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54 Kiln support assembly for fast firing of tiles.

57 A kiln support assembly for fast firing of ceramic ware comprises three tubular uprights having caps with locating formations which are received in three locating recesses (15) on the underside of a die pressed ring having an accurately flat top surface. The ring has external grooves (20) into pairs of which are slotted upright surfaces (18) of a die-pressed bar (16), several of which are disposed parallel across the ring (14). The die pressing controls accurately the uppermost and lowermost edges of the bars so that the uppermost edges (21) define an accurately flat surface to support ceramic ware. All the components are lightweight and of low thermal mass and the open ring and bar arrangement permits free circulation of kiln gases during fast firing.

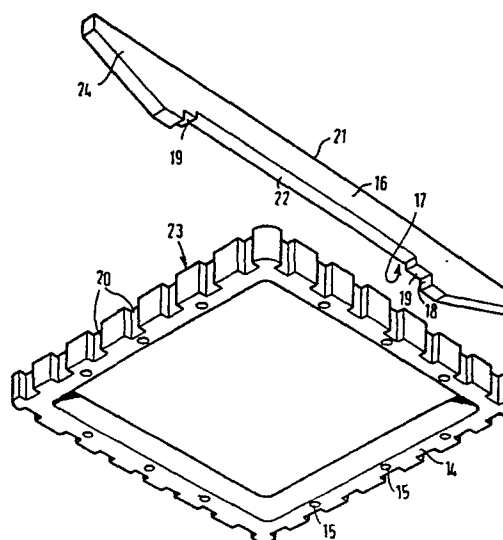


FIG 3

- 1 -

Title: "Kiln support assembly for fast firing of ceramic ware"

This invention relates to a kiln support assembly for fast firing of ceramic ware.

It is primarily intended for once-fired tiles or tableware such as plates or cups, these processes requiring that the soft, unfired tile or other article is well supported over its entire area to prevent deformation. The following description will, for convenience, refer to the firing of tiles.

It has previously been proposed to support each tile on a generally horizontal bat or shelf of a plan area approximately the same as that of the tile. In fast firing, in which the whole firing process takes a time of the order of only about thirty minutes, this prior arrangement is unsatisfactory. The hot kiln gases cannot circulate freely around the tile, especially the underside, even if holes are provided in the bat. The very rapid heating in the kiln may cause strong temperature gradients to occur in the bat and/or in the tile because of the large thermal mass they form. The heat is permitted to penetrate only slowly into such a large thermal mass.

Where thermal gradients occur, these are likely to cause severe stresses on expansion or contraction which result in cracking of the bat and/or the tile.

In an attempt to reduce this problem of high thermal mass, it has been proposed to support each tile on a plurality of horizontal bars so that the kiln gases have much freer access to the tile and bulky massive bats can be avoided.

However, it has proved difficult in practice to ensure that the bars supporting a tile afford an accurately flat supporting surface.

For example, it has been proposed to provide upright pillars resting on the base of a kiln car and carrying bars slotted into their upper ends. Any irregularity in the fitment of the bars in the slots, or differences in length between the pillars, or irregularities of the base surface of the kiln car, would give rise to an uneven supporting surface formed by the bars. The result would be that the tiles supported on the bars would not be flat but would be warped.

It is an object of the present invention to provide a kiln support assembly for fast firing of ceramic ware such as tiles which permits freer circulation of kiln gases than the first mentioned arrangement, without increased risk of deformation of the tiles.

According to the invention there is provided a kiln support assembly for fast firing of ceramic ware comprising a plurality of uprights; an open support resting on and supported by said uprights; and a plurality of bars located on and supported by the open support and extending generally parallel to each other in closely spaced relation; the open support having a planar upper surface on which the bars are supported and the bars being identical in depth so that their uppermost edges define a planar supporting surface for ceramic ware supported thereby.

The expression "open support" is intended to indicate a support of low thermal mass having a major part of its plan area open to permit circulation of kiln gases.

The underside, in use, of the open support may be provided with locating means cooperating with locating means of the uprights. Three uprights may support each open support.

