(12) UK Patent (19) GB (11) 2 193 205 (13) B

(54) Title of invention

Apparatus for applying glaze to granules to tiles maintained at a high temperature

(51) INT CL[5]; C04B 41/50, B05C 5/00, 19/00

(21) Application No
8713450.8

(22) Date of filing
9 Jun 1987

(30) Priority data

(31) 21363

(32) 1 Aug 1986

(33) IT

(43) Application published
3 Feb 1988

(45) Patent published
20 Jun 1990

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(52) Domestic classification
(Edition K)
C1M MVN M498
B2L LCH
U1S S1386 S1699

(56) Documents cited
GB 1174485 A

(58) Field of search

As for published application
2193205 A *viz:*
UK CL B2L C1M
INT CL[4] B05C C04B
updated as appropriate

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Fig.1

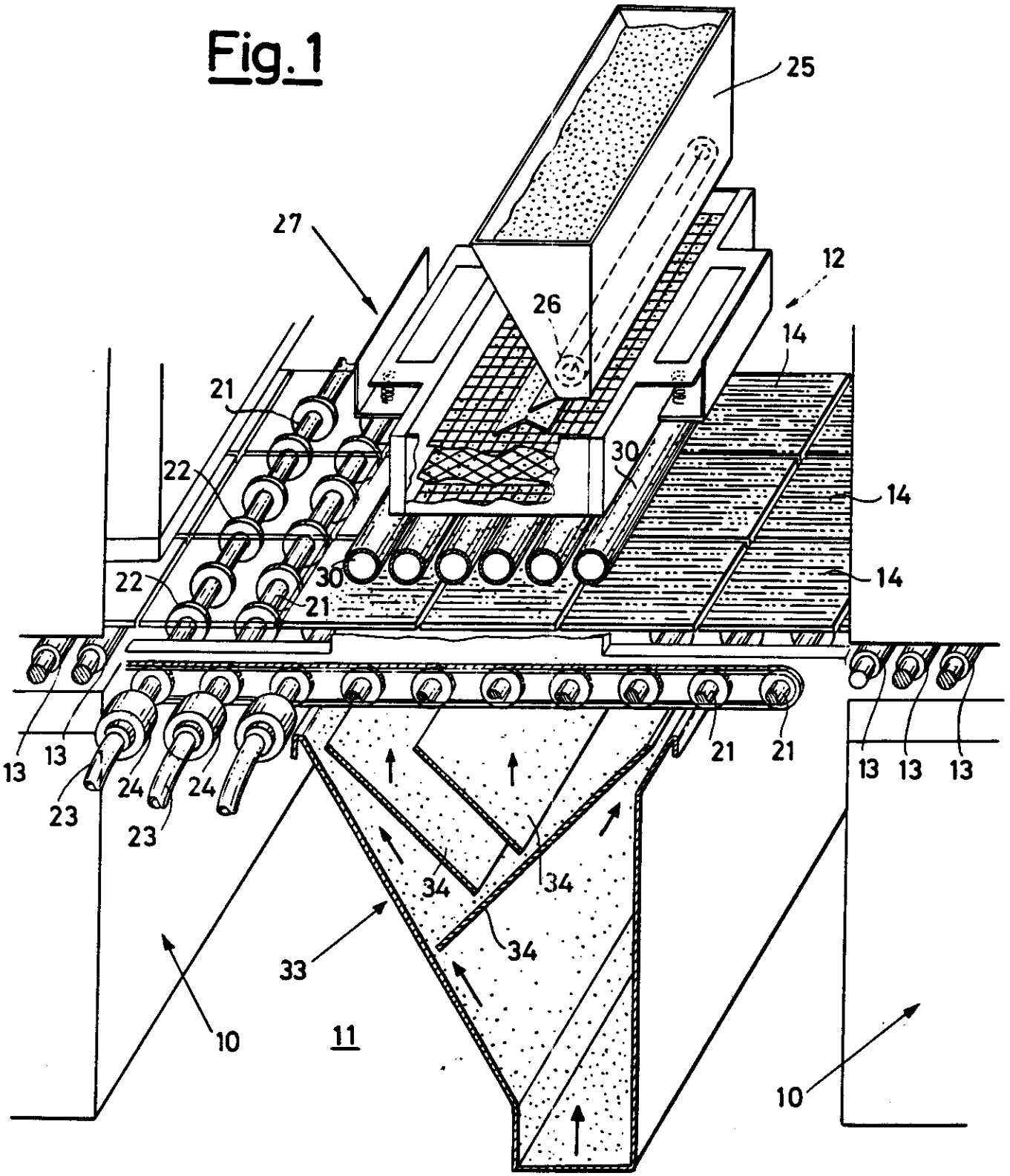

