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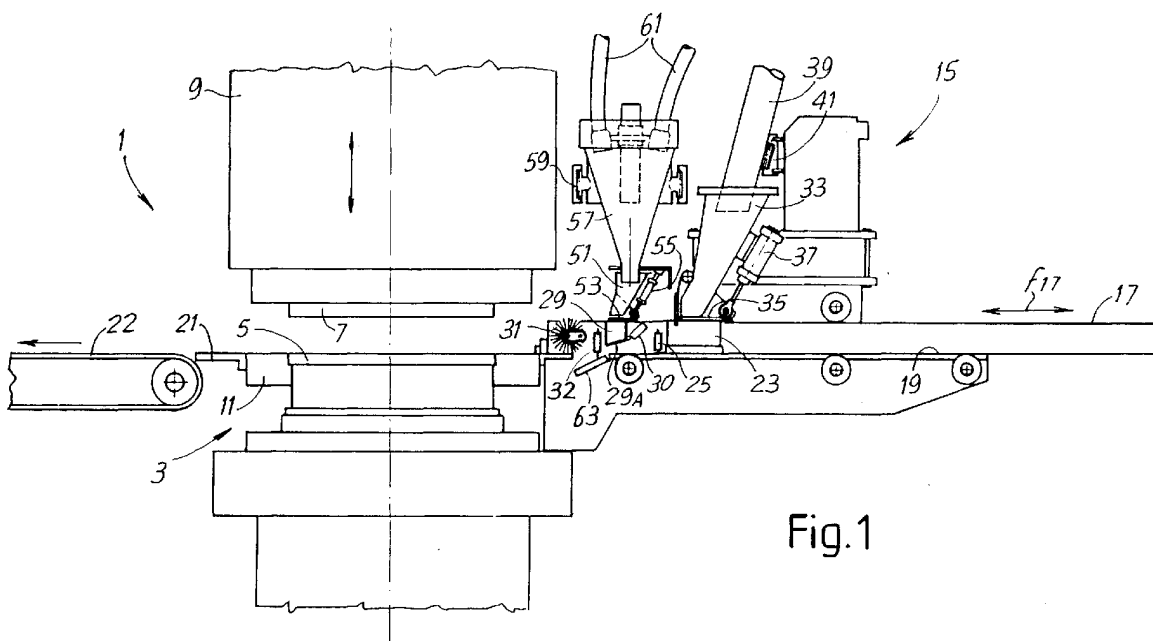
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50123 Firenze (IT)****(54) Device for loading moulds in a press to produce tiles and method of loading**

(57) The device comprises: a carriage (17) equipped with an alternate loading movement along a sliding surface (19); on said carriage, a main grid (23) which receives a base powder material from a first loading means (33) and transfers said base powder material to a cavity of said mould; on said carriage, in front of the main grid, an auxiliary tray (29) for loading an additional

powder material, such as a coloured enamel or the like. The auxiliary tray is at a distance from the main grid, in the direction of movement of the carriage, notwithstanding the dimension that the mould cavity has in said direction and preferably less than this. Moreover, the auxiliary tray has a bottom closing component controlled in synchronism with the movement of the carriage in relation to said mould.

**Fig.1****EP 1 358 983 A2**

Description

Technical Field

[0001] The present invention relates to a device to load powders in a mould to make tiles, and in particular a device comprising a so-called double-loading carriage, i.e. a carriage of the type comprising a main grid which is filled with base powder material, and a hopper or an auxiliary tray which is loaded with a small quantity of additional powder material (for example a coloured powder material), which is deposited on the surface intended to form the visible side, that is the top side of the tile, and which provides the coloured pattern on the surface of the tile.

[0002] The invention also relates to a method of loading powders in a mould for the production of ceramic tiles.

State of the art

[0003] In the field of ceramic tile production it is known to load the cavity of the mould with a layer, of noteworthy thickness, constituted by a base material (for example atomized clay) and intended to form the body of the tile, on which a small quantity of a colouring material is deposited, generally constituted by a mixture of granules of various colours and/or various effects.

