate layer of ceramic fibre board according to the invention provides a kiln car of extremely useful properties. The other layers of the car may be adjusted to take advantage of the superior heat-insulating and heat-resistant properties of the intermediate layer so that an overall construction can be achieved that is relatively light, has excellent load-carrying capacity, gives excellent thermal protection to the frame and wheels of the car and yet has a relatively small heat-absorption capacity, thereby improving thermal efficiency of the kiln firing cycle.

Moreover, a further serious disadvantage of conventional kiln cars is overcome by the present invention. The blocks on a conventional car, which are normally of firebrick, expand and contract as the car is exposed to and then removed from heat. This causes gaps to appear between the blocks and dust generated by the wares being carried can accumulate between the blocks. This can result in the blocks moving from their original positions and in the case of the outer blocks there is a danger that they will cut into the kiln wall as the car travels

along its path. Such damage can be a major problem. The fibre board layer of the present invention does not suffer from this disadvantage in that it can accommodate the temperature changes without gaps appearing between adjacent boards.

The materials of the lower and upper layers may be any conventionally used. For example, the upper layer may be of dense refractory blocks of e.g. firebrick. The lower layer may be, for example, a composite layer of pillars of dense refractory material to support the load, with the spaces between the pillars being filled with fibrous or particulate material e.g. a packed particulate mixture of cement and other refractory filler.

In another embodiment the lower layer of heat-insulating material may comprise a low density insulation board lying on the metal base frame of the kiln car with a layer of low density castable insulating material lying on top of the insulation board. The low density insulation board may be, for example, of pressed vermiculite or pressed calcium silicate fibres and have a density of 0.4 to 0.8 g/cc, and the low density castable insulating material may comprise, for example, expanded fireclay grog and a cement such as ciment fondu, and have a density of 0.8 to 1.4 g/cc.

Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a vertical partly-sectioned view through one construction of kiln car of the invention, and

Figure 2 is a similar view of an alternative construction of kiln car of the invention.

In Figure 1 is shown a kiln car 1 having a metal frame 2 supported on pillars 3 to which may be attached wheels (not shown). A number of spaced pillars 4 of dense refractory material stand on frame 2. Between the pillars 4 a screed or skim base 5 of cementitious-castable material is applied over the exposed upper surface of frame 2. On top of this set screed base 5, the space between pillars 4 is filled to the top of the pillars by a loose packing material 6 of cement and fireclay grog. A further skim coating layer 7 of the same material in water is then applied over the top of the pillars and loose packing material as a retaining coating. The intermediate layer 8 of homogeneously-bound ceramic fibre boards is placed over set skim coating 7. Finally, on top of fibre board 8 is positioned a number of spaced blocks 9 of dense refractory material to form the load-receiving surface on which the items to be fired are placed. These blocks 9 are positioned with gaps 10 corresponding to the rows of burners in the kiln. Smaller blocks 11 of dense refractory material are positioned on the fibreboard 8 to fill the lower portions of these gaps and to protect the boards 8 from direct contact with

the heat source in the kiln.

The sides of the kiln car are protected from the frame 2 up to the top of the fibre boards 8 by refractory side blocks 12 which fit underneath the side edges of outside upper surface blocks 9.

In Figure 2 is shown a kiln car 21 having a metal frame 22 supported on pillars 23 to which may be attached wheels (not shown). The base of frame 22 is covered by a layer 25 of a low density insulation board. Lying on top of layer 25 is a layer of blocks 26 of low density castable insulating material. Between adjacent blocks 26 are positioned pieces 27 of compressible ceramic fibre board or blanket which act as expansion joints.

A layer 28 of homogeneously-bound ceramic fibres is placed over blocks 26 and an upper layer of dense refractory firebrick blocks 29 overlies the layer 28.

The sides of the kiln car are protected from the frame 2 up to the top of the ceramic fibre layer 28 by refractory side blocks 30.

Claims

1. A kiln car having a frame including a base on which lie a lower layer (4, 5, 6 or 25, 26) of heat-insulating material and an upper layer (9, 11 or 29) of refractory, heat-resistant material, characterised in that these layers are separated by an intermediate layer (8 or 28) of homogeneously-bound ceramic fibre board.
2. A kiln car according to Claim 1, characterised in that the ceramic fibre board (8 or 28) is made of fibres of alumina or of alumino-silicate or mixtures thereof.
3. A kiln car according to Claim 1 or 2, characterised in that the ceramic fibre board (8 or 28) is made of fibres of alumino-silicate containing up to 20% by weight of zirconia.
4. A kiln car according to Claim 1, 2 or 3, characterised in that the binder used to form the homogeneously-bound ceramic fibre board (8 or 28) is colloidal alumina and/or colloidal silica.
5. A kiln car according to Claim 4, characterised in that the binder is present in the ceramic fibre board (8 or 28) in an amount up to 30% by weight.
6. A kiln car according to Claim 5, characterised in that the binder is present in an amount of from 10 to 15% by weight.

7. A kiln car according to any one of the preceding claims, characterised in that the ceramic fibre board (8 or 28) contains a refractory filler in an amount up to 50% by weight. 5
8. A kiln car according to Claim 7, characterised in that the refractory filler is of size up to 75 microns.
9. A kiln car according to any one of the preceding claims, characterised in that the lower layer of heat-insulating material is a composite layer having load-supporting pillars (4) of dense refractory material with the spaces between the pillars packed with fibrous or particulate material (6). 10 15
10. A kiln car according to any one of Claims 1 to 8, characterised in that the lower layer of heat-insulating material comprises a low density insulation board (25) lying on the base of the frame (22) with a layer (26) of low density castable insulating material lying on top of the insulation board (25). 20 25
11. A kiln car according to Claim 10, characterised in that the low density insulation board (25) is formed of pressed vermiculite or pressed calcium silicate fibres. 30
12. A kiln car according to any one of the preceding claims, characterised in that the sides of the kiln car are protected from the base of the frame (2 or 22) up to the top of the intermediate ceramic fibre layer (8 or 28) by refractory side blocks (12 or 30). 35

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Figure 1.