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Fig.2

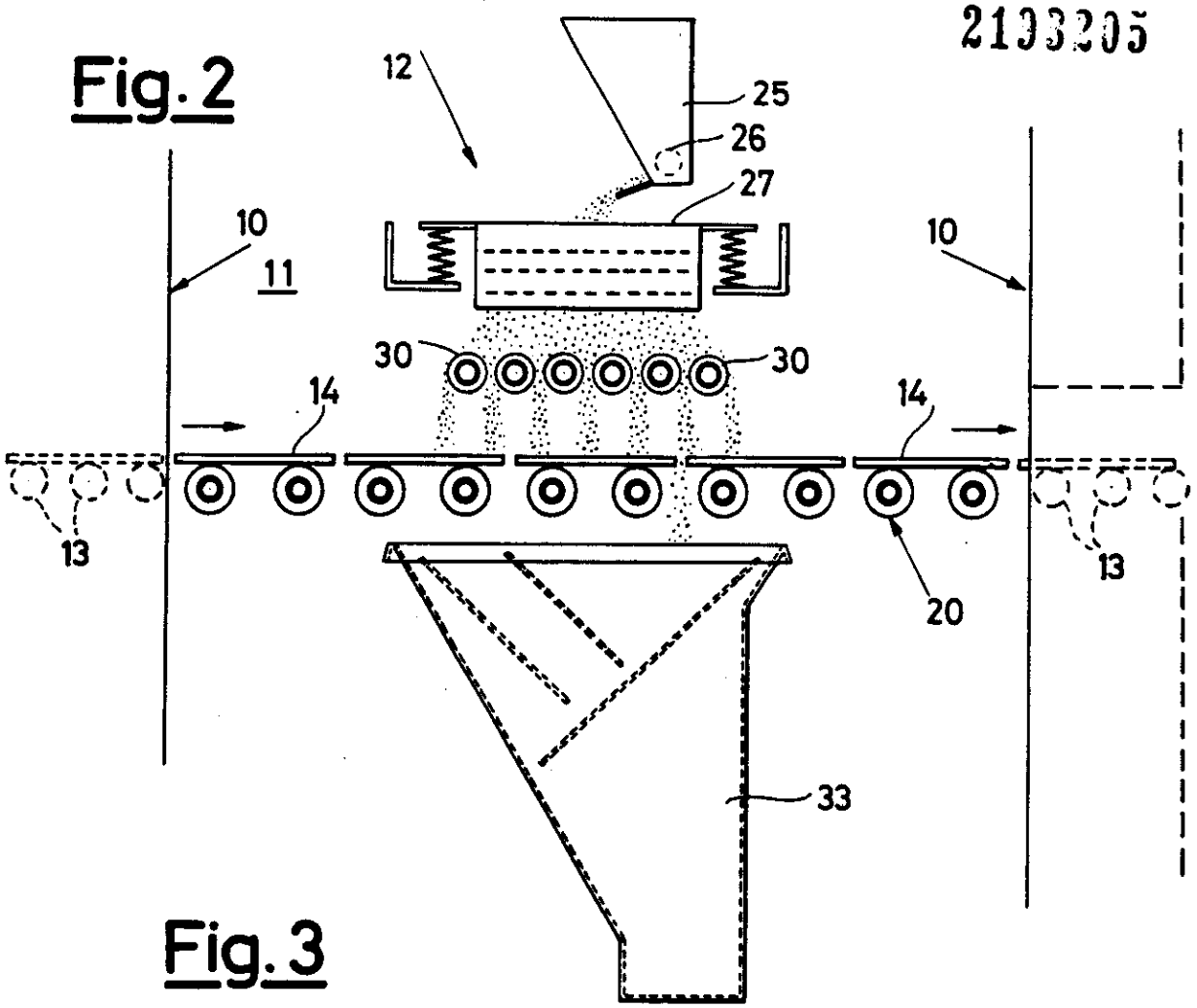

Fig.3

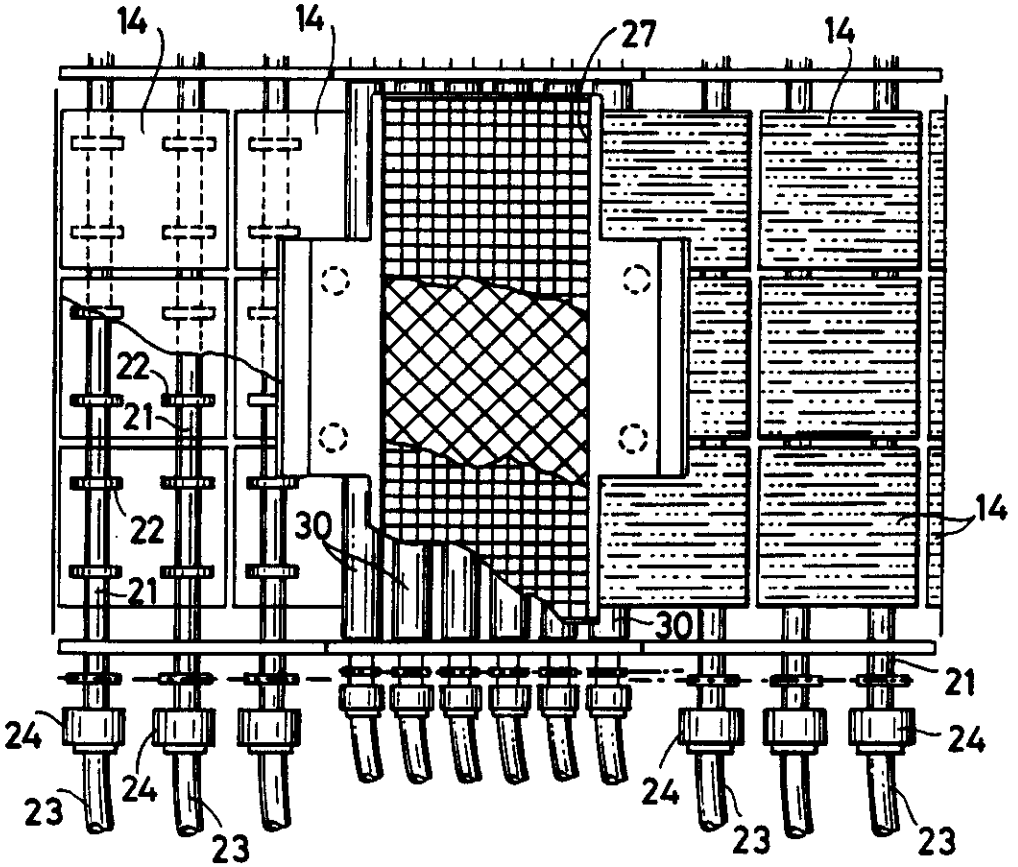

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Fig.4

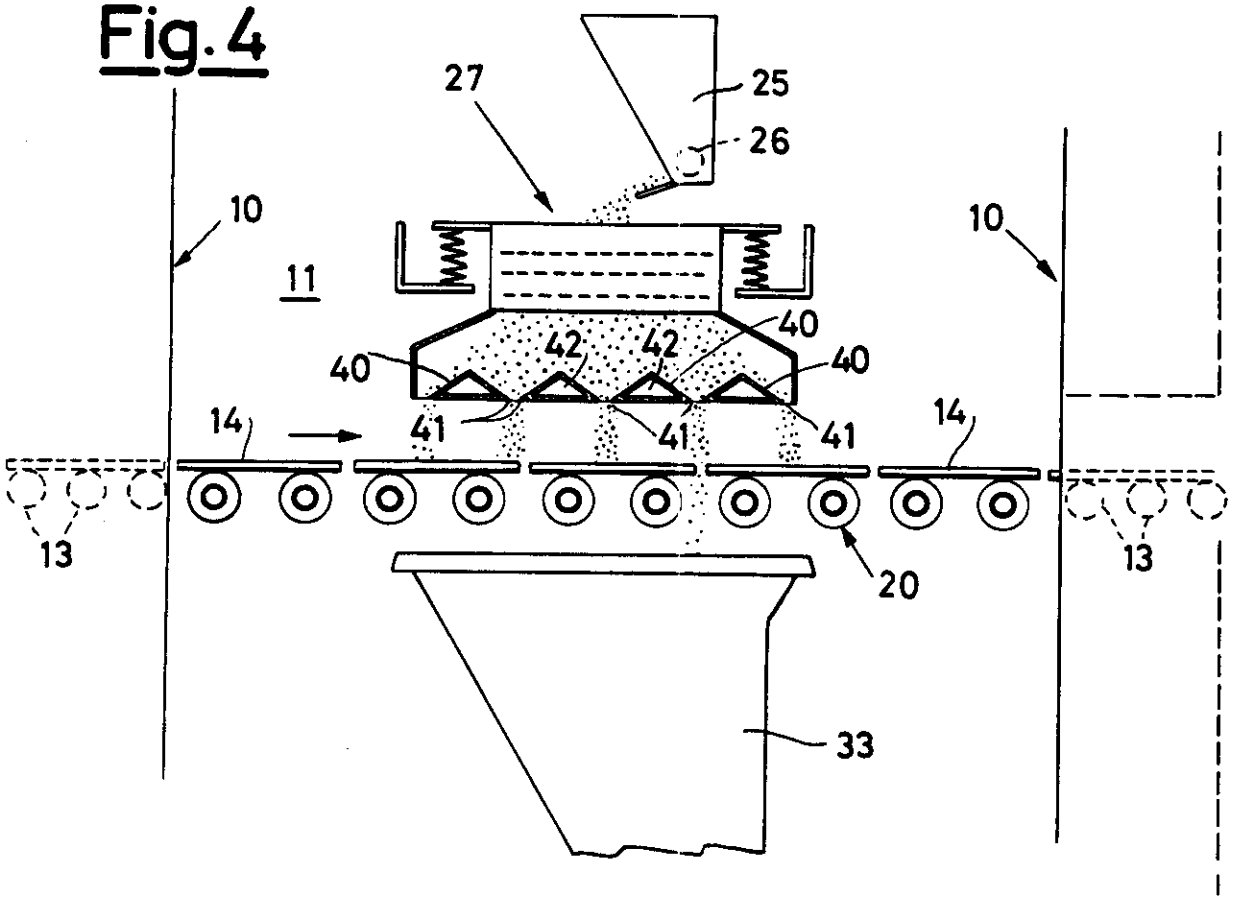
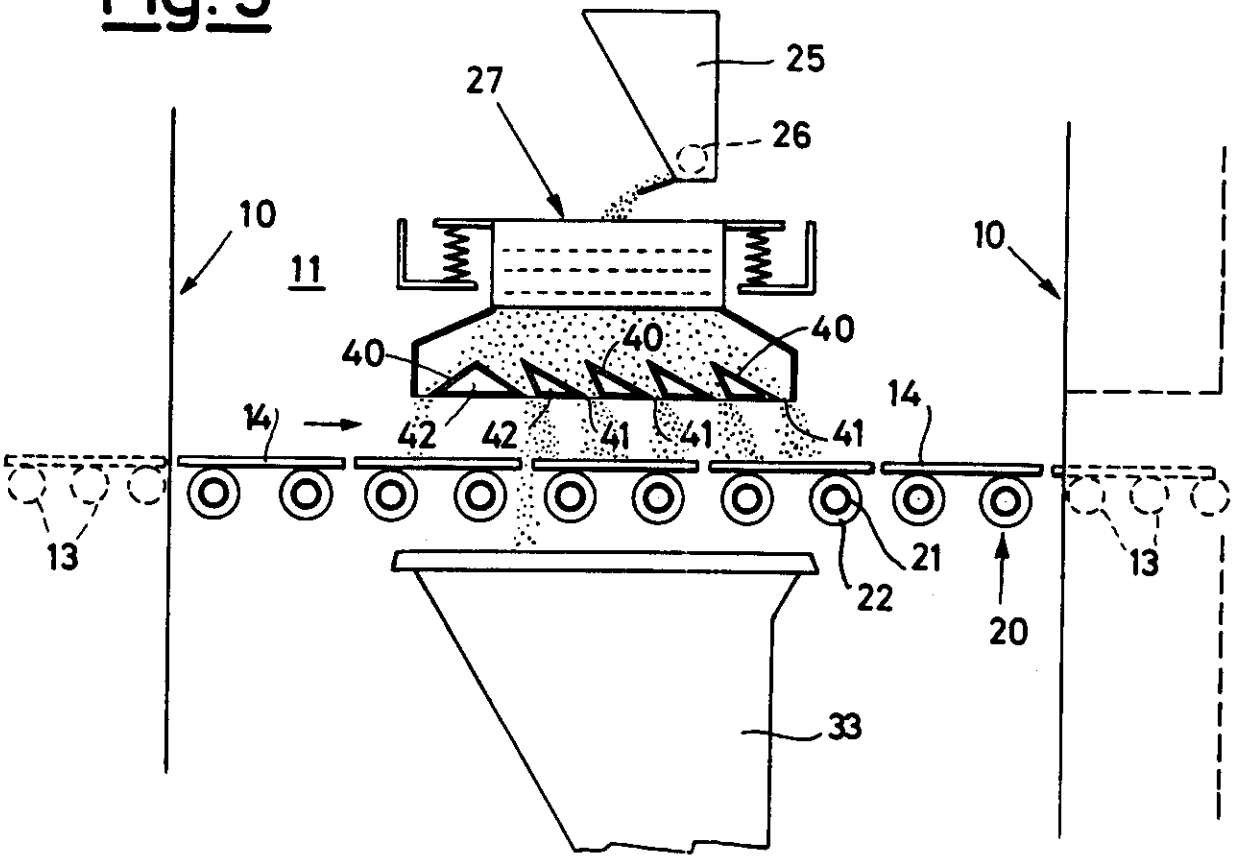