[0004] The Italian patent application n. MO99A00141 describes a loading device for ceramic presses to produce tiles with a technique of this type, which is provided with a carriage with a loading grid, which is filled with the base material and which is then transferred above the cavity of the mould to deposit the base material. Disposed in front of the loading grid is a means to distribute a specific quantity of coloured powder material. This means comprises a perforated flexible screen which slides in front of a hopper, with a movement synchronized with the movement of the carriage, in order to distribute the coloured material according to a specific pattern.

[0005] The Italian patent application n. MO99A000016 describes a similar device to the previous one, wherein the coloured material is however distributed through a series of rotating and perforated hollow cylinders inside which the coloured material is placed.

[0006] These two systems, although allowing noteworthy aesthetic results to be obtained on the tiles, are complex, costly and subject to frequent maintenance operations.

[0007] EP-A-0444730 describes a device to load ceramic presses comprising:

- a carriage provided with alternate loading movement along a sliding surface;
- on said carriage, a main grid which receives a base powder material from a first loading means and

transfers said base powder material to a cavity in said mould;

- on said carriage, in front of said main grid, an auxiliary tray for loading a coloured powder material.

[0008] The auxiliary tray is produced in the form of a hopper moving on the carriage, in a direction parallel to the to-and-fro movement of the carriage. During this movement the hopper passes over a mesh bearing a pattern, while the carriage remains still in a position in which the mesh is above the cavity of the mould, in which a layer of base material has previously been disposed.

[0009] This device and the relative production method have the problem of limited production speed. In fact, the filling cycle of the mould cavity includes a first phase in which the grid is positioned above the bottom punch of the mould and in which the latter is lowered (performing a first lowering) to create the cavity which is filled with the material contained in the grid. Following this first phase is a second phase in which the carriage, after having travelled for a certain distance, stops to allow movement of the hopper containing the coloured powders and their distribution through the mesh onto the layer of material previously deposited in the mould cavity. The punch must be lowered a second time, between the first and second phase.

[0010] EP-A-0941826 describes a loading device with a double-loading carriage, which comprises a main grid, which receives the base material and transfers it to the mould, and a hopper or tray provided with a controlled bottom closing component, to deposit the coloured material on top of the base layer previously deposited in the mould cavity. As the bottom punch of the mould must be lowered a second time, that is travel downwards a second time, after the base material has been deposited on it and before the coloured material is deposited, the carriage has an intermediate portion, between the main grid and the hopper, with the object of spacing these two elements by a length corresponding at least to the dimension of the mould cavity in the direction parallel to the direction in which the carriage moves. This prolongs the production cycle and consequently reduces productivity of the device.

Objects and summary of the invention

[0011] The object of the present invention is to provide a loading device for presses to produce ceramic tiles, which overcomes entirely or in part the problems of the prior art. In particular, the object of the invention is to provide a device which may reach high production rates and which has a simple structure.

[0012] In substance, the device according to the invention includes a double-loading carriage, with a main grid and an auxiliary tray, characterized in that these two elements are placed on the carriage at a reciprocal distance independent from the dimension of the mould and

if necessary may be less than this, and in that the auxiliary tray has a bottom closing component controlled in synchronism with the movement of the carriage in relation to said mould.

[0013] Further advantageous characteristics and embodiments of the device according to the invention are indicated in the attached dependent claims.

Brief description of the drawings

[0014] The finding shall now be better understood by following the description and attached drawing, which shows a non-limiting practical embodiment of the invention. In greater detail, in the drawing:

Fig.1 shows a side view of a press with a loading device according to the invention; and
Figs.2A-2D schematically show successive phases of the cycle to load the powders in the mould.

Detailed description of an embodiment of the invention

[0015] With initial reference to Fig.1, the system comprises a press generically indicated with 1, equipped with a mould 3 with a bottom punch or pad 5 and a top punch or pad 7 carried by a moving crosspiece 9. The bottom punch 5 moves inside a die 11 to define together with it a cavity which must be filled with powders, which are subsequently pressed by the two punches of the mould to form the tile.