Preferably, the open support comprises a ring, which may be of generally square shape in plan view.

The open support may be provided with guide means which are upright in use and which are engageable by

respective guide portions of the bars to locate the bars correctly in use.

Where the open support comprises a ring, the guide means may comprise a plurality of grooves or ribs in the outer or inner periphery of the ring.

The guide portions of the bars may comprise upright edges provided on the bars and engageable in the grooves or between the ribs forming the guide means on the ring.

Where the guide means are on the outer periphery of the ring, the bar may have a cut-out in its edge which is lowermost in use, upright border edges of the cut-out forming said guide portions.

Where the guide means are on the inner periphery of the ring, the edge of the bar which is lowermost in use may have a downwardly projecting tongue, upright border edges of the tongue forming said guide portions.

The cut-out or tongue may be centrally disposed and may extend through approximately one half of the length of the bar.

The lowermost edge of the bar may taper upwardly at the end portions of the bar beyond the cut-out or tongue.

The upright edges of the cut-out or tongue may be provided adjacent stepped portions of the border of the cut-out or tongue affording localised contact faces, the bar being supported from the open support on said contact faces.

The bars may be made by die pressing, the uppermost and lowermost edges in use being accurately defined by the dies.

Similarly, the open support may be made by die pressing with the planar upper surface being accurately defined by the dies.

The invention will now be described in more detail by way of example only with reference to the accompanying drawings in which:-

FIGURE 1 is an upright detail section of a kiln support assembly;

FIGURE 2 is a plan view of a plurality of such assemblies;

FIGURE 3 is an exploded perspective view from underneath of an open support and bars forming part of the assembly.

Referring to the drawings, a kiln support assembly 10 for fast firing tiles is intended to be mounted on the base 11 of a kiln car (not shown). The assembly 11 comprises a plurality of uprights which are in the form of tubes 12 embedded in the base 11 and carrying, at their upper ends, small locating members 13. Each locating member, which is of generally known type, comprises a disc having a downwardly extending projection to locate in the top of the tube 12 and an upwardly projecting stud to locate in an open support in the form of a ring 14.

The ring 14 can be seen more clearly in Figure 3 and is generally square in plan. On its underside, a plurality of locating recesses 15 are provided to receive the respective studs of locating members on which the ring is carried. As is customary in supporting kiln furniture, each ring is supported at three spaced positions on three tubes 12 and locating members 13, to avoid the ring rocking if the tubes are of unequal lengths or are not accurately vertical for example.

The ring 14 supports a plurality of bars 16 which form the platform to receive a tile to be fired. Each bar has a cut-out 17 in its lowermost edge, the cut-out having upright edges 18 and adjacent stepped portions affording contact edges 19. The bar rests on the ring at the contact edges 19. The upright edges 18 engage within cooperating upright grooves 20 in the outer periphery of the ring. Alternatively, the grooves could be replaced by spaces defined between pairs of ribs on the outer periphery of the ring.

It will therefore be seen that the bars can be slotted into place on the ring so as to be located and

supported by the ring. No cement is used in this assembly.

The bars and the ring are each formed by die pressing, for example dust pressing, which gives rise to products with specific dimensional characteristics. It will be appreciated that the quantity of material is placed between dies which are forced together. Because of unpredictability in the amount of compression possible between the dies, the thickness of such products is subject to some variation. However, the dimensions defined by the contours of the dies themselves, and the profiles of surfaces defined by the dies are all accurate to very close tolerances.

As applied to the bars, this means that the thickness of the bar may vary slightly but that the exact shape and orientation of the uppermost and lowermost edges 21 and 22 are accurately controlled. As applied to the ring, the upper surface 23 can be accurately flat whereas the precise thickness of the ring in the vertical direction in use may be subject to some variation.

The kiln support assembly constructed as shown will always define a flat surface for supporting a tile placed on top because the upper surface 23 of the ring is accurately flat and the top to bottom dimension of the bar, between the uppermost edge and the lowermost edge, is also accurately controlled. It is not absolutely critical that the upper surface 23 of the ring is horizontal in use, and it may not be so if the supporting tubes 13 are of unequal lengths or are not accurately level where they are supported at the base 11 of the kiln car.