Fig.5



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APPARATUS FOR APPLYING GLAZE AS GRANULES TO TILES MAINTAINED AT A HIGH TEMPERATURE

Processes for tile making are known which provide for the depositing of granular glaze onto the tiles during their baking by heat treatment, thus when the tiles are at a high temperature.

The application of the granular glaze onto the incandescent tiles entails numerous technological, physical and chemical problems. For example, account has to be taken of the fact that, in this process, tile temperature is propitiously higher than the melting temperature of at least of the components of the glaze.

A glaze dispenser facing the tiles is subject to heating as a result of the heat yielded to it by the incandescent tiles, either by irradiation or by convection.

It might be supposed that this difficulty could be overcome by distancing the glaze dispensing unit from the tile, thus reducing the heat yielded to it by the tile.

The Applicant has however found that the increased fall height of the granular glaze that is in this way caused gives rise to serious disadvantages.

For, if the fall height is excessive, the glaze becomes selectively subject to the action of the rising air-streams which occur in the presence of incandescent tiles located within an environment of lower temperature; the particles of smaller size are clearly more likely to be slowed down by such rising air-streams, which effect a kind of separation between the granules of different size.

In addition, when the larger granules fall from a greater height they acquire excessive kinetic energy which causes them to recoil off the surface of the tiles: as a result also of the rising air-stream, the separation of the small-sized fractions during the fall can cause uneven application due to a not perfectly constant and uniform fall of the glaze particles.

Moreover, the fact that the granules falling too fast tend to recoil off the tiles causes unevenness of application on the surface of the tile, especially proximal to the edges, and to the leading edge in particular.

It follows that all these factors make it necessary for the fall height of the granular glaze to be as small as possible.

The spontaneous heating of the dispenser placed in close proximity to the incandescent tiles is therefore inadmissible, since the nearer its temperature comes to that of the tiles the more the lowest-melting fraction of the glaze is caused to melt, with the result that it agglomerates in the dispenser and in practice prevents a

correct dispensing of the glaze.