[0016] At the side of the press 1 a powder loading device, indicated as a whole with 15, is provided. This comprises a carriage 17 moving in the direction of the arrow f17, controlled by an actuator, not shown, along a sliding surface 19, the top surface of which is flush with the top surface of the die 11. On the opposite side of the mould, in relation to the loading device 15, a continuous conveyor with belts or strips 22 is disposed, to remove the tiles formed by the press 1.

[0017] Disposed on the carriage in sequence from right to left are: a base grid or main grid 23, a first scraper 25, an auxiliary tray 29, a second scraper 32 with an actuator, not shown, to raise it and lower it in relation to the surface 19, and a cylindrical brush 31, controlled by an actuator, not shown, suitable to raise and lower it, for reasons explained hereunder. The auxiliary tray 29 is closed at the bottom by a gate valve 29A, the opening and closing of which are controlled by an actuator 30 controlled by a central control unit in synchronism with the movement of the carriage 17.

[0018] During the phase to fill the main grid 23 and the auxiliary tray 29, shown in Fig.1, the carriage 17 is in a position in which the main grid 23 is placed below a base hopper 33, extending orthogonal to the plane of the figure for a width equal to the width of the main grid 23 and equipped with a bottom opening closed by a gate valve 35 controlled by a piston-cylinder actuator 37. The hopper 33 is filled with a base powder material, for ex-

ample atomized clay, through a duct 39 connected to an overhead silo containing the material, not shown. The duct 39 is carried by a slide 41 equipped with alternate movement parallel to the hopper 33 and therefore orthogonal to the plane of the drawing and to the movement according to f17 of the carriage 17. The transverse movement of the duct 39 guarantees uniform filling of the main hopper 33.

[0019] When the carriage 17 is in the position in Fig. 1 the gate valve 35 to close the hopper 35 is opened to fill the main grid 23. This is divided internally, in a per se known way, by a series of vertical slats orthogonal to the direction of movement of the carriage 17, or if necessary distributed according to another pattern, to obtain a desired distribution of the base material in the mould cavity of the press 1. In the example shown the main grid 23 is of the so-called tray type, that is of noteworthy height and with a reduced dimension in the direction parallel to the movement of the carriage 17, that is a dimension lower than the corresponding dimension of the mould cavity. However, it may also be possible to use traditional grids, of a lesser height and greater length in the direction of forward movement of the carriage.

[0020] In this case filling of the main grid 23 is completed during the first length of the travel towards the press 1 of the carriage 17, so that most of the compartments into which the grid is divided by the respective slats are filled completely. In this case the gate valve 35 may not be required, as the carriage has a seal-plate behind the grid 23.

[0021] When the carriage 17 is in the position in Fig. 1, the auxiliary tray 29 is below the preload hopper 51 closed at the bottom by a gate valve 53 controlled by an actuator 55. The preload hopper 51 is filled with coloured powder material (for example a mixture of enamels) through a mixer 57 moving along guides 59 transverse in relation to the movement of the carriage 17. The mixer 57 is filled with coloured powders from the silos overhead, not shown, through flexible ducts 61. These loadings take place at any time, irrespective of the position of the carriage.

[0022] When the auxiliary tray 29 is in the position shown in Fig.1, the gate valve 53 can be opened to load the coloured material into the tray 29.

[0023] The base material with which the main grid 23 is filled forms the base of the tile, while the coloured material (enamel or the like) which is loaded into the auxiliary tray 29 forms the surface layer of the visible face of the tile.

[0024] As can be seen in Fig. 1, the auxiliary tray 29 is at a distance from the main grid 23 lower than the dimension, in the direction of movement of the carriage 17, of the mould cavity 5, that is than the dimension of the tile produced by the press 1. The distance between the auxiliary tray 29 and the main grid 23 is sufficient to house the scraper 25.