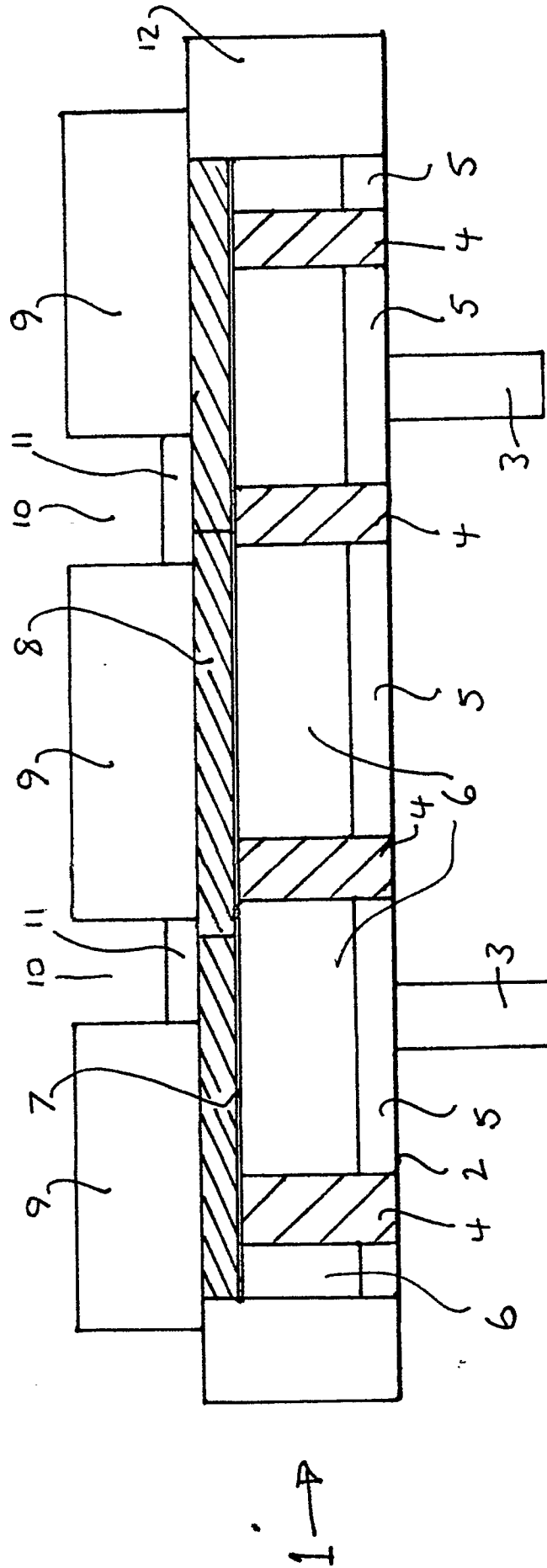
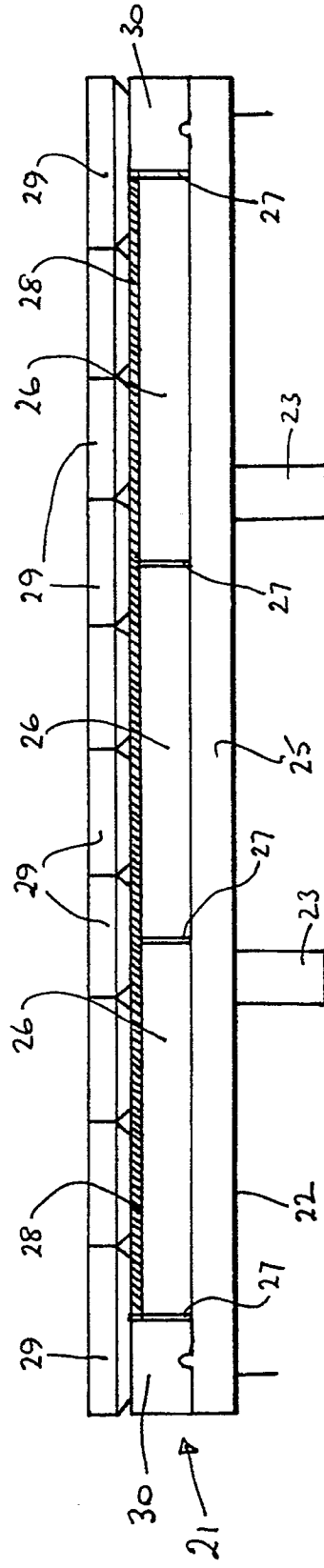


Figure 2.





European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 31 1519

DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)		
A	AU-B-1 288 6 (ACMIL INDUSTRIES PTY LTD)(1983) - - -		F 27 D 3/12		
A	DE-A-3 343 909 (KERAMIK INDUSTRIEANLAGEN) - - -		F 27 D 5/00		
A	DE-A-3 832 358 (KELLER GmbH) - - -				
A	GB-A-2 168 284 (DIDIER-WERKE AG) - - -				
A	EP-A-0 067 451 (PETER HUBERTUS) - - -				
A	US-A-4 714 072 (BABCOCK & WILCOX) - - - - -				
The present search report has been drawn up for all claims					
Place of search The Hague		Date of completion of search 09 January 91	Examiner COULOMB J.C.		
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