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(54) **Decorated ceramic tiles, apparatus and method for decorating the same**

(57) A method for forming decorated ceramic tiles (1, 1a, 1b, 1d) comprises distributing ceramic material (20) suitable for forming a base layer of a ceramic support (2), decorating said base layer (2) with a decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m), pressing together said decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) and said base layer for obtaining a compact ceramic support, said decorating comprising associating to said base layer only laminar elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) of said decorating material. An apparatus for forming decorated ceramic tiles (1, 1a, 1b) comprises

distributing means arranged for distributing a layer of ceramic material (20) suitable for forming a base body of a ceramic support (2), decorating means arranged for decorating said base layer with a decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m), pressing means (6) arranged for pressing together said decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) and said base layer in order to obtain a compact ceramic support (2), said decorating means comprising associating means (32, 32a, 36, 113) arranged for associating to said base layer only laminar elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) of said decorating material.

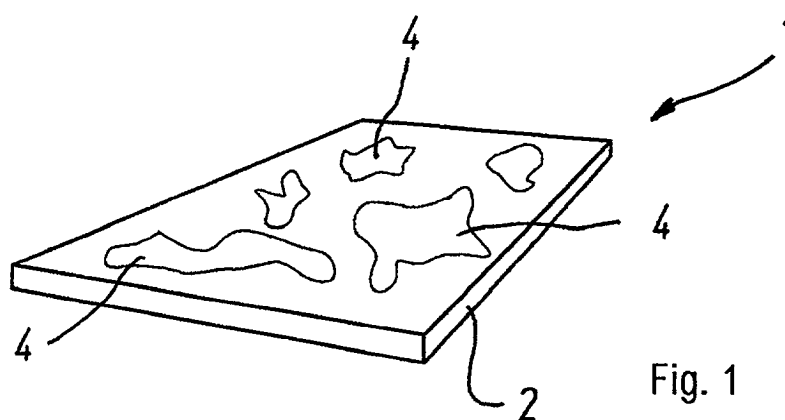


Fig. 1

Description

[0001] The invention relates to a method and an apparatus arranged for forming ceramic supports incorporating decorations carried out during the dry pressing step of flowable material, such as powders, granules or the like, basic constituent of the mixture from which such supports are substantially formed, as well as a tile with decorations obtained during forming.

[0002] In the area of valuable finishes for building products, a type of floor is known named Venetian beaten floor comprising a layer of binding material, usually cement mortar, that is laid down and smoothed through convenient beating. The bed obtained in this manner is decorated by inserting into the cement mortar granules of ornamental stones, e.g. marble cobbles, so arranged as a portion of granule protrudes from the surface of the cement mortar.

[0003] After setting, the floor so obtained is subjected to smoothing; with the passing of time, the cement mortar is subjected to a greater wear than the cobbles that are instead more and more, smoothed through the effect of trampling.

[0004] In the area of ceramic tiles manufacturing, everybody does not know products capable of imitating the Venetian beaten floor with enough valuable aesthetical properties. That is essentially due to limitations of the known devices for loading ceramic presses.

[0005] The prior art comprises, in fact, apparatuses for producing ceramic tiles in which ceramic powders are distributed into two superimposed layers during distinct strokes of the trolleys or distinct stages of the same stroke of trolley, the trolleys being generally provided with grids, each trolley bringing to the press die the respective amount of powders relative to a certain layer.

[0006] On the other hand, such plants have a very lower productivity than the productivity obtainable with a single layer loading, since the provision of distinct strokes for each trolley, or distinct stages of the loading stroke, a certain waste of time, because the layers are placed onto the die of a respective mould at different times and at a certain time interval from each other.

[0007] In some of the above mentioned "double loading" apparatus, the regions of the base layer to be decorated are left accessible by openings made in masks, or screens, that are placed above the base layer before the powders constituting the layer of decorating material are spread thereabove. In this way, the powders of decorating material are distributed only at such openings, thus defining drawings or ornamental. A disadvantage of double loading apparatus mentioned above is that it is possible to form decorations having only the form and dimensions corresponding to forms and dimensions of the available masks. Furthermore, it is difficult to control the position of the powders of the decorating material layer during pressing, which results in a poor definition of the decorations obtained with such systems.

[0008] Furthermore, apparatus are known for loading

ceramic presses, which are an improvement of the apparatus described above, comprising a feed trolley which may be moved between a back position for loading the powders and an advanced unloading position over the press die, the powders unloaded by the trolley being transferred into cavities of the above mentioned press forming a first layer of base powders, said apparatus being further provided with an additional transfer device, mounted on the trolley and capable of placing a second layer of ceramic powders mixed to granules, or flakes (i.e. lamina-like ceramic elements) above the first layer of base powders, already unloaded from the trolley.

[0009] A disadvantage of the apparatus of this type is that, inside such transfer devices, the flakes and granules constituting the decoration of the finished tile are mixed to powders of the type forming the body of the tile.

[0010] That leads to an irregular distribution of the flakes, or granules, which is uneconomic because the granules and flakes, that have a remarkably higher cost than the ceramic powders, are spread on a quite large portion of the thickness of the tile, whereas a positioning only in the surface layer thereof should be sufficient.

[0011] In addition, the random distribution of the flakes or granules allows to obtain only ceramic tiles in which such decorating elements result remarkably set apart each from the other by less valuable ceramic powders, with a resultant worsening of the aesthetical properties of the product.

[0012] Furthermore, with reference to flakes, the known apparatus do not allow to control their orientation, while frequently a disadvantageous circumstance occurs in which the flake does not show a face substantially parallel to the face of the tile, but arranged transversally to the latter with reference to thickness direction.

[0013] In addition, known apparatus make possible to obtain tiles having a visible face in which, after firing, the powders constituting the body of the tile partially cover the flakes and the granules. In order to obtain a product with better aesthetical properties, a deep smoothing is therefore used that uniformly removes the whole surface layer of the tile until a visible surface having a homogeneous degree of brightness is obtained.

[0014] Furthermore, the prior art comprises the application of decals on the layer of soft powders forming the base body of the tile. At the end of pressing, the resulting tile shows a decorating surface layer firmly attached to the base body.

[0015] The application of decals leads to a very higher definition of the images, but the selection of the decoration is unacceptably limited to the typology of available decals.

[0016] The object of the present invention is to increase the variety of decorating effects obtainable for ceramic tiles.

[0017] Another object of the present invention is to improve the decoration of ceramic tiles obtained by means

of multiple loading of powders, or granules, or flakes into the press cavities.

[0018] Still another object of the invention is to obtain ceramic tiles decorated with flakes the visible face of which has a very high surface density of the above-mentioned flakes.

[0019] A further object is to produce ceramic tiles having substantially the typical aesthetical properties of artisan-made floor obtained using the technique of Venetian beaten floor.

[0020] A still further object is to improve the known apparatus for feeding ceramic presses, working through multiple loadings of powders, or granules, or flakes.

[0021] A further object is to provide an apparatus for feeding ceramic presses which allows to obtain tiles substantially similar to hand-made floors obtained using the technique of the Venetian beaten floor.

[0022] Still another object of the invention is to provide an apparatus for feeding ceramic presses which allows to obtain veined tiles in a particular simple way.

[0023] A still further object is to provide a method for manufacturing ceramic tiles remarkably similar to floors obtained with the technique of the Venetian beaten floor.

[0024] Another object is to provide a method for the obtaining ceramic tiles decorated with flakes which seems particularly agreeable.

[0025] A still further object is to provide a method which allows to produce veined or streaked ceramic tiles in a particular simple way.

[0026] In a first aspect of the invention, a method is provided for forming decorated ceramic tiles, comprising the following steps:

- distributing ceramic material suitable for forming a base layer of a ceramic support;
- decorating said base layer with a decorating material;
- pressing together said decorating material and said base layer for obtaining a compact ceramic support;

characterized in that, said decorating comprises associating to said base layer only laminar elements of said decorating material.

[0027] In a second aspect of the invention, an apparatus is provided for forming decorated ceramic tiles, comprising:

- distributing means arranged for distributing a layer of ceramic material suitable for forming a base body of a ceramic support;
- decorating means arranged for decorating said base layer with a decorating material;
- pressing means arranged for pressing together said decorating material and said base layer in order to obtain a compact ceramic support;

characterized in that, said decorating means comprises

associating means arranged for associating to said base layer only laminar elements of said decorating material.

[0028] In a preferred embodiment, the associating means comprises vibrating means suitable for applying said laminar decorating elements without mixing them in advance with further ceramic powders.

[0029] In another preferred embodiment, the associating means comprises conveyor belt means suitable for receiving thereon a thin layer of laminar decorating elements and to transfer it into the cavity of the press without substantially altering the disposition of the laminar decorating elements.

[0030] Due to this aspect of the invention, it is possible to obtain a loading apparatus of a ceramic press that is capable to arrange laminar decorating elements, not mixed in advance with further ceramic powders, on a soft layer of powder previously loaded into the cavities of the press.

[0031] In a further preferred embodiment, the decorating material comprises sheet decorating means comprising humidified ceramic powders, kneaded and laminated until a desired thickness is obtained; in such circumstance the associating means comprises decorating roller means suitable for interacting with the sheet decorating means for decorating ceramic tiles to be formed.

[0032] Advantageously, the decorating roller means may comprise protrusions suitable for crushing in an irregular manner said sheet decorating means generating a plurality of tesserae having a jagged edge and capable of producing an aesthetical effect similar to the effect obtained with the use of laminar decorating elements.

[0033] Further advantageously, the decorating roller means can be provided with blades that cut said sheet decorating means to subdivide it in portions having a pre-established geometry.

[0034] Still advantageously, the decorating roller means may comprise, on their external surface, impressions suitable for subdividing said sheet decorating means into portions having profiled edges, so as to be able to be arranged close to each other to obtain an ornamental pattern.

[0035] Due to this aspect of the invention, it is possible to obtain an apparatus that allows to produce ceramic tiles in which the laminar decorating elements are very close to each other and arranged so as to obtain compositions provided with particular aesthetical value.

[0036] In a third aspect of the invention, a ceramic tile is provided comprising a base body and decorating means associated to said base body, characterized in that, said decorating means comprises laminar decorating elements arranged so as to define a pre-established decorating pattern of said tile.

[0037] In this way, a new type of tile is made available having a ceramic base body, because the application, anyway obtained, of the laminar decorating elements to

a support leads to new and agreeable aesthetical effects.

[0038] In a fourth aspect of the invention, a semi-finished product is provided for decorating ceramic tiles, comprising sheet decorating means having a laminar structure and so shaped as to contribute to the definition of a more complex ornamental pattern.

[0039] The preparation of the laminar decorating elements can be obtained with a method comprising the following steps:

- preparing a mixture based on coloured clays, or ceramic glazes or other initially powdery decorating material, by incorporating a convenient amount of water in said mixture until an amalgamated mass having a pasty consistency is obtained;
- reducing the above mentioned amalgamated mass into a lamina, for example by extrusion, or lamination, or something else, so as to obtain a relatively thin foil, having generally a thickness between some tenth of millimetres and some millimetres;
- separating portions from said lamina so as to obtain laminar decorating elements.

[0040] In a preferred embodiment, the thickness of the laminar decorating elements is preferably not greater than 50% of the thickness of the formed tile.

[0041] The laminar decorating elements can have a regular or irregular plane form, depending on the available methods for separating them from the above mentioned lamina.

[0042] Obviously, the laminar decorating elements applied to the base support can be equal to or different from each other, whether by form, or by composition, or by colour, and can form homogeneous, monochromatic, or polychromatic, geometrical, or figurative decorations, according to the aesthetical effect one desires to confer to the tile.