The present invention sets out to solve problems by embodying a dispenser which applies the glaze with a low-height fall onto incandescent tiles, that is to say tiles at temperatures higher than the melting temperature of the glaze.

This solution is based on the observation that the largest amount of heat yielded by the incandescent tile to the dispenser above it is irradiated heat.

It is known that heat exchange by irradiation is proportional to the difference between the fourth powers of the temperatures of the bodies between which the heat exchange takes place.

It has been experimentally demonstrated that cold glaze that falls onto the surface of the tiles drastically reduces irradiation.

For the outer surface of the tile come to consist of the glaze itself, which absorbs heat from the surface layer of the tile: the rise in temperature of the glaze (with regard to which account has to be taken of the specific heat of the glaze and of the melting temperature of its melting component) clearly occurs with a resulting lowering of the temperature of the suface layer of the tile, there being borne in mind also the low heat transmission coefficient of ceramic bodies such as the support or substrate of a tile.

Thus, according to the invention, the glaze is poured as a cascade or curtain from at least a free edge of a cooled inclined surface on which the granular glaze fed onto its surface can flow.

The glaze is fed onto this inclined surface and, when it falls thereon, loses the kinetic energy that it may possess.

Advantageously, the free edge from which the glaze falls onto the tiles is disposed proximally to the perimetral area of the dispenser, which area is directionally placed so as to lie in the path of approach of the tiles proximal to the dispenser, so that the tiles pass below the body of the dispenser after having received at least part of the granular glaze.

In particular, the dispenser typically comprises a plurality of edges from which the glaze falls, which are transversal to the tile after feed direction.

The characteristics of the invention will become more apparent from an examination of the forms of embodiment thereof described below, with reference to the appended drawings, in which:

Figure 1 is a diagrammatic general perspective view of a preferred embodiment of the apparatus according to the invention;

Figures 2 and 3 are, respectively, side and plan views of the apparatus in Figure 1;

Figures 4 and 5 are partial views similar to those in

Figure 2, for different forms of embodiment of the apparatus.

With reference to Figures 1 to 3, diagrammatic illustration is therein given of a furnace 10 in which is formed a gap 11 housing a dispenser device in accordance with the invention, indicated overall by 12.

The furnace 10 is a roller furnace which is per se conventional and therefore not described in detail; the numeral 13 diagrammatically indicates the power-driven rollers which transport the tiles 14 to within the furnace, wherein they are given the appropriate heat treatment as in particular is explained in Patent Application GB 2 171 402A.

The dispenser 12 is provided with rollers 20 for conveying the tiles, which are an extension of the roller line 13 of the furnace.

The means employed for entraining the rollers into rotation are not here shown in detail; they can be for example of the chain or gear type, as is usual in this kind of equipment.

Preferably, and as shown in the Figures, the said rollers 20 have a discontinuous surface so that the tile is supported by resting on discrete points.

This discontinuity can be advantageously obtained by embodying the rollers 20 with a central tubular part

thereof 21 provided with annular projections 22; the tubular part 21 is traversed by cooling liquid, preferably water, fed to and taken off from the two ends through pipes 23 and rotating joints 24 respectively (Figure 3).

This configuration of the rollers 20 proves useful in preventing their heat deformation in the event of stoppage ans subsequent restarting of the rollers bearing the incandescent tiles.

For, when the incandescent tiles arriving from the furnace on the said rollers 20 come into contact with the rollers which, if their movement is stopped, cool rapidly, touching the rollers proximally to a longitudinal portion thereof, the latter tend to undergo deformation and to form a convexity proximal to the generating line having the highest temperature.

Such deformation, which is the result of thermal disequilibrium, has no tendency to self-compensation and indeed in the first few minutes of operation tends to increase, and thereafter gradually ceases.

In effect, when the rollers roll in order to convey the tiles, the hottest convex portion of them comes into contact with the tiles and this tends to maintain the thermal disequilibrium between the different longitudinal areas of the rollers.

The designing of the rollers so as to provide them with a discontinuous support surface prevents this thermal disequilibrium from arising and persisting, and it also

sets a limit on the amount of heat yielded by the tiles to the rollers and makes it more possible to cool the latter without appreciably lowering tile temperature: there has been seen to be particularly suited to maintaining thermal equilibrium of the rollers an external surface consisting of annular ribs, which also fulfil the function of distributing the heat circumferentially.