The advantages of the kiln support assembly described for fast firing are considerable. The open support in the form of the ring 14 allows kiln gases to pass freely through and between the bars 16. Thus the gases have access to virtually the whole undersurface of

the tile held on the uppermost edges 21 of the bars 16. At the same time, the bars define an accurately flat supporting surface for the tile.

It will be seen that the cut-out 17 is central in the bar 16 and occupies about one half of its length, the remaining end portions 24 of the bar each being about one quarter of its total length. The lowermost edge 22 tapers upwardly of these end portions so as to reduce the weight of the outermost parts which support the least load.

The bars are of fairly thin material and have low thermal mass. Similarly, the ring has low thermal mass because of its open centre. The tubes 12 and locating members 13 are also of relatively low thermal mass and connections between them and the ring are very localised. At no part of the assembly is there a large mass of material into which heat from the kiln cannot penetrate fairly rapidly. In this way, the possibility of cracking in the strong heating encountered in a fast firing kiln is reduced to a minimum.

To speed up assembly of the kiln support structure, the ring is provided with grooves 20 in pairs along each pair of opposed sides so that the rings need not be turned round during assembly. The grooves 20 adjacent the corners of the ring coincide with part of the thickness of the side wall of the ring and, if a bar is laid directly across the top of the ring at this point, an undesirably large area of contact is formed. For this reason, the bars rest on the small contact edges 19 provided adjacent the upright edges 18 of the cut-out 17. The area of contact is therefore very small for each of the bars, even those placed across the ring adjacent its end walls.

Considering the plan view, it will be seen that each ring has a plan area only about half that of the supporting surface defined by the bars 16. This means that a

- 7 -

small ring can be used for firing a large tile or, without any modification of the assembly, for supporting two or more small tiles. Compared with using a massive bat of the same size as the tile, it will be seen that there is considerable economy in the mass of the kiln support assembly and this leads to production economies because the mass to be heated up is smaller, and also to reduction in cracking risk because of the slow heat up of a bat having a large thermal mass.

When one or more tiles have been placed on the bars, which can be done by automatic machinery, any damage to the bars by cracking in the kiln is unlikely to have disastrous results on subsequent firing. For example, any bar that cracks is likely to do so in a central region and, because of the weight of the tile or tiles resting on the bar, it will not be able to fall out of the assembly but will remain in place until the kiln car emerges from the kiln and the tile is removed. However, by the reduction of thermal mass and the loosely assembled nature of the support assembly, it is very unlikely that such cracking would occur.

In a modified form of assembly (not shown) the ring can be provided with upright grooves or pairs of guide ribs on its innermost periphery. The bars will then be provided with downwardly extending tongues in their lower edges which will sit within the ring, located by the grooves or ribs. Again, it is preferable that the upright edges of the tongue are provided adjacent a step at each side which will afford a small contact edge to support the bar on the upper surface of the ring.

It is desirable that the bars extend outside the plan area of the ring so that the overhanging end portions constitute cantilevers which spread the load of the tile carried by the bar and reduce the tendency for each bar to "bend" in the middle. The upward taper on the lowermost edge of the end portions of all the bars

provides a horizontal passageway or chimney through the kiln below the tapered ends of the bars which promotes excellent circulation of kiln gases.

In a further modification (not shown) the uppermost edge 21 of the bar need not be flat. It could be provided with regular, accurately positioned undulations or projections so that the contact between the tile and the bar would be extremely localised. Of course, with the bars being closely spaced, and the undulations or projections being close together, the tile would still be adequately supported but gas circulation to the back of the tile would be extremely good.

Although the assembly is primarily designed for once fired tiles, or tableware such as plates or cups, it can be used for second or subsequent firing of twice fired tiles or tableware such as plates or cups. In this case the amount of support required is minimal and it would be economical to remove all but two or three of the bars from each assembly so as to support the tile with the minimum amount of heat loss in the support assembly.