[0043] In a fifth aspect of the present invention, a method is provided for manufacturing ceramic tiles, comprising the following steps, sequentially:

- indexing conveyor belt means towards a ceramic press through a plurality of stations;
- arranging a portion of an ornamental pattern formed by laminar decorating elements on said belt at each station;
- transferring said ornamental pattern into a cavity of a ceramic mould;
- pressing together ceramic powders and said ornamental pattern in said cavity.

[0044] That makes possible to manufacture the decorated ceramic tiles with laminar decorating elements in a very efficient manner.

[0045] In a sixth aspect of the invention, a ceramic tile is provided comprising ceramic powders suitable for defining a base layer of said tile and laminar decorating

elements suitable for being associated to said base layer for decorating said tile, characterized in that, the visible face of said tile exhibits a portion covered by said laminar decorating elements greater than 90% of the total surface of said visible face.

[0046] In a preferred version, said portion has an extension comprised between 90% and 98% of the area of the above-mentioned visible face.

[0047] Due to this aspect of the invention, it is possible to obtain a ceramic tile in which the laminar decorating elements are more visible than in known ceramic tiles; that contributes considerably to improve the aspect of the tile, being substantially reduced the extension of the interstices filled by non particularly valuable material, that separate the laminar decorating elements from each other.

[0048] In a seventh aspect of the invention, a ceramic tile is provided, comprising ceramic powders suitable for defining a base layer of said tile and laminar decorating elements suitable for being associated to said base layer for decorating said tile, characterized in that said laminar decorating elements exhibits a portion incorporated into said base layer and a portion protruding from said base layer.

[0049] Due to this aspect of the invention, it is possible to obtain a ceramic tile remarkably similar to a floor carried out with the technique of the Venetian beaten floor; in fact, by smoothing selectively the portions of laminar decorating elements protruding from the tile body a valuable aesthetical effect of bright stony inserts which show up with respect to the matt surface in which they are incorporated.

[0050] In a eighth aspect of the invention, an apparatus for loading a ceramic press is provided, comprising trolley means movable between a loading position and an unloading position and suitable for transferring a first layer of ceramic powders into cavities of said press, associating means for positioning on said first layer a further layer of ceramic powders suitable for being pressed together with said first layer, characterized in that, said associating means comprises positioning means suitable for interacting with said further layer for introducing in said cavities portions of said further layer arranged according to a pre-established pattern.

[0051] In a preferred embodiment, said associating means comprises vibrating means suitable for favouring the transfer of the further layer of ceramic powders to the cavities of the press.

[0052] Due to this aspect of the invention, it is possible to obtain an apparatus that allows to produce ceramic tiles decorated with veins and streaks in a particularly simple way.

[0053] In a ninth aspect of the invention, a method is provided for forming a ceramic tile provided with laminar decorating elements partially extending from the surface of said tile, comprising filling mould cavities of a ceramic press with a layer of ceramic powders, arranging said laminar decorating elements on said layer,

pressing said laminar decorating elements against said layer, characterized in that, said pressing comprises compacting said layer and said laminar decorating elements by means of a punch having an active surface made of soft rubber.

[0054] In a preferred version, after said pressing it is provided smoothing selectively the portion of said laminar decorating elements protruding from the surface of said tile, without smoothing the body of said tile obtained by pressing of said ceramic powders.

[0055] Due to this aspect of the invention, it is possible to obtain ceramic tiles reproducing a floor obtained with the technique of the Venetian beaten floor.

[0056] In a tenth aspect of the invention, a method is provided for obtaining a decorated ceramic tile, comprising filling mould cavities of a ceramic press with a layer of ceramic powders, arranging on said layer sheet decorating means comprising humidified ceramic powders, kneaded and laminated until a desired thickness is obtained, pressing said sheet decorating means and said layer together, characterized in that before said arranging it is provided treating said sheet decorating means for improving the decorating properties thereof.

[0057] In a preferred version, said treating comprises crushing said sheet decorating means for obtaining ceramic tiles having properties similar to the tiles obtained by using laminar decorating elements.

[0058] In an other preferred version said treating comprises cutting said sheet decorating means for obtaining a plurality of profiled tesserae arranged closely side by side.

[0059] In a preferred still further version, said treating comprises dividing said sheet decorating means for obtaining contiguous portions provided with conjugated profiles, which may be arranged closed to each other for defining particular patterns.

[0060] Due to this aspect of the invention, it is possible to obtain a method that allows to produce tiles decorated with laminar decorating elements, or sheet decorating means that are aesthetically very agreeable.

[0061] In an eleventh aspect of the invention, a method is provided for obtaining a decorated ceramic tile, comprising filling mould cavities of a ceramic press with a first layer of ceramic powders, arranging a further layer of ceramic powders on said layer, pressing said further layer and said first layer together, characterized in that before said arranging it is provided orienting portions of said layer for introducing them into said cavity according to a pre-established pattern.

[0062] Due to this aspect of the invention, it is possible to obtain a method that allows to produce ceramic tiles decorated with veins or streaks in a particularly simple way.

[0063] In a twelfth aspect of the invention, it is provided using a punch provided with an active surface made of soft rubber as forming means for pressing ceramic tiles provided with laminar decorating elements partially protruding from the surface of the visible face of said

ceramic tiles.

[0064] Due to this aspect of the invention, it is possible to obtain ceramic tiles provided with laminar decorating elements having portions extending from the body of the tiles, said portions being able to be smoothed for obtaining an aesthetical effect similar to the technique of the Venetian beaten floor.

[0065] The invention will be better understood and carried out with reference to the enclosed drawings, that illustrate some exemplifying and not limiting embodiments thereof, wherein:

Figure 1 is a perspective view of a tile decorated according to the invention;

Figure 2 is a view as in Figure 1, but concerning a squared decoration;

Figure 3 is a view as in Figure 1, but concerning a figurative decoration;

Figure 4 is a schematic section along a vertical plane of a ceramic press fed with a basic material and laminar decorating elements supported on a belt conveyor;

Figure 5 is a section like that of Figure 4, but showing laminar decorating elements fed to the press through vacuum means; Figure 6 is a plan view of an apparatus for arranging laminar decorating elements into groups suitable for forming a complex decoration;

Figure 7 is a section along the plane VII-VII of Figure 6;

Figure 8 is a view like that of Figure 6, but showing a variation in which the laminar decorating elements are lying on supporting plates;

Figure 9 is a section along the vertical plane IX-IX of Figure 8;

Figure 10 is a plan view like that of Figure 6, but showing a version in which the laminar decorating elements are separated by sheet decorating means comprising a continuous thin plate;

Figure 11 is a schematic vertical section of a forming apparatus according to the invention, showing trolley means in a rear loading position;

Figure 12 is an enlarged and broken view of a detail of Figure 11, highlighting associating means fed with laminar decorating means drawn from a respective hopper;

Figure 13 is a schematic and broken vertical section of a forming apparatus according to the invention, showing the trolley means at a forward unloading position;

Figure 14 is a section like that of Figure 13 showing a variation in which the associating means is provided with trimming strap means for adjusting the thickness of the layer formed by the laminar decorating means;

Figure 15 is a section like that of Figure 13 showing conveyor belt means during the step of transferring the laminar decorating means into the cavities of the

press;

Figure 16 is a section like that of Figure 15 showing the conveyor belt means at the end of the step of transferring the laminar decorating means into the cavities of a press;

Figure 17 is a plan view of an apparatus according to the invention;

Figure 18 is an elevation front view of the apparatus of Figure 17;

Figure 19 is a perspective broken view of a ceramic tile according to the invention;

Figure 20 is a vertical section of a ceramic mould containing a basic layer of ceramic powders onto which laminar decorating means has been arranged that is pressed by means of a punch of soft rubber;

Figure 21 is a section like that of Figure 20 highlighting the punch at a raised position at the end of pressing;

Figure 22 is a schematic and broken vertical view of a forming apparatus according to the invention provided with decorating roller means suitable for interacting with sheet decorating means, showing trolley means at a forward unloading position;

Figure 23 is a section like that of Figure 22 showing conveyor belt means during the step of transferring the sheet decorating means into the cavities of the press;

Figure 24 is a section like that of Figure 23 showing the conveyor belt means at the end of the step of transferring the sheet decorating means into the cavities of the press;

Figure 25 is a schematic and broken vertical section of a forming apparatus according to the invention showing trolley means, at a forward unloading position, provided with a further layer of ceramic powders arranged on conveyor belt means;

Figure 26 is a section like that of Figure 25 showing the conveyor belt means during the step of transferring the further powder layer into the cavities of the press;

Figure 27 is a section like that of Figure 26 showing the conveyor belt means at the end of the step of transferring the further powder layer into the cavities of the press;

Figure 28 is a section like that of Figure 25 highlighting sprocket wheel means associated with the conveyor belt means;

Figure 29 is a section like that of Figure 26 highlighting screw means associated with the conveyor belt means and suitable for interacting with the powders of the further layer for obtaining preferred accumulations of powders;

Figure 30 is a section like that of Figure 27 showing the preferred accumulations of powders arranged in cavities of a press, above the layer of ceramic powders previously introduced.

[0066] As highlighted in Figure 1, a ceramic tile 1 comprises a base body 2 that is associated to laminar decorating elements 4 on the surface thereof, the laminar decorating elements 4 may have irregular contours.

[0067] In Figure 2, a tile 1a exhibits a laminar decorating element 4a defining a squared pattern.

[0068] Figure 3 shows how a tile 1b is decorated with laminar decorating elements 4b, 4d, 4e, defining a flower-like decoration. With reference now to Figure 4, a ceramic press 6 comprises a bed 8 and a cross-bar 10 to which an upper punch 12 of a ceramic mould is fixed. A die 14 is coupled to the bed 8 through vertical acting means 16 that defines, together with a lower matching block 18 a cavity 22 of the ceramic mould in which basic powders 20 are introduced by means of a trolley 24 with a loading grid 26. The trolley 24 reciprocates in a direction indicated by arrow F for passing under the lower end of a hopper 28 into which the base powders 20 are initially contained and to receive from it a controlled amount of the base powders 20. The reciprocating motion of the trolley 24 takes place onto a loading plane 30 at one side of the press 6, while, at the opposite side, a conveyor belt 32, on which laminar decorating elements as a whole indicated with 4 are lying, reciprocates in a direction F1 so that the belt 32 can penetrate under the upper punch 12 above the cavity 22 at the position shown with dot lines, when the trolley 24 has moved away from it after leaving the base powders load 20 therein. The belt 32, while coming back to its original position, out of the overall operative dimensions of the press, can unwind and placing the laminar decorating elements 4 onto the base powders 20. When it is desired to prevent the laminar decorating elements 4 from falling out of the belt 32 onto the base powders 20 by mixing themselves, it is advisable that the belt 32 is provided, at its end facing the press 6, with a ramp 34 ending near the layer of base powders 20.

[0069] In the version shown in Figure 5, a belt 32a is placed in a fixed position at the side of press 6 facing the side concerned by the motion of the trolley 24, so as to bring the flat decorating elements 4 near the press 6, without inserting them therein. A suction plate 36 lowers onto the laminar decorating elements 4 and subsequently raises along the direction F3 holding them in touch with its lower face by vacuum pressure DEP and finally transfers them along the direction F4 and arranges them onto the layer of base powders 20, or causes them to fall from a certain height, so as to obtain, in the first case, a very accurate positioning of the laminar decorating elements 4 and, in the second case, a pseudo-random distribution of the laminar decorating element 4 on the layer of base powders 20.

[0070] The laminar decorating elements 4, 4a, 4b, 4d, 4e can be distributed on the belt 32, 32a in any suitable manner.