[0025] Operation of the device described hereinbefore shall now be described with reference to Figs. 2A-

2D. In Fig. 2A the carriage 17 is in the filling position, the crosspiece of the press is raised and the bottom punch 5 has been raised until it is flush with the top surface of the die 11 and therefore with the sliding surface 19 of the carriage 17. A tile P1 produced in the previous pressing cycle is laid on the top surface of the bottom punch 5 to be ejected by the carriage 17 during its movement to enter the press 1.

[0026] In Fig.2B the carriage 17 has moved to its most forwardly position. The auxiliary tray 29 is beyond the mould cavity, the main grid 23 is in proximity to the outlet edge of the mould cavity, that is the edge nearest to the conveyor 22. The tile P1 has been pushed by the carriage 17 out of the press 1 to the conveyor 22, by which it is removed and conveyed towards the firing kiln.

[0027] As during the forward movement of the carriage 17 from the position in Fig.2A to the position in Fig. 2B the bottom punch 5 is positioned with its top face flush with the sliding surface 19, the powder material contained in the main grid 23 is not unloaded. On the contrary, the material contained in the tray 29 is held there by the respective closing gate valve.

[0028] In the subsequent phase (Fig.2C) the bottom punch 5 is lowered (so-called first lowering of the mould) to form between its top surface and the die 11 the mould cavity which must be filled with the powders destined to form the tile. The powder material contained in the main grid 23 starts to fill the mould cavity. Sometimes the first lowering is anticipated to improve loading of the front part of the cavity.

[0029] As in the example shown the grid is a tray grid, of reduced longitudinal dimension, filling of the mould cavity is completed with reverse movement of the carriage 17, towards the original filling position (Fig.2A). The height of the main grid 23 is sufficient to house the quantity of powder material required to fill the entire mould cavity.

[0030] While the carriage 17 moves back from the position in Fig.2C towards the position in Fig.2A, passing through the position in Fig.2D, the main grid 23 "sweeps" the entire area of the cavity delimited by the die 11 and by the bottom punch 5, and the top surface of the layer of base powder material deposited by the main grid 23 in the mould cavity is levelled by the scraper 25.

[0031] A layer MC of coloured powder material or of another additional material (enamel or the like) is deposited by the auxiliary tray 29 on the free and levelled surface of the layer of base material MB deposited by the base grid 23. For this purpose the auxiliary tray is promptly opened in order to start unloading the coloured material contained in it starting from the edge of the mould cavity nearest to the outlet of the press. For this purpose it may be necessary to anticipate opening slightly, according to the speed of the carriage 17.

[0032] As the bottom punch 5 is preferably not lowered again, the layer MC of coloured powders formed by the auxiliary tray 29 is positioned above the surface

defined by the top surface of the die 11. To prevent it from being removed the brush 31 is promptly raised before it starts to pass over the mould cavity, to be lowered again as soon as it has exceeded the area of the cavity. The auxiliary tray 29 is also promptly closed as soon as it reaches the inlet edge of the mould cavity, that is the edge opposite the conveyor 22.

[0033] As can be seen in Fig.1 and in Fig.2D, a door or trap 63 is provided between the die 11 and the filling position of the carriage 17, along the sliding surface 19 of the carriage, which is opened when the second scraper 32 travels over it; this is lowered onto the sliding surface 19, after it has passed through the area of the mould cavity during the return travel of the carriage. The scraper 32 will unload through the opening thus formed in the sliding surface 19 all the residual powder material, and in particular the enamel powders, collected during the return travel of the carriage 17. This prevents subsequent contamination of the loading system by enamel powders which may have aggressive chemical properties and the presence of which on the rear face or brand of the tiles must be avoided to prevent problems from arising during the firing phase of the tile in the kiln.

[0034] The cylindrical brush 31 has the function of cleaning the top punch during the return travel of the carriage and for this purpose is promptly raised by the relative driving actuator.