The glaze dispenser is provided with a hopper 25 for receiving the granular glaze, at the base of which a feed mechanism consisting for example of a moving wheel 26 of a kind that prevents clogging of the mass, feeds the glaze onto an oscillating sieve 27.

From this sieve the granular glaze falls onto a set of rotating cylinders 30 disposed immediately above the surface of the tiles carried by the rollers 20.

Also these rotating cylinders 30 are provided with cooling in the form of the fluid passing through them, in a manner entirely similar to that of the cooling of the rollers 20.

It should here be noted that, when the glaze falls onto the rotating cylinders 30, it is decelerated, thus reducing its kinetic energy by impact.

This means that the height of the feeding members is not very critical, and such members can therefore be mounted at a convenient distance from the tiles so as not to be subject to dangerous overheating, it again being recalled that the possibility of separation between the different glaze phases during the fall and the irregular accumulation of fine glaze fractions must be minimized.

Account has also to be taken of the fact that the rotating cylinders 30 represent a screen against the radiant heat coming from the tiles.

Proximally to the rotating distributor cylinders 30, below the rollers 20, there is provided a hopper 33 for collecting any glaze that passes through the line of side-by-side tiles brought close to the glaze dispenser.

This hopper should be constructed so as to reduce the occurrence of chimney effects due to the presence of the incandescent tiles, and for this purpose it is useful for the hopper to have transversal partitions 34 and for the outlet mouth for the collected glaze be in seal with the extractor members.

A dispenser structure of this kind has been found to achieve the objects of the invention satisfactorily.

Each of the rotating cylinders 30 constitutes in its upward-facing portion an inclined double surface from which the glaze falls as a cascade or curtain onto the tiles more specifically from the edges which come to be formed by the generating lines of the rotating cylinders tangential to the vertical planes.

The rotation of the rotating cylinders 30 is not critical as regards the dispensing of the glaze, which they could dispense even if stationary.

However, the rotation is extremely useful for continuously varying the portion of surface of the cylinders that is exposed to the radiant heat coming from the incandescent tiles, the cylinders thus becoming easier to cool, and the said rotation also assures that no portion of the cylinders reaches a temperature that can trigger glaze component melting phenomena and that there do not arise any differential expansions that can deform the cylinders 30.

The first of the cylinders 30 met by the tiles carried on the rollers 20 (from left to right in Figure 1) is positioned so that it yields the glaze, by means of one of its edges, to the tiles before these enter the area below the dispenser proper.

As explained heretofore, this first fall of glaze brings about a drastic diminution of the irradiation of the tiles, and this as a result of a lowering of the temperature of their surface layer, though without this causing within them any cooling of mass such as to cause significant thermal disequilibria and inner stresses leading to fissures in the article.

The cylinders 30 complex is therefore subjected to a drastically lower irradiation than would be the case if the tiles travelled below them not cooled by the fall of the glaze.

Moreover, the cylinders 30 form a screen that protects the upper parts of the dispenser both from irradiation and convection.

The existence of a plurality of cylinders 30 (rather than only one) allows the area of tiles screened off from them to be enlarged, although maintaining the relatively small diameter of the cylinders and thus limiting glaze fall height in accordance with the objects of the invention.

It has been found advantageous to dispense the glaze by fall from several successive edges, and thus also to improve the distribution over the tiles.

The glaze falling from the first edge of the dispenser onto the incandescent tile immediately triggers a softening and melting phenomenon, with the result that the glaze falling from the edges subsequently met by the tile in its travel has a lower recoil tendency.

The tiles carried from the furnace on the rollers 13 and then on the rollers 20 of necessity have a certain longitudinal and transversal spacing between them: the glaze dispensed by the cylinders 30 facing in the area of these spaces between tiles is collected by the lower hopper 33 and can optionally be recycled into the dispenser.

The hopper 33 has screens 34 which form a labyrinth for the glaze, deviate the rising air-streams to outside the glaze application area proper, and can be appropriately cooled to subduct the heat received from the lower side of the tiles.