CLAIMS:

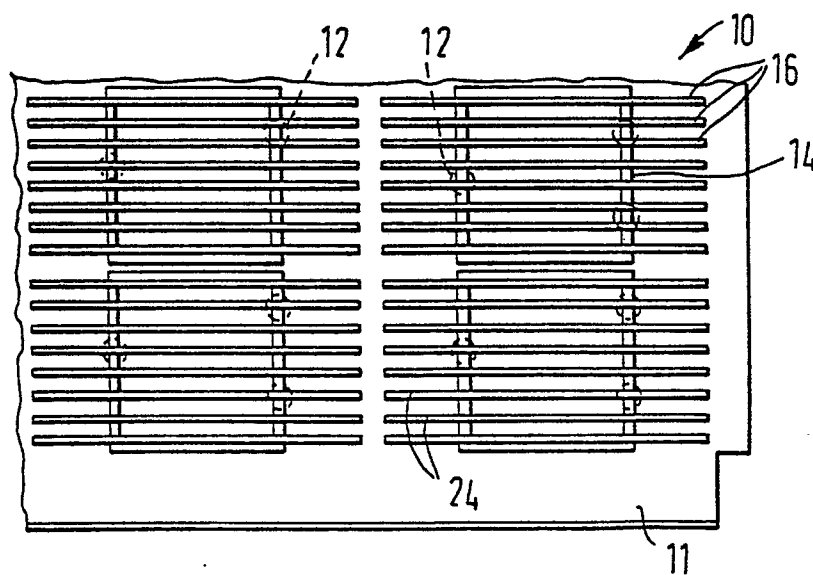
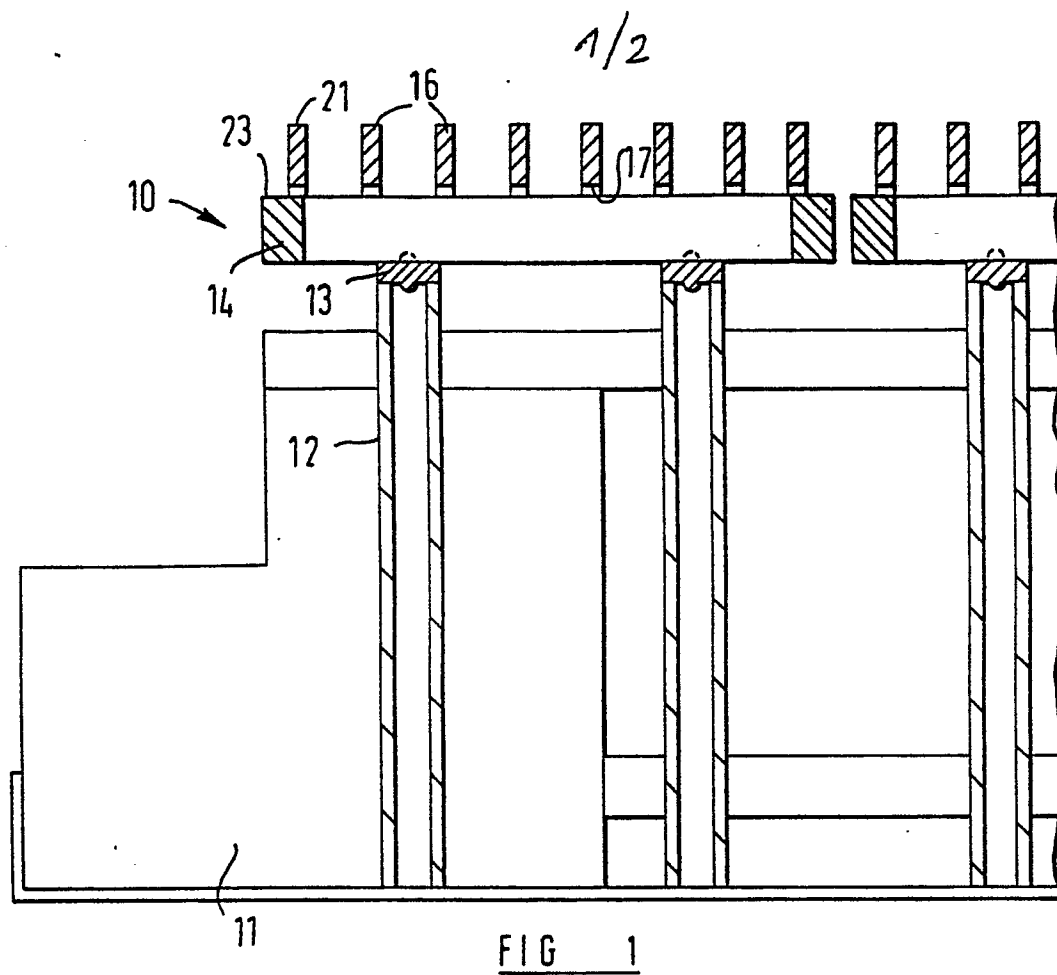
1. A kiln support assembly for fast firing of ceramic ware comprising a plurality of uprights and support means mounted on the uprights, characterised in that the support means comprise an open support (14) resting on and supported by said uprights (12); and a plurality of bars (16) located on and supported by the open support (14) and extending generally parallel to each other in closely spaced relation; the open support (14) having a planar upper surface (23) on which the bars (16) are supported and the bars (16) being identical in depth so that their uppermost edges (21) define a planar supporting surface for ceramic ware supported thereby.
2. An assembly according to Claim 1 further characterised in that the underside, in use, of the open support (14) is provided with locating means (15) co-operating with locating means (13) of the uprights (12).
3. An assembly according to Claim 1 or Claim 2 further characterised in that the open support (14) comprises a ring which is of generally square shape in plan view.
4. An apparatus according to any preceding claim further characterised in that guide means (20) are provided on the open support (14) and are engageable by respective guide portions (18) of the bars (16) to locate the bars correctly in use.
5. An apparatus according to Claim 3 and Claim 4 further characterised in that the guide means comprise a plurality of grooves (20) or ribs in the outer or inner periphery of the ring and the guide portions of the bars (16) comprise upright edges (18) provided on the bars and engageable in the grooves (20) or between the ribs forming the guide means of the ring (14).