[0035] As may be understood from the Figs.2A-2D, the loading cycle of the mould is very brief, as the bottom punch must perform a single lowering movement and not two lowering movements as is the case in traditional devices. Even if, for the purpose of preventing the layer MC of coloured powders from extending beyond the top surface of the die 11, the bottom punch 5 implements a second downward travel, this operation does not prolong the time of a cycle. In fact, the second lowering of the mould may be implemented as soon as the main grid 23 has left the loading area of the mould cavity, when the auxiliary tray 29 is already above the cavity. In fact, the quantity of coloured material deposited on the top surface of the tile is not determined by the distance between the outlet of the tray and the free surface of the layer of base material, but by the speed at which the carriage moves, by the amplitude to which the gate valve of the auxiliary tray 29 opens and by the flowability of the material applied.

[0036] Moreover, the carriage 17 is extremely short, thanks to the fact that the auxiliary tray 29 may be disposed very close to the main grid 23.

[0037] It is understood that the drawing purely shows a possible embodiment of the invention, the forms and layouts of which may vary, without however departing from the scope of the concept underlying the invention.

Claims

1. A device for loading powders in a mould to form

tiles, comprising:

- a carriage equipped with an alternate loading movement along a sliding surface;
- on said carriage, a main grid which receives a base powder material from a first loading means and transfers said base powder material to a cavity of said mould;
- on said carriage, in front of said main grid, an auxiliary tray for loading an additional powder material, such as a coloured enamel or the like;

characterized in that: said auxiliary tray is located at a distance from the main grid, in the direction of movement of the carriage, independent from the dimension that the mould cavity has in said direction and preferably less than this, and **in that** said auxiliary tray has a bottom closing component controlled in synchronism with the movement of the carriage in relation to the mould.

2. Device as claimed in claim 1, **characterized in that** a first scraping component is disposed between said main grid and said auxiliary tray, to level the base material deposited in the mould cavity by the main grid of the carriage.
3. Device as claimed in claim 1 or 2, **characterized in that** it comprises, on the opposite side of the auxiliary tray to said first scraping component, a second scraping component associated with an actuator which controls raising and lowering in synchronism with the position of the carriage in relation to the mould.
4. Device as claimed in claim 3, **characterized in that** said second scraping component is a scraper with a raising mechanism.
5. Device as claimed in one or more of the previous claims, **characterized in that** the auxiliary tray has a bottom opening at a greater height than the sliding surface of the carriage.
6. Device as claimed in one or more of the previous claims, **characterized in that** provided along said sliding surface of the carriage, between the mould and a station for loading the material into the carriage, is an unloading opening which may be opened in synchronism with the movement of the carriage, to unload any powder material removed by said first and/or said second scraping element.
7. Method for loading powders into a mould cavity to form tiles, comprising the phases of:
 - loading a layer of base material (MB) into said cavity;

- distributing, on said layer of base material (MB), by means of an auxiliary tray (29) which translates on said mould, a layer of colouring material (MC) destined to form the visible surface of the tile;
- pressing said layer of base material and said layer of colouring material in said cavity to form a tile;
- ejecting the tile from the cavity;

characterized by levelling the free surface of the layer of base material deposited in the mould cavity and depositing by dropping the colouring material from said auxiliary tray onto the levelled surface of the layer of base material, said layer of colouring material projecting beyond the edge of said cavity.

8. Method as claimed in claim 7, **characterized in that** the quantity of colouring material (MC) distributed by said auxiliary tray is determined by the speed of movement of the tray and by the amplitude of opening of a gate valve to close the auxiliary tray and by the flowability of the material.

9. Method as claimed in claim 7 or 8, **characterized by:**

- disposing a quantity of base material on a main grid;
- disposing a quantity of colouring material in said auxiliary tray;
- translating said main grid and said auxiliary tray from a loading position to a position to fill the mould cavity, in which the auxiliary tray is positioned, in relation to the mould, on the opposite side to said loading position;
- translating in the opposite direction said main grid and said auxiliary tray, filling said cavity with a layer of base material;
- when the auxiliary tray is at or in proximity to said cavity, opening the auxiliary tray in a controlled way and distributing by dropping from said auxiliary tray a controlled quantity of colouring material onto the free surface of said layer of base material.