As a result of their being cooled and of the smallness of their contact-zones with the tiles, the rollers 20 can be maintained at a temperature

distinctly lower than the melting temperature of the lowest-melting component of the glaze, thus preventing this from adhering to their surface.

As stated previously, the rotating cylinder configuration of the inclined surface for cascade or curtain pouring of the glaze onto the tiles has been seen to be extremely advantageous for the variety of reasons set out hitherto.

These cylinders can, however, be substituted by surfaces 40 featuring edges 41 from which the glaze falls onto the tiles.

The surfaces 40 are preferably formed with a hollow space 42 in which cooling liquid is force-circulated, as for the cylinders 30.

The surfaces 40 need not necessarily be static; however, in the interests of a satisfactory distribution and freer flow of the glaze they can be embodied in a vibrating form, for example mounted solidly with the sieve 27.

With surfaces 40, it is also advantageous for them to number more than one, in order to obtain a gradual, progressive distribution of the glaze over the tiles and a better evenness of the layer.

In particular, Figure 5 shows the first surface 40 toward the tile feed side so that the tiles arrive below the dispenser already coated with glaze, in accordance with what has been explained above.

The other surfaces 40, however, are shown facing the opposite direction, in that it has been found that it is advantageous as regards a more uniform covering of the front and rear sides for the glaze granules to have a horizontal component in their fall trajectory, parallel to tile feed and in the same direction.

CLAIMS

1. Apparatus for applying glaze in granular form to tiles maintained at a high temperature, comprising a tile conveyance system above which is a glaze dispensing unit, wherein the dispenser unit features at least an elongated glaze pouring edge which extends proximal to, and in a manner substantially transversal to, the path of the tiles and which constitutes the terminal edge of at least one inclined surface cooled by means of a forced-circulation cooling circuit, provision being made for means for depositing glaze on said surface or surfaces.

2. Apparatus as described in Claim 1, wherein the said glaze pouring edge extends substantially proximally to the periphery of the dispenser, which periphery faces the tile approach direction.

3. Apparatus as described in Claim 1, wherein the said dispenser unit includes a plurality of said inclined surfaces having respective parallel terminal edges.

4. Apparatus as described in Claim 1, wherein the said inclined surfaces feature a hollow body in which cooling liquid is caused to circulate.

5. Apparatus as described in Claim 3, wherein each said inclined surface consists of the upward-facing portion of a cylinder mounted with its axis horizontal, and the said glaze pouring edges consist of the areas of the dispenser cylinders adjacent the generating line tangential to vertical planes.

6. Apparatus as described in Claim 5, wherein provision is made for means for maintaining the said cylinders in rotation.

7. Apparatus as described in Claim 5, wherein the said cylinders are hollow and are traversed internally by cooling liquid.

8. Apparatus as described in Claim 1, wherein the said tile conveyance system is a roller system, each roller having an external surface featuring discontinuous projections for supporting the tiles at a number of discrete points.

9. Apparatus as described in Claim 8, wherein the said discontinuities consist of annular bodies mounted coaxially on a shaft.

10. Apparatus as described in Claim 9, wherein the said shaft is hollow to be traversed by a cooling liquid.

11. Apparatus as described in Claim 1, wherein below the tile conveyance system provision is made for means for collecting the granular glaze that overreaches the edge of the tiles.

12. Apparatus as described in Claim 11, wherein the said glaze collection means consist of a hopper having glaze deviation partitions.

13. Apparatus as described in Claim 1, wherein the said

means for depositing the glaze on the said inclined surfaces consists of a vibrating sieve.

REGISTER ENTRY FOR GB2193205

Form 1 Application No GB8713450.8 filing date 09.06.1987

Priority claimed:
01.08.1986 in Italy - doc: 21363

Title APPARATUS FOR APPLYING GLAZE AS GRANULES TO TILES MAINTAINED at a high temperature

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Classified to
C1M B2L U1S
C04B B05C

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Publication No GB2193205 dated 03.02.1988

Examination requested 16.06.1988

Patent Granted with effect from 20.06.1990 (Section 25(1)) with title
APPARATUS FOR APPLYING GLAZE AS GRANULES TO TILES MAINTAINED AT A HIGH TEMPERATURE

**** END OF REGISTER ENTRY ****