6. An assembly according to Claim 5 further characterised in that the guide portions of the bars are provided by upright border edges (18) of a cut-out (17) or tongue centrally disposed along the length of the bar (16) and extending through approximately one half of the length of the bar.

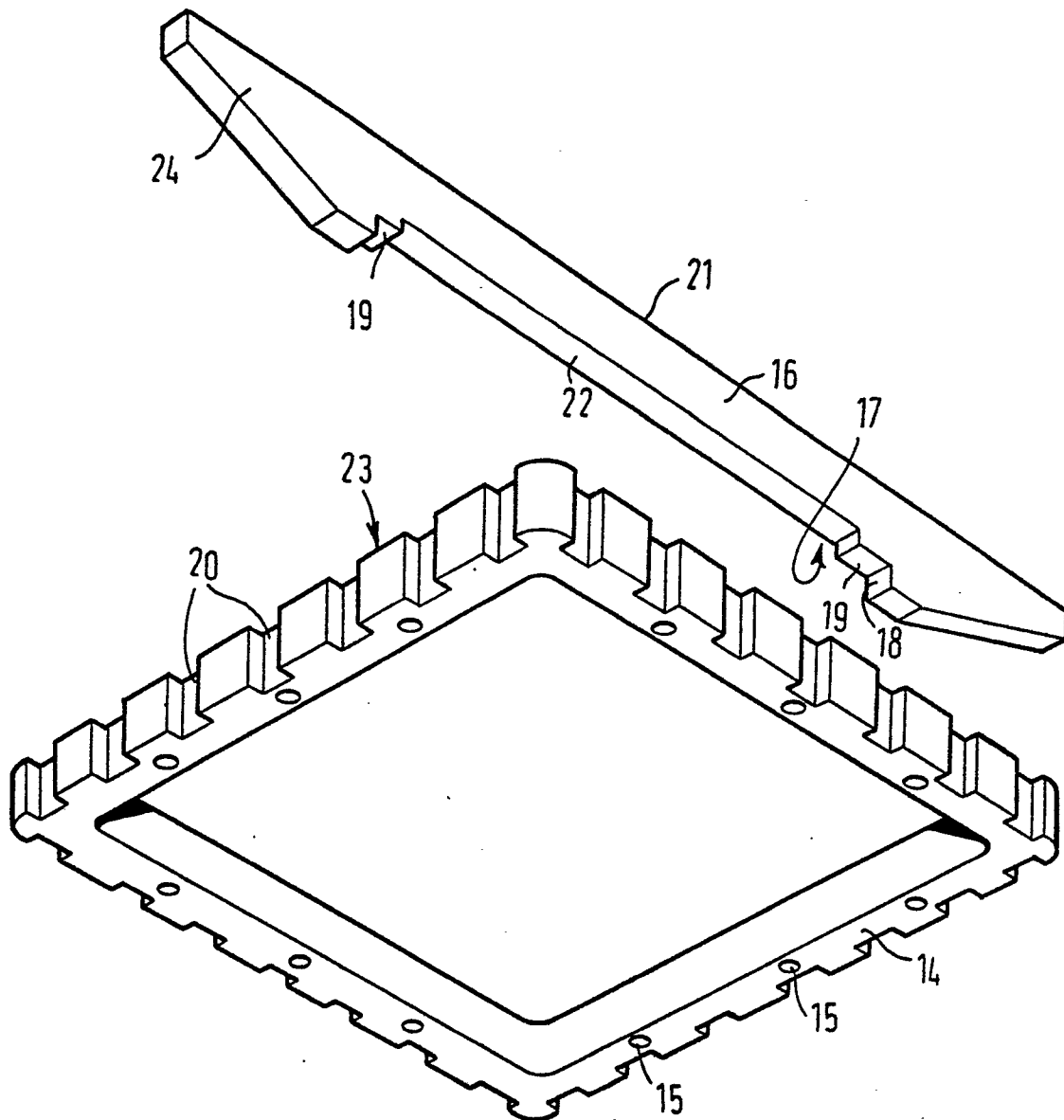
7. An assembly according to Claim 6 further characterised in that the lowermost edge of the bar, in use, taper upwardly at the end portions (24) of the bar beyond the cut-out (17) or tongue.

8. An assembly according to Claim 6 or Claim 7 further characterised in that the upright edges (18) of the cut-out (17) or tongue are provided adjacent stepped portions of the border of the cut-out or tongue affording localised contact faces (19), the bar (16) being supported from the open support (14) on said contact faces.

9. An assembly according to any preceding claim further characterised in that the bars (16) and the open support (14) are made by die pressing, the uppermost and lowermost edges of the bars (16) and the planar upper surface (23) of the open support (14) being accurately defined by the dies.



2/2

FIG 3



European Patent
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EUROPEAN SEARCH REPORT

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Application number

EP 81 30 2252

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>DE - A - 1 800 718</u> (ANNAWERK GmbH) * claim 1; figure 3 * ---	1,2	F 27 D 5/00
	<u>US - A - 2 434 852</u> (JACKSON) * claims; figures 1-3 * ---	1,2	
	<u>US - A - 1 240 204</u> (ACME MARLS LTD.) * claim 1; figure 1 * ---	1	
	<u>DE - A - 2 121 741</u> (CERAMANO-KERAMIK) * claims 1,2; figure 1 * ---	1	TECHNICAL FIELDS SEARCHED (Int.Cl. 3) F 27 B F 27 D F 26 B
P	<u>GB - A - 2 063 801</u> (SALVIATI) * page 2, figures * ---	1	
A	<u>DE - A - 2 028 407</u> (ANNAWERK GmbH) -----		
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☒ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 12.01.1982	Examiner COULOMB