[0071] In particular, as highlighted in Figures 6 and 7, the belt 32a extends, at its farthest portion from the press 6, so as to pass at positions near the ends of aux-

iliary conveyor belts 38, 38a, 38b onto which respective laminar decorating elements 4f, 4g, 4h, unloaded from containers 40, 40a, 40b are poured.

[0072] The laminar decorating elements 4f, 4g, 4h are distributed on the respective auxiliary conveyors 38, 38a, 38b so as to be available for forming portions of a decorating pattern indicated as a whole with 42. Between the ends of the auxiliary conveyor belts 38, 38a, 38b and the belt 32a, respective suction plates 44, 44a, 44b are provided, similar to the suction plate 36 and capable of transferring the laminar decorating elements 4f, 4g, 4h from the respective auxiliary conveyors 38, 38a, 38b, by taking them away from the top of the auxiliary conveyors, in order to arrange them on the conveyor belt 32a at pre-established positions.

[0073] The conveyor 32a is indexed so as to move gradually the laminar decorating elements arranged thereon towards the press 6, stopping at the end of each step near an auxiliary conveyor in order to wait for the laminar decorating element or the laminar decorating elements to be loaded thereon.

[0074] As highlighted in Figures 8 and 9, the laminar decorating elements 4f, 4g, 4h, can be placed on support plates, or trays, 46 lying on the conveyor belt 32a.

[0075] The trays 32a at the end of the transfer on the conveyor belt 32a are cleared of the respective laminar decorating elements 4f, 4g, 4h, are collected at the end of the conveyor belt 32a, near the press 6 and placed again at the opposite end in order to be indexed towards the press 6.

[0076] Alternatively, the trays 46 can be firmly fixed to the conveyor belt 32a, in order to follow it also in the return, non active branch without means being required for bringing them at the entry end after their use.

[0077] In a further version, the belt 32a can be provided with impressions or pockets in which the different decorating elements can be placed.

[0078] As highlighted in Figure 10, the conveyor belt 32a can be transversally crossed by laminae 48, 48a, 48b arranged above the trays 46. The laminae 48, 48a, 48b, are laminated by laminator means 50, 50a, 50b, extend continuously beyond the conveyor belt 32a and are inserted into recycling containers 52, 52a, 52b, placed at the opposite side of the conveyor belt 32a. Above the laminae 48, 48a, 48b, at the positions where the trays 46 stop, punch means (not shown for drawing simplicity) are arranged that separate the laminar decorating elements 4h, 4m, 4n from the laminae 48, 48a, 48b, placing them on the underlying trays 46 and leaving some openings 54, 54a, 54b in the laminae 48, 48a, 48b.

[0079] The trays 46 can be provided with recesses having a shape corresponding to the shape of the laminar decorating elements 4h, 4m, 4n, acting like seats for a proper and exact positioning of the above mentioned elements thereon.

[0080] Instead of arranging the laminar decorating elements on the base powders 20, it is also possible to arrange them on the bottom of the cavity 22, thus ob-

taining that the decoration is formed on the face of the support under formation in contact with the lower reference block 18.

[0081] With reference to Figure 11, a ceramic press 6 is shown comprising a die 14 of a ceramic mould that defines the loading plane 30 of the press 6 and is provided with cavities 22 designed to be filled with the ceramic material to be pressed, and punches 12 fixed to a cross-bar 10 sliding on both directions perpendicularly to the die 14.

[0082] At a side of the die 14, a feeding apparatus 106 is arranged for loading the cavities 22 of the die 14 with ceramic powders to be pressed.

[0083] The feeding apparatus 106 comprises a trolley 24 provided with tray means 109 equipped with loading grid 26 and arranged for containing ceramic powders 20 (Figure 13).

[0084] The trolley 24 slides along a longitudinal direction between a loading position, where the tray means 109 are fed with the ceramic powders 20 contained into a hopper 28 and an unloading position where the tray means 109 transfers the ceramic powders 20 contained thereon into the cavities 22.

[0085] The trolley 24 further comprises associating means 113 firmly connected at their front portion to the trolley 24 and arranged for placing the laminar decorating elements 4, withdrawn from a further hopper 118, on the ceramic powders 20 already introduced into the cavities 22. With reference to Figures 12 to 18, the associating means 113 comprises containment means 115 for the laminar decorating elements 4 downwardly delimited by inclined plane means 116 arranged for removing said laminar decorating elements 4 through slot means 117.

[0086] Below the containment means 115, conveyor belt means 119 is arranged, moving around a couple of rollers 120, one of which is motorized, and suitable for receiving the laminar decorating elements 4 discharged from the containment means 115 through the slot means 117.

[0087] Vibrating means 121 is associated to the containment means 115, said vibrating means being arranged for vibrating the containment means 115 so as to cause the laminar decorating elements 4 to be discharged therefrom.

[0088] The slot means 117 has such a shape and geometry as to cause that the laminar decorating elements 4 to be arranged on the conveyor belt means 119 as near as possible to each other: therefore laminar decorating elements 4 are arranged on the conveyor belt means 119 forming a thin layer, said laminar decorating elements being separated one from the other by gaps of very limited extension. Said distribution, substantially maintained during the next press feeding step, makes possible to obtain a finished tile 1d (Figure 19) in which the laminar decorating elements 4 are adjacent each other and concentrated near the visible surface of the tile 1d.

[0089] In order to assist the action of the vibrating means 121, the containment means 115 is supported to the trolley 24 through springs 122. Ramp conveyor means 123 is disposed below the belt conveyor means 119, said ramp conveyor means being arranged for receiving the laminar decorating elements 4 from the belt conveyor means 119 and directing them into the cavities 22. During transfer of the laminar decorating elements 4, the ramp conveyor means 123 is caused to vibrate by the vibrating means 121, being connected to the containment means 115 by walls 115a (Figure 117).

[0090] With reference to Figure 14, a variation of the apparatus 106 is shown in which the associating means 113 comprises trimming strap means 200 connected to said containment means 115 so as to be spaced from the underlying conveyor belt means 119 at an adjustable distance, in order to allow the above mentioned laminar decorating elements 4 to be arranged as near as possible to each other giving rise to a thin layer. In this way overlaps are substantially prevented between the laminar decorating elements 4 that are positioned on the conveyor belt means 119 by being discharged from the slot means 117,

[0091] At the start of the pressing cycle, the trolley 24, as highlighted in Figures 11 and 12, lies at its back position, where the hopper 28 feeds the tray means 109, while the further hopper 118 feeds the containment means 115.

[0092] Subsequently, the vibrating means 121 is operated and therefore the removal of the laminar decorating elements 4 starts; at the same time, the conveyor belt 119 is started allowing the close and substantially single layer distribution of the laminar decorating elements 4.

[0093] Then, the trolley 24 is translated towards the press 6 until filling of the cavities 22 is obtained, as shown in Figure 13. Once filling of the cavities 22 has been completed, the trolley 24 is retracted, and, during the back stroke of the trolley, the conveyor belt means 119 is operated again for transferring the laminar decorating elements 4 on the layer of ceramic powders 20 previously arranged in the cavities 22.

[0094] With reference to Figure 20, a cavity 22 is shown, filled with a layer of ceramic powders 20 on which laminar decorating elements 4 have been subsequently arranged, that are pressed by means of a punch 12 comprising an active surface 12a made of soft rubber.

[0095] As shown in Figure 21, due to the deformability of the active surface 12a, at the end of the pressing, a semi-finished product is obtained in which the laminar decorating elements 4 partially protrude from the upper surface. In this event, preferably, after the firing step, it is possible to smooth the portion of the above mentioned laminar decorating elements 4 that protrudes from the body of the tile obtained by compressing and firing the ceramic powders 20, thus obtaining a finished product having the aesthetic values of a Venetian beaten floor.

[0096] With reference to Figures 22 to 24, a feeding apparatus 106 is shown similar to the apparatus shown in Figures 11 to 18, wherein sheet decorating means 125 is disposed above the conveyor belt means 119, said sheet decorating means being suitable for being positioned on a layer of ceramic powders 20, previously introduced into the cavities 22.

[0097] The sheet decorating means 125 is obtained from humidified ceramic powders 20, kneaded and laminated until a desired thickness is obtained. The ceramic powders 20 are of the same type as the powders forming the body of the tile to be obtained, but usually differing from these powders only in the chromatic properties that make them more valuable and therefore suitable for constituting the decoration of the above mentioned tile.

[0098] As shown in Figure 23, the sheet decorating means 125 is constituted by material in a semi-plastic condition, therefore it deforms without being damaged during insertion into the cavities 22, and, in particular, during transfer from the conveyor belt means 119 to the ramp conveyor means 123 and to the cavities 22.

[0099] In addition, the feeding apparatus 106 comprises decorating roller means 126, rotationally coupled to the trolley 24 and arranged above the belt conveyor means 119, the decorating roller means being suitable for interacting with the sheet decorating means 125 while it is conveyed by the belt conveyor means 119.

[0100] The decorating roller means 126 can be provided with protrusions suitable for crushing irregularly said sheet decorating means 125 in order to produce an effect similar to the effect obtained with the use of laminar decorating elements 4.

[0101] In an other version, the decorating roller means 126 comprises a plurality of blades arranged in order to subdivide the sheet decorating means 125 into portions having small dimensions, by cutting it along pre-established lines.

[0102] In a still further version, the decorating roller means 126 is provided with impressions so as to subdivide the sheet decorating means 125 in portions having profiled contours capable of being arranged close to each other in order to reproduce a pre-established pattern.

[0103] With reference to Figures 25 to 27, a feeding apparatus 106 is shown similar to that of Figures 22 to 26, wherein a further layer 127 of ceramic powders is arranged on the belt conveyor means 119, said further layer being suitable for being superimposed to the layer of ceramic powders 20 previously introduced into the cavities 22.

[0104] The ceramic powders constituting the further layer 127 are positioned on the belt conveyor means 119 so as to form a pattern, for example a plurality of veins, usually obtained by using powders of different colours, that can be premixed in a hopper, not shown.

[0105] As shown in Figures 26 and 27, the further layer 127 is transferred from the belt conveyor means 119 to the cavities 22 through the ramp conveyor means 123

substantially without displacements of the powders capable of modifying the pattern formed by the powders.

[0106] With reference to Figure 28, the feeding apparatus 106 further comprises sprocket wheel means 128, rotationally coupled to the trolley 24 and arranged above the belt conveyor means 119 in order to interact with the further layer of powders 127 carried by the belt conveyor means 119.

[0107] The sprocket wheel means 128 is provided with protruding means 131 extending from the surface of the sprocket wheel means 128 and is suitable for arranging in a pre-established manner the powders constituting the further layer 127 so as to obtain the decoration of the finished tiles.

[0108] With reference to Figures 29 and 30, instead of the sprocket wheel means 128, the feeding apparatus is provided with spiral means 129 arranged in order to group together the powders of said further layer in order to produce pre-established arrangements 130 constituting the decoration, for example in form of veins, of the finished tiles.

[0109] Obviously, the systems described with reference to the enclosed Figures can be subject of protection also taken alone, or in combination with systems different from those represented.

Claims

1. Method for forming decorated ceramic tiles (1, 1a, 1b, 1d), comprising the following steps:

- distributing ceramic material (20) suitable for forming a base layer of a ceramic support (2);
- decorating said base layer (2) with a decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m);
- pressing together said decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) and said base layer in order to obtain a compact ceramic support;

characterized in that said decorating comprises associating to said base layer only laminar elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) of said decorating material.

2. Method according to claim 1, wherein said distributing comprises filling a cavity (22) of a ceramic mould (12, 14, 18).

3. Method according to any of the preceding claims, wherein, before said associating, there is provided prearranging said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) on conveyor means (32, 32a).

4. Method according to claim 3, when appended to claim 2, wherein said associating comprises moving said conveyor means (32) towards said cavities

(22) until it is positioned thereabove.

5. Method according to claim 4, wherein said associating comprises removing said conveyor means (32) from above said cavity (22) while said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) are introduced into said cavity (22) by said conveyor means (32).

6. Method according to any of claims 3 to 5, wherein said associating comprises transferring said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) from said conveyor means (32a) to said cavity (22) by means of transfer means (36).

7. Method according to claim 6, wherein said transfer means (36) picks said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) up by vacuum and introduce them into said cavity (22).

8. Method according to any of claims 3 to 7, wherein said prearranging further comprises distributing said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) on auxiliary conveyor means (38, 38a, 38b).

9. Method according to any of claims 3 to 7, or 8, wherein said prearranging comprises introducing said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) into container means (46) associated with said conveyor means (32a).

10. Method according to claim 8, or 9, wherein after said prearranging there is provided moving said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m), by means of auxiliary transfer means (44, 44a, 44b), from said auxiliary conveyor means (38, 38a, 38b) to said conveyor means (32, 32a), or to said support means (46), according to the circumstances.

11. Method according to any of claims 3 to 10, wherein said prearranging comprises separating said laminar decorating elements (4, 4h, 4n, 4m) from sheet decorating means (4; 48, 48a, 48b) comprising a continuous lamina of decorating material.

12. Apparatus for forming decorated ceramic tiles (1, 1a, 1b), comprising:

- distributing means arranged for distributing a layer of ceramic material (20) suitable for forming a base body of a ceramic support (2);
- decorating means arranged for decorating said base layer with a decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m);
- pressing means (6) arranged for pressing together said decorating material (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) and said base layer in order to

obtain a compact ceramic support (2);

characterized in that, said decorating means comprises associating means (32, 32a, 36, 113) arranged for associating to said base layer only laminar elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) of said decorating material.

13. Apparatus according to claim 12, wherein said associating means comprises conveyor means (32, 32a) suitable for receiving said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) coming from container means (40, 40a, 40b). 10
14. Apparatus according to claim 13, wherein said conveyor means (32) is coupled to respective operating means capable of allowing movements thereof towards a cavity (22) of ceramic mould (12, 14, 18) until it is positioned above the same, and away from said cavity. 15 20
15. Apparatus according to claim 14, wherein said transfer means (32) comprises belt means.
16. Apparatus according to claim 14, or 15, wherein said transfer means (32) is provided with ramp means (34) arranged for allowing said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) to fall into said cavity (22) without being substantially mixed together. 25 30
17. Apparatus according to claim 13, wherein said associating means comprises transfer means (36) arranged for moving said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) from said conveyor means (32a) to a cavity (22) of ceramic mould (12, 14, 18). 35
18. Apparatus according to claim 17, wherein said transfer means (36) is associated vacuum means (DEP) arranged for picking up by vacuum said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) from said transfer means (36) and for introducing them into said cavity (22). 40 45
19. Apparatus according to any of claims from 12 to 18, and further comprising support means (46) arranged on said conveyor means (32, 32a) for receiving said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m). 50
20. Apparatus according to claim 19, wherein said support means (46) is provided with impressions suitable for receiving said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m). 55
21. Apparatus according to any of claims 12 to 20, and further comprising auxiliary conveyor means (38,

38a, 38b) operatively arranged at a side of said conveyor means (32, 32a).

22. Apparatus according to claim 21, and further comprising auxiliary transfer means (44, 44a, 44b) suitable for transferring said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) from said auxiliary conveyor means (38, 38a, 38b) to said conveyor means (32, 32a) or to said support means (46), according to the circumstances.
23. Apparatus according to any of claims 12 to 22, and further comprising separating means arranged for separating said laminar decorating elements (4h, 4n, 4m) from sheet decorating means (48, 48a, 48b) comprising a continuous lamina.
24. Apparatus according to any of claims 12 to 23, wherein said associating means (113) comprises vibrating means (121) suitable for applying said laminar decorating elements (4) without previously mixing them to further ceramic powders (20).
25. Apparatus according to claim 24, wherein said associating means (113) comprises containment means (115) for said laminar decorating elements (4) operated by said vibrating means (21).
26. Apparatus according to claim 25, wherein said containment means (115) is delimited downwardly by ramp means (116) arranged for discharging said laminar decorating elements (4) through slot means (117).
27. Apparatus according to claim 25, or 26, wherein below said containment means (115) belt conveyor means (119) is provided suitable for receiving said laminar decorating elements (4) arranged such as to form a thin thickness layer.
28. Apparatus according to claim 27, wherein ramp conveyor means (123) is associated to said belt conveyor means (119), operated by said vibrating means (121) and suitable for receiving said laminar decorating elements (4) from said belt conveyor means (119), for directing said laminar decorating elements (4) into said cavities (22).
29. Apparatus according to any of claims 12 to 28, wherein said laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) are obtained from humidified ceramic powders (20), kneaded and laminated until a desired thickness is obtained.
30. Apparatus according to claim 29, wherein said associating means (131) comprises decorating roller means (126) suitable for interacting with said sheet decorating means (125) in order to decorate ceram-

ic tiles to be formed.

31. Apparatus according to claim 30, wherein said decorating roller means (126) comprises crushing means suitable for irregularly crushing said sheet decorating means (125) for obtaining a plurality of tesserae provided with a peripheral indented edge.
32. Apparatus according to claim 30, wherein said decorating roller means (126) is provided with cutting means suitable for cutting said sheet decorating means (125) for subdividing said sheet decorating means (125) into portions having a pre-established geometry.
33. Apparatus according to claim 30, wherein said decorating roller means (126) outwardly comprises die means suitable for subdividing said sheet decorating means (125) into elements which may be placed close to each other according to a pre-established pattern.
34. Ceramic tile, comprising a base body (2) and decorating means (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) associated with said base body (2), characterized in that said decorating means comprises laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) arranged so as to define a pre-established decorating pattern of said tile.
35. Tile according to claim 34, wherein said laminar decorating elements are arranged so as to form a substantially random decorating pattern.
36. Semi-finished product for decorating ceramic tiles (1, 1a, 1b), comprising sheet decorating means (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) having laminar structure and conformed so as to contribute to the definition of a more complex ornamental pattern.
37. Method for manufacturing ceramic tiles, comprising the following steps, sequentially:
 - indexing conveyor belt means (32, 32a) towards a ceramic press (6) through a plurality of stations (38, 44, 38a, 44a, 38b, 44b);
 - arranging a portion of an ornamental pattern formed by laminar decorating elements (4, 4a, 4b, 4f, 4g, 4h, 4n, 4m) on said belt conveyor means (32, 32a) at each station (38, 44, 38a, 44a, 38b, 44b);
 - transferring said ornamental pattern into a cavity (22) of a ceramic mould (12, 14, 18);
 - pressing together ceramic powders (20) and said ornamental pattern in said cavity (22).
38. Ceramic tile comprising ceramic powders (20) suitable for defining a base layer of said tile (1d) and

laminar decorating elements (4) suitable for being associated to said base layer for decorating said tile (1d), characterized in that the visible face of said tile (1d) exhibits a portion covered by said laminar decorating elements (4) greater than 90% of the total surface of said visible face.

39. Tile according to claim 38, wherein said portion has an extension comprised between 90% and 98% of said total surface.
40. Ceramic tile according to claim 38, or 39, wherein said laminar decorating elements (4) exhibit a portion incorporated into said base layer and a portion protruding from said base layer.
41. Ceramic tile, comprising ceramic powders (20) suitable for defining a base layer of said tile (1d) and laminar decorating elements (4) suitable for being associated to said base layer for decorating said tile (1d), characterized in that said laminar decorating elements (4) exhibits a portion incorporated into said base layer and a portion protruding from said base layer.
42. Tile according to claim 41, wherein the visible face of said tile (1d) exhibits a portion covered by said laminar decorating elements (4) greater than 90% of the total surface of said visible face.
43. Tile according to claim 41, or 42, wherein said portion has an extension comprised between 90% and 98% of said total surface.
44. Apparatus for loading a ceramic press (6), comprising trolley means (24) movable between a loading position and an unloading position and suitable for transferring a first layer of ceramic powders (20) into cavities (22) of said press, associating means (113) for positioning on said first layer a further layer of ceramic powders (127) suitable for being pressed together with said first layer, characterized in that said associating means (113) comprises positioning means (128; 129) suitable for interacting with said further layer (127) for introducing in said cavities (22) portions of said further layer (127) arranged according to pre-established pattern.
45. Apparatus according to claim 44, wherein said positioning means comprises sprocket wheel means (128) provided with protruding means (131) extending from the surface of said sprocket wheel means (128) in order to change the disposition of said ceramic powders of said further layer (127).
46. Apparatus according to claim 44, wherein said positioning means comprises spiral means (129) arranged for grouping together said ceramic powders

(20) of said further layer (127) into arrangements (130) of pre-established form and orientation.

47. Apparatus according to any of claims from 44 to 46, wherein said associating means (113) further comprises vibrating means (121) suitable for favouring the transfer of said further layer into said cavities (22).

48. Apparatus according to any of claims from 44 to 47, wherein said associating means (113) further comprises belt conveyor means (119) suitable for receiving said further layer (127) and transferring it towards said cavities (22).

49. Apparatus according to claim 48, when appended to claim 47, wherein ramp conveying means (123) is associated to said belt conveyor means (119) operated by said vibrating means (121) and suitable for receiving said further layer (127) from said belt conveyor means (119) for directing said further layer (127) to said cavities (22).

50. Method for forming a ceramic tile (1d) provided with laminar decorating elements (4) partially extending from the surface of said tile (1d), comprising filling cavities (22) of a mould (12, 14, 18) of a ceramic press (6) with a layer of ceramic powders, arranging said laminar decorating elements (4) on said layer, pressing said laminar decorating elements (4) against said layer, characterized in that said pressing comprises compacting said layer and said laminar decorating means (4) by means of a punch (12) having an active surface (12a) made of soft rubber.

51. Method according to claim 50, wherein said arranging comprises positioning said laminar decorating elements (4) on belt conveyor means (119) for obtaining a thin thickness layer and operating said belt conveyor means (119) for transferring said laminar decorating elements (4) into said cavities (22).

52. Method according to claim 50, or 51, wherein after said pressing there is provided acting on said ceramic tile (1d) for smoothing the portion of said laminar decorating elements (4) extending from the surface of said ceramic tile (1d), without smoothing the body of said tile (1d) obtained by pressing said ceramic powders (20).

53. Method for obtaining a decorated ceramic tile, comprising filling cavities (22) of mould (12, 14, 18) of a ceramic press (6) with a layer of ceramic powders (20), arranging on said layer sheet decorating means (125) comprising humidified ceramic powders (20), kneaded and laminated until a desired thickness is obtained, pressing said sheet decorating means (125) and said layer together, character-

ized in that before said arranging it is provided treating said sheet decorating means (125) for improving the decoration properties thereof.

54. Method according to claim 53, wherein said treating comprises irregularly crushing said sheet decorating means (125) for obtaining a plurality of tesserae provided with a peripheral jagged edge.

55. Method according to claim 53, wherein said treating comprises cutting said sheet decorating means (125) for subdividing said sheet decorating means (125) into portions having pre-established geometry.

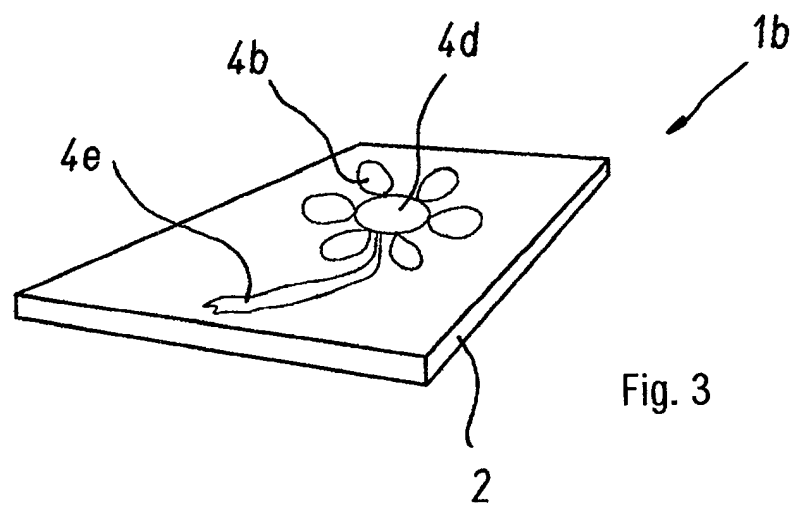
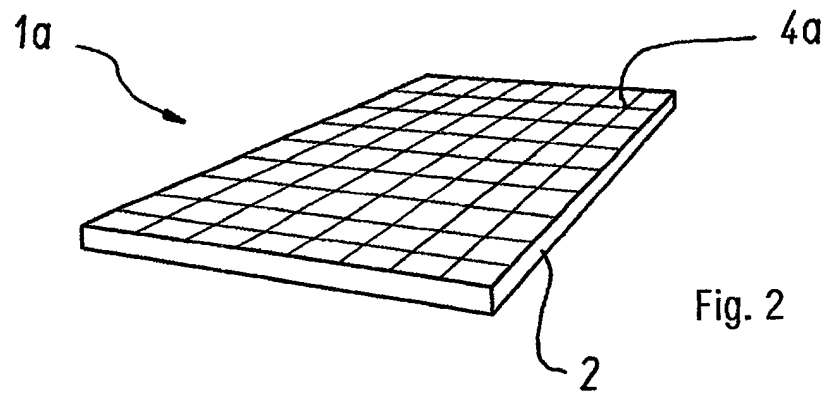
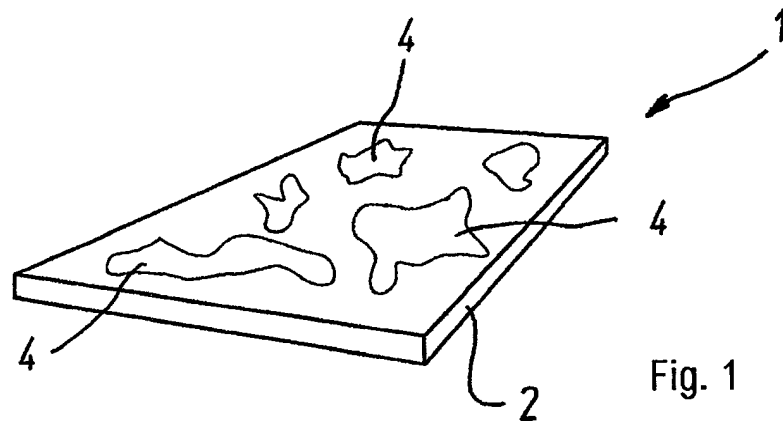
56. Method according to claim 53, wherein said treating comprises subdividing said sheet decorating means (125) into mutually approachable elements according to a pre-established pattern.

57. Method for obtaining a decorated ceramic tile, comprising filling cavities (22) of mould (12, 14, 18) of a ceramic press (6) with a first layer of ceramic powders (20), arranging a further layer (127) of ceramic powders on said layer, pressing said further layer (127) and said first layer together, characterized in that before said arranging it is provided orientating portions of said further layer (127) for introducing them into said cavities according to a pre-established pattern.

58. Method according to claim 57, wherein said orientating comprises handling said further layer by means of sprocket wheel means (128) for changing the disposition of said ceramic powders of said further layer (127).

59. Method according to claim 57, wherein said orientating comprises grouping together said ceramic powders of said further layer (127) into arrangements (130) of pre-established form and orientation.

60. Use of a punch (12) provided with an active surface (12a) made of soft rubber as forming means for pressing ceramic tiles (1d) provided with laminar decorating elements (4) partially protruding from the surface of the visible face of said ceramic tiles (1d).



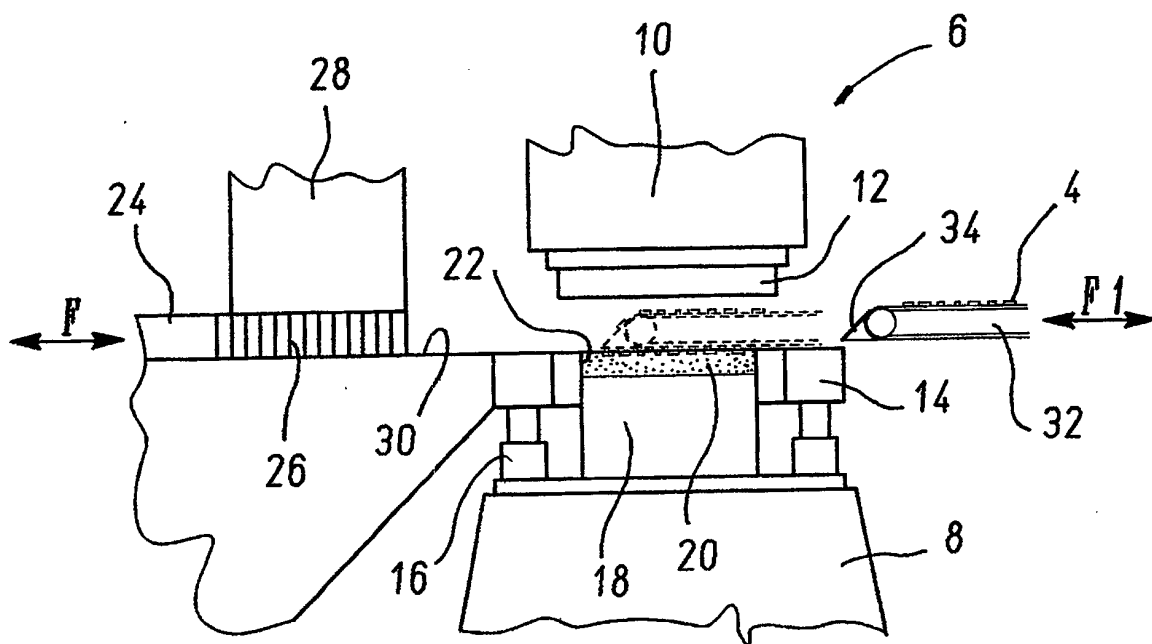


Fig. 4

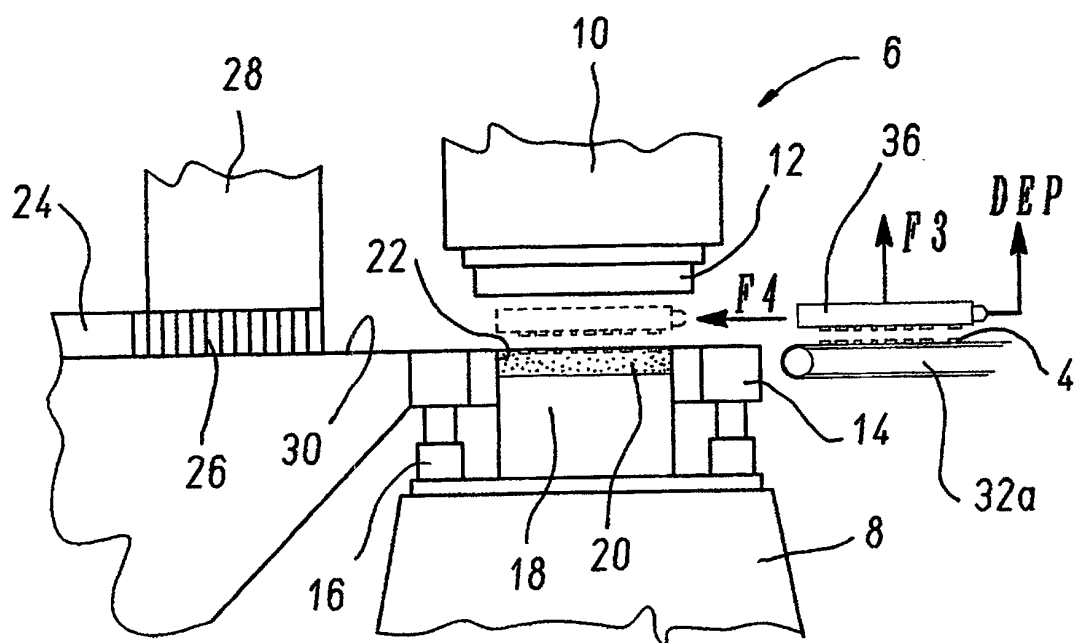


Fig. 5

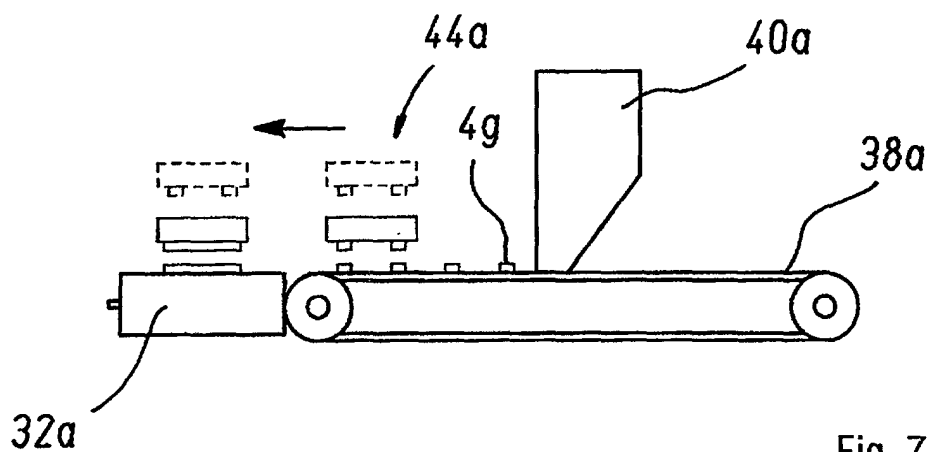


Fig. 7

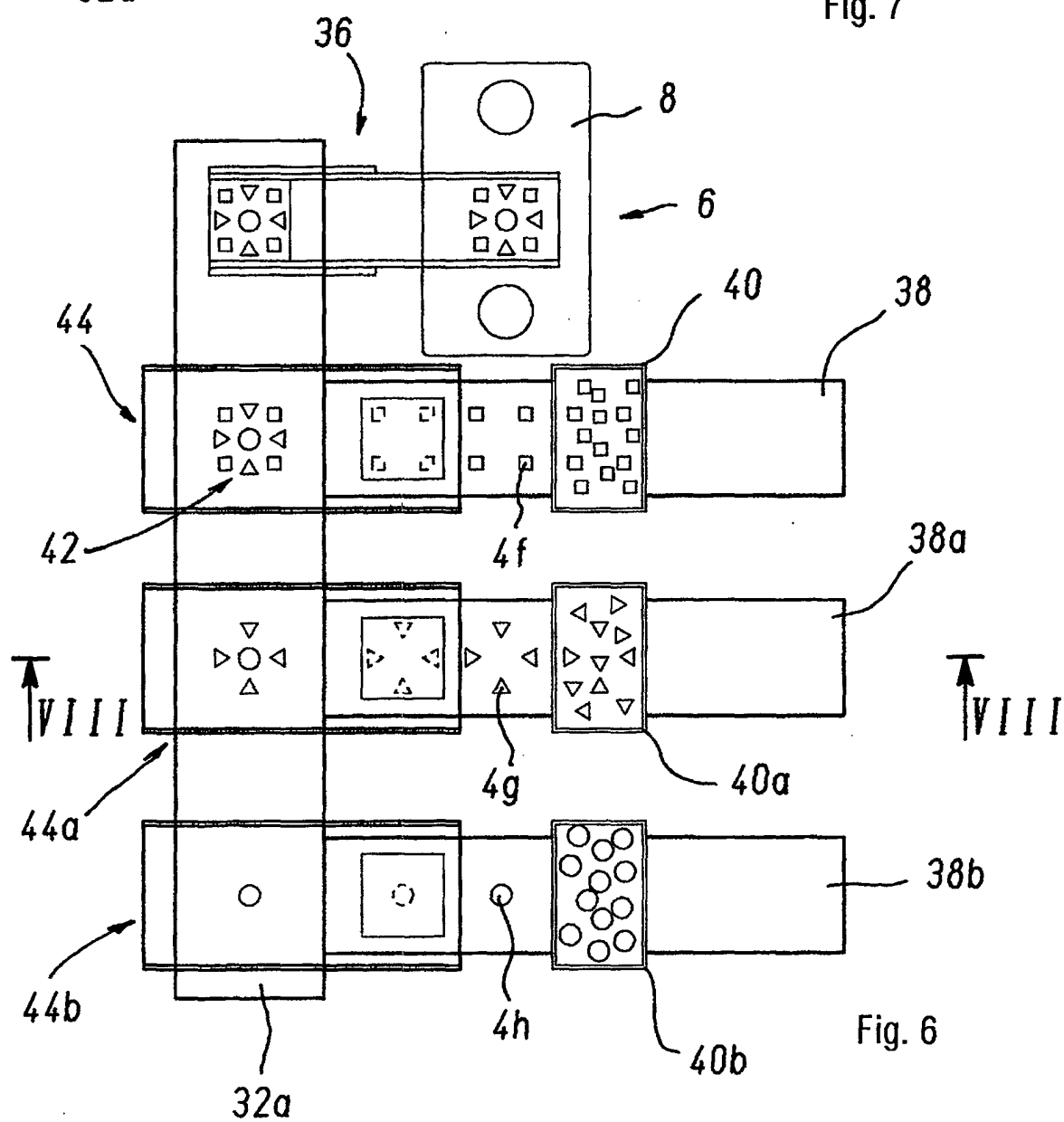
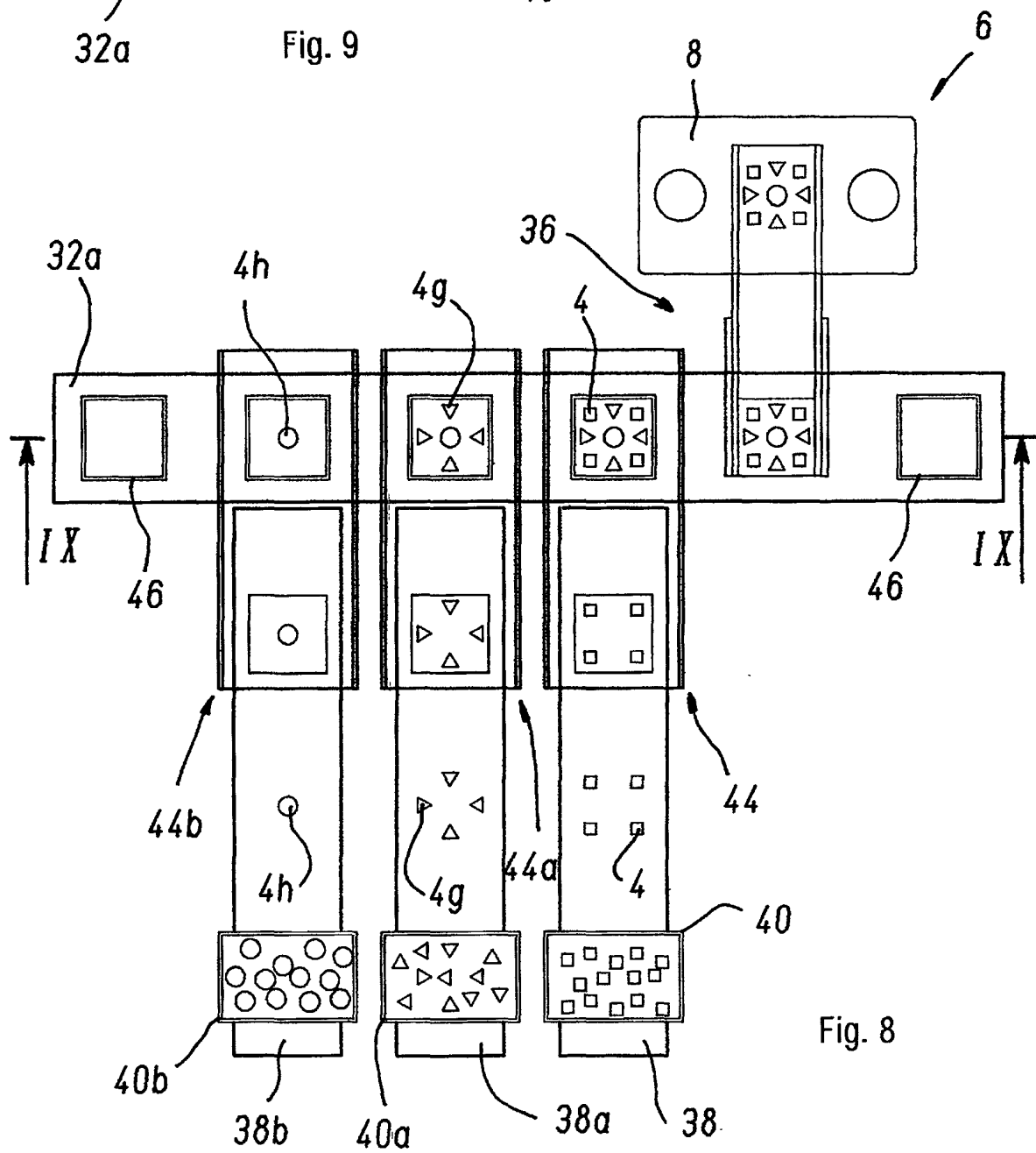
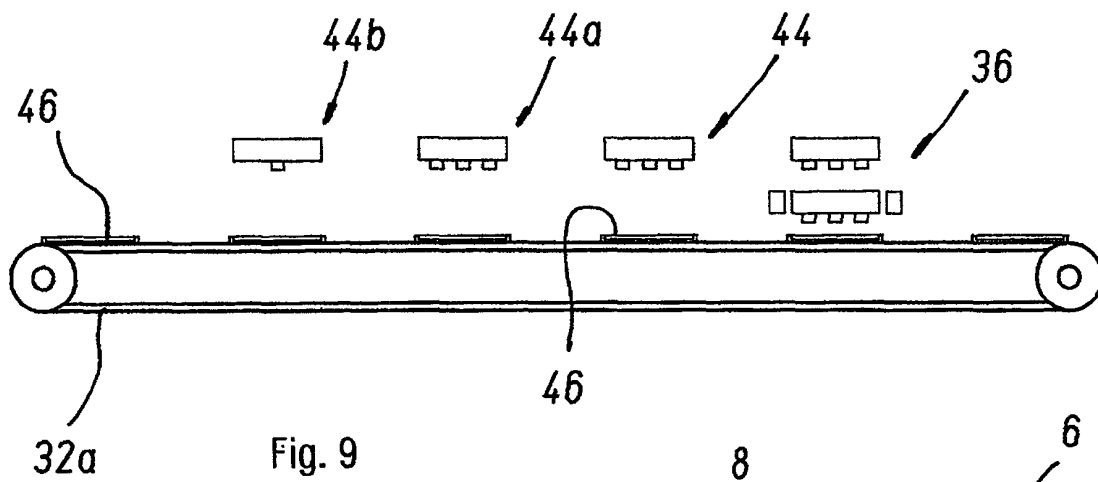
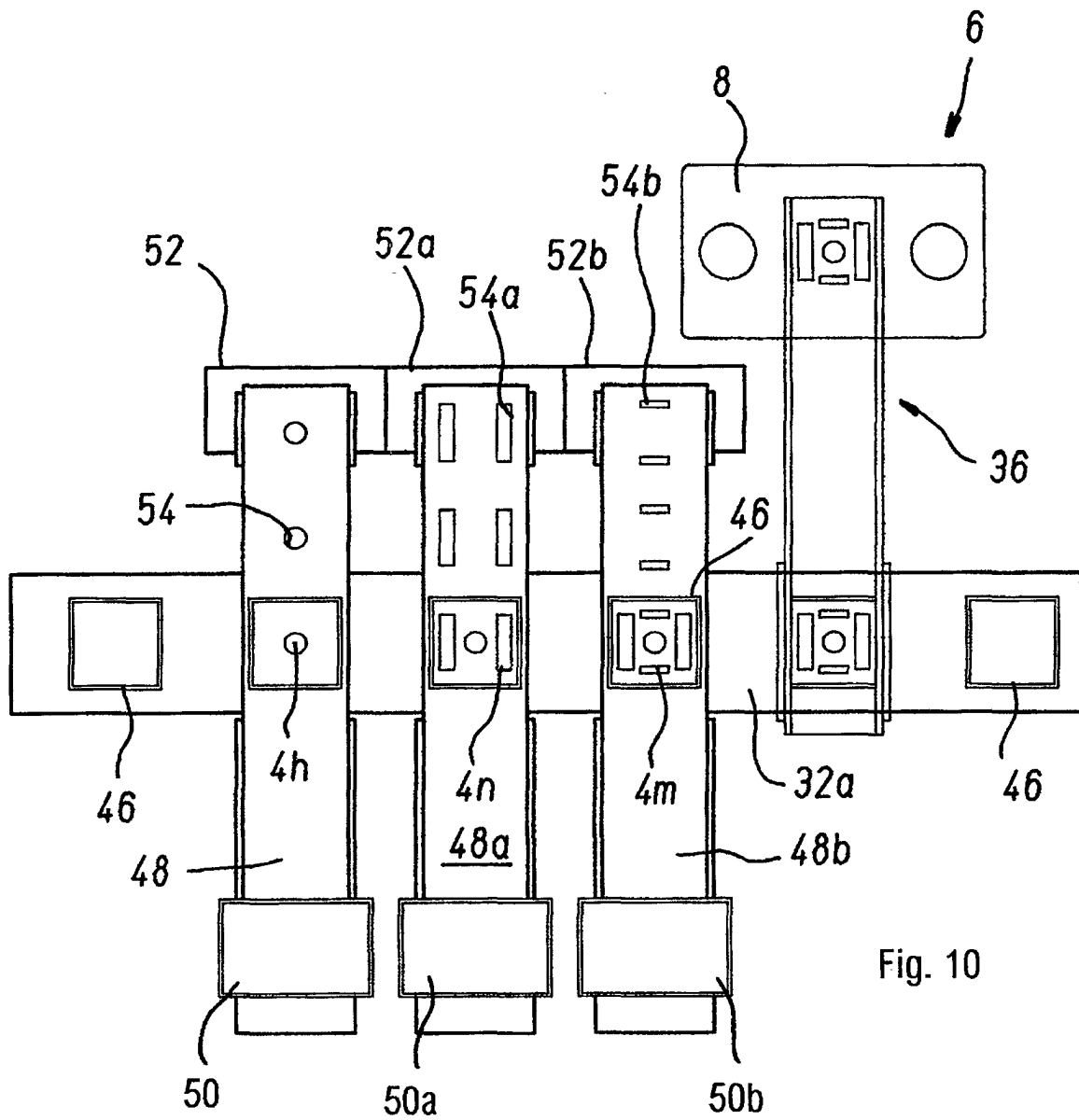


Fig. 6





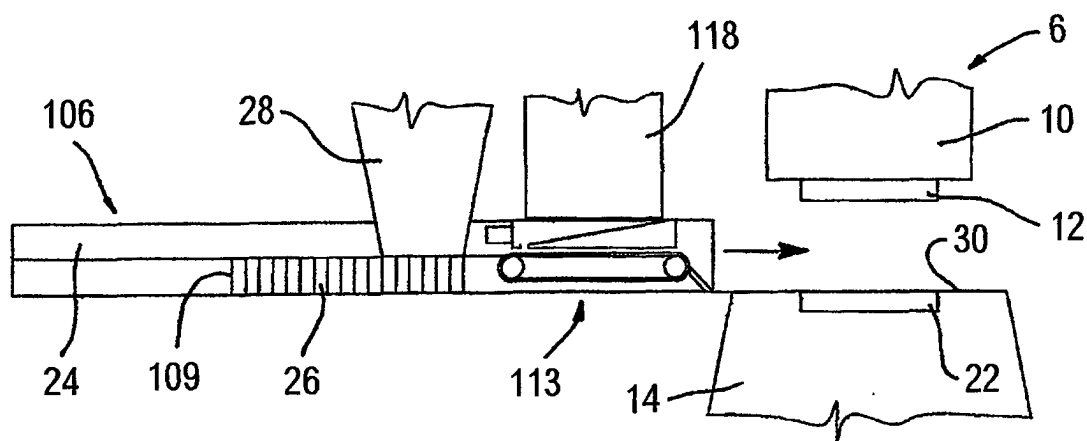


Fig. 11

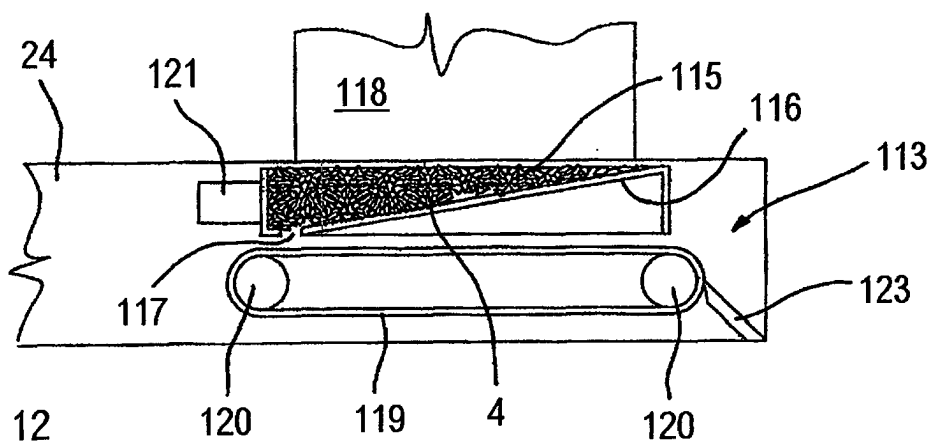


Fig. 12

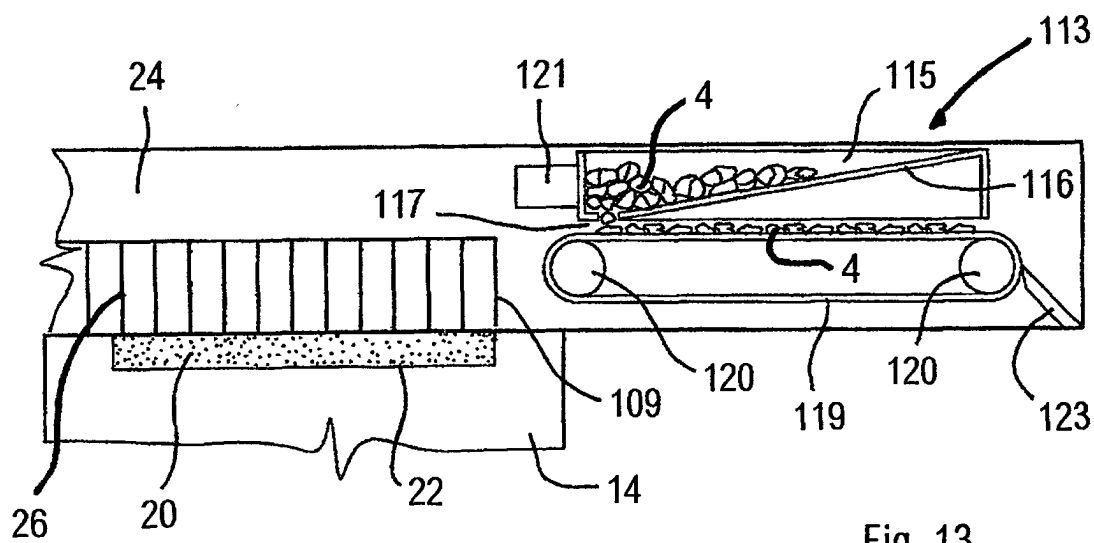


Fig. 13

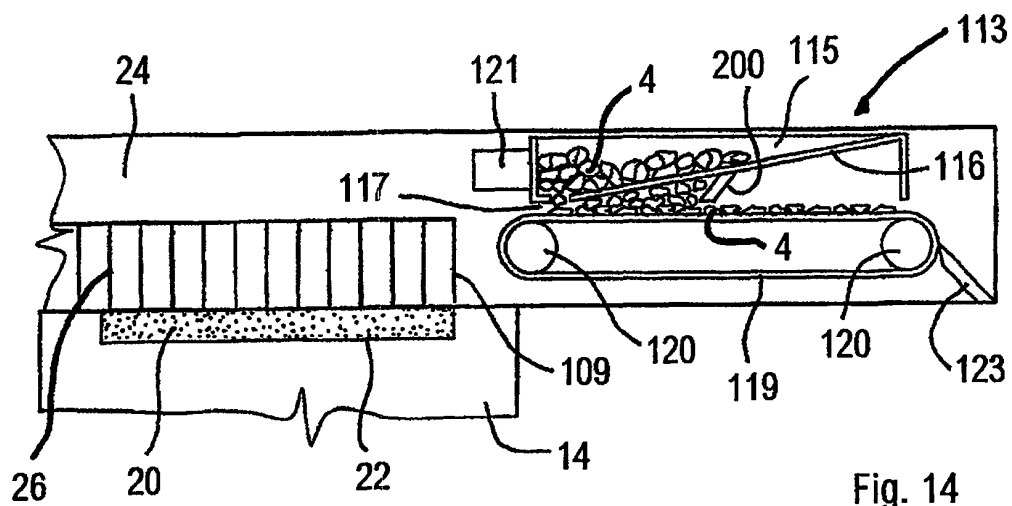


Fig. 14

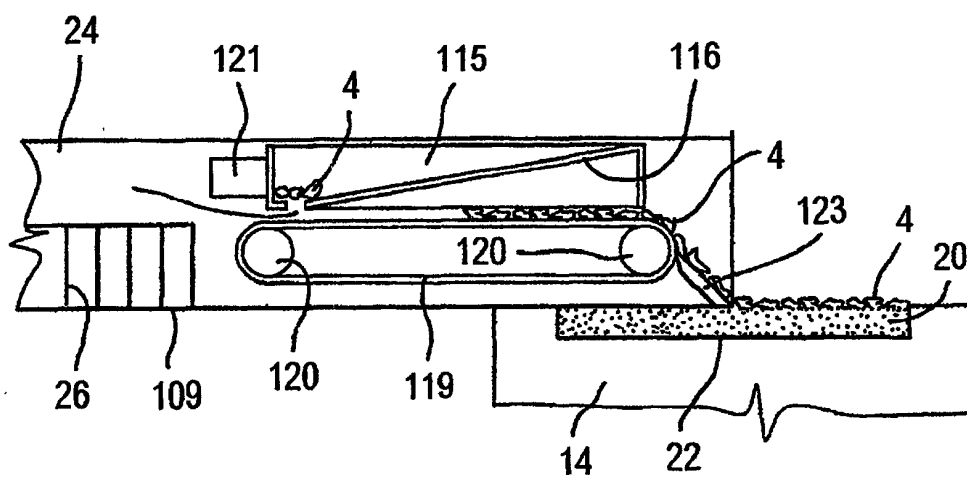


Fig. 15

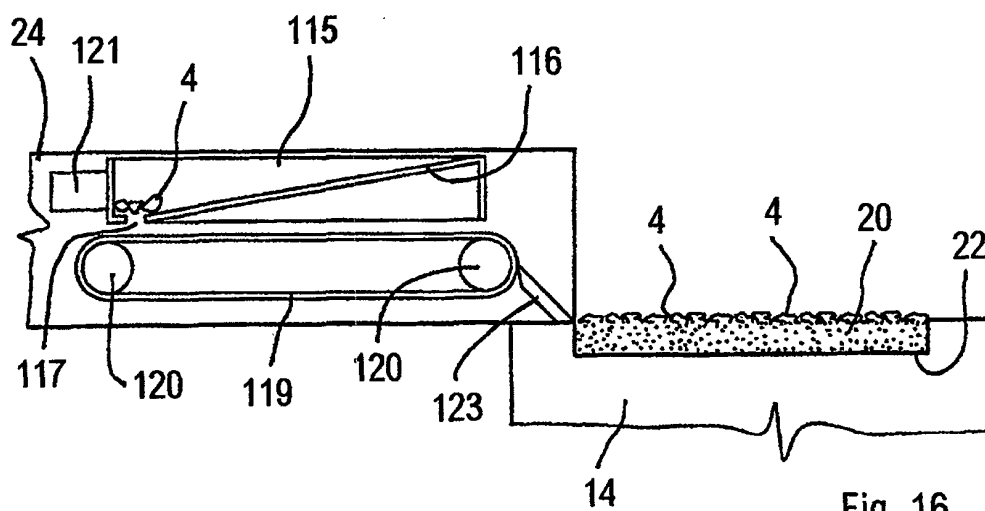


Fig. 16

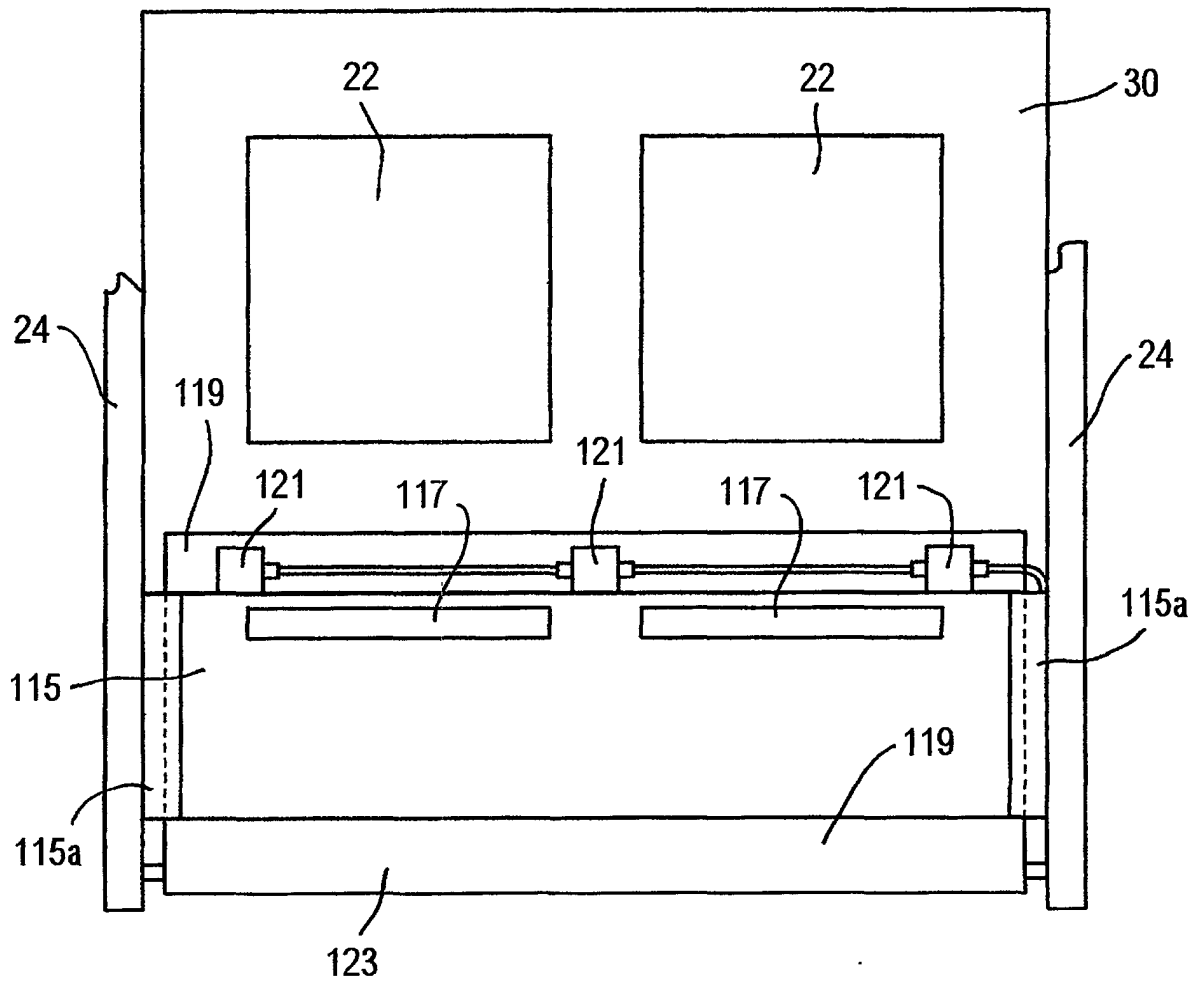


Fig. 17

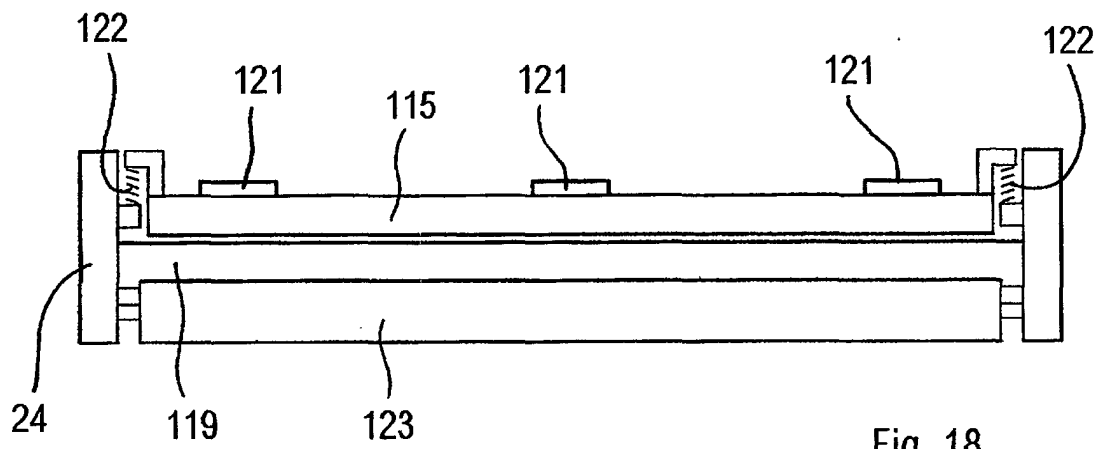
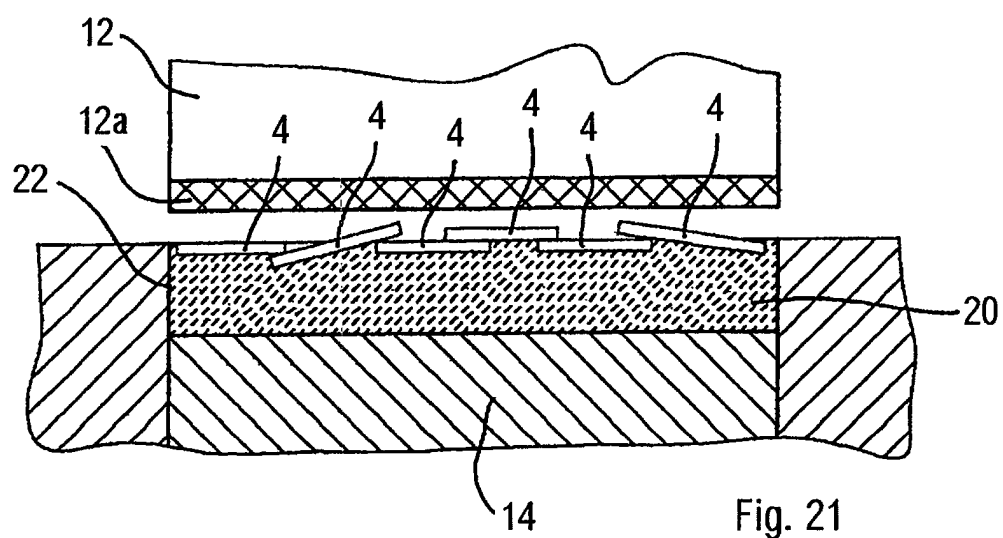
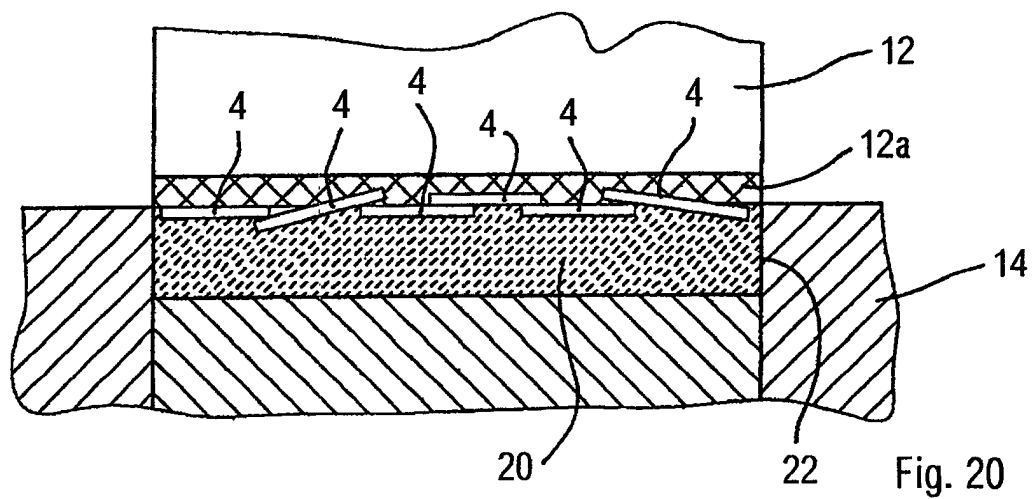
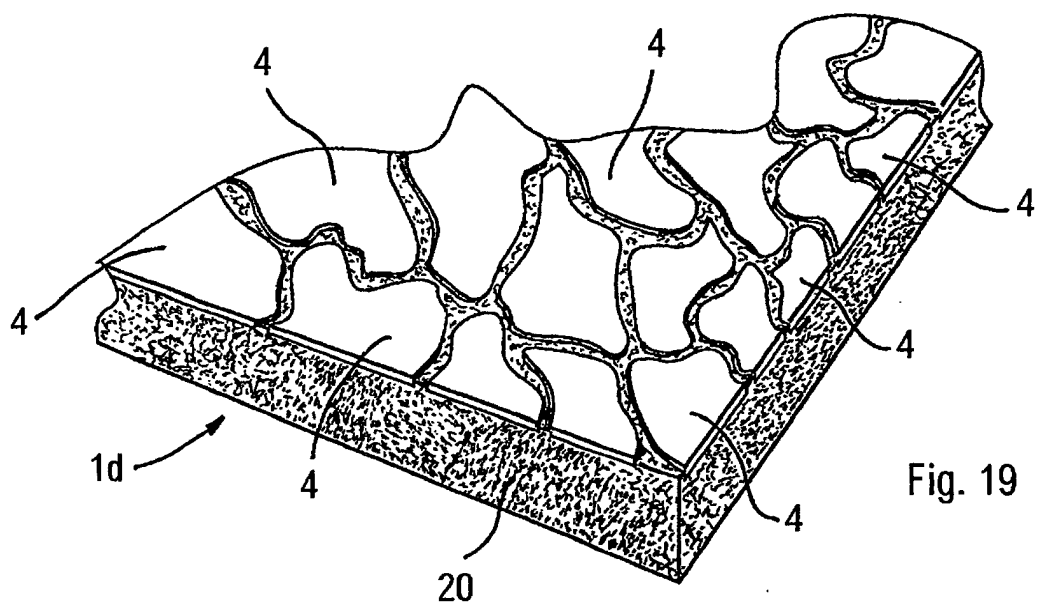


Fig. 18



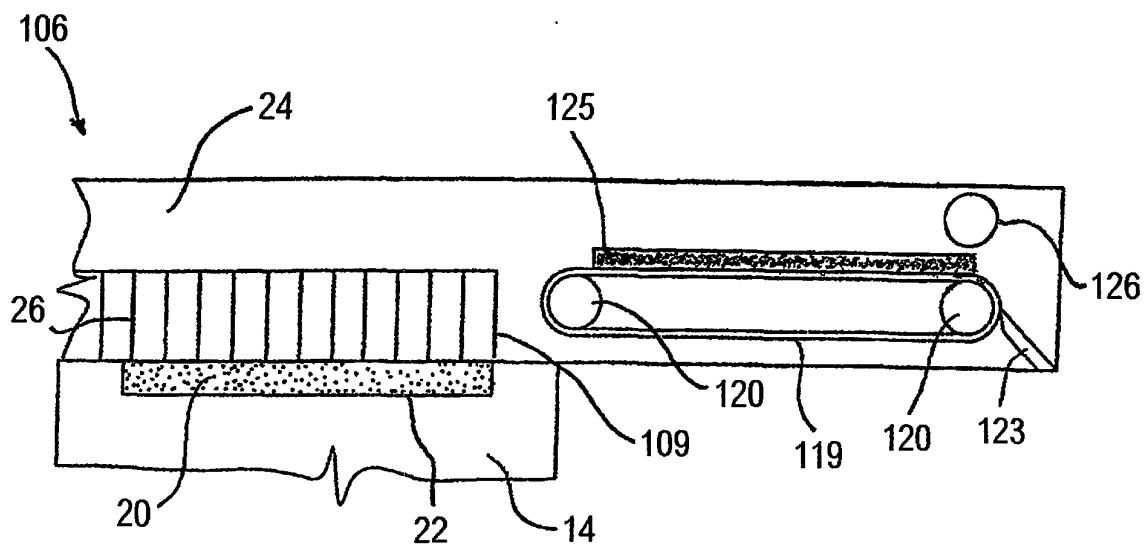


Fig. 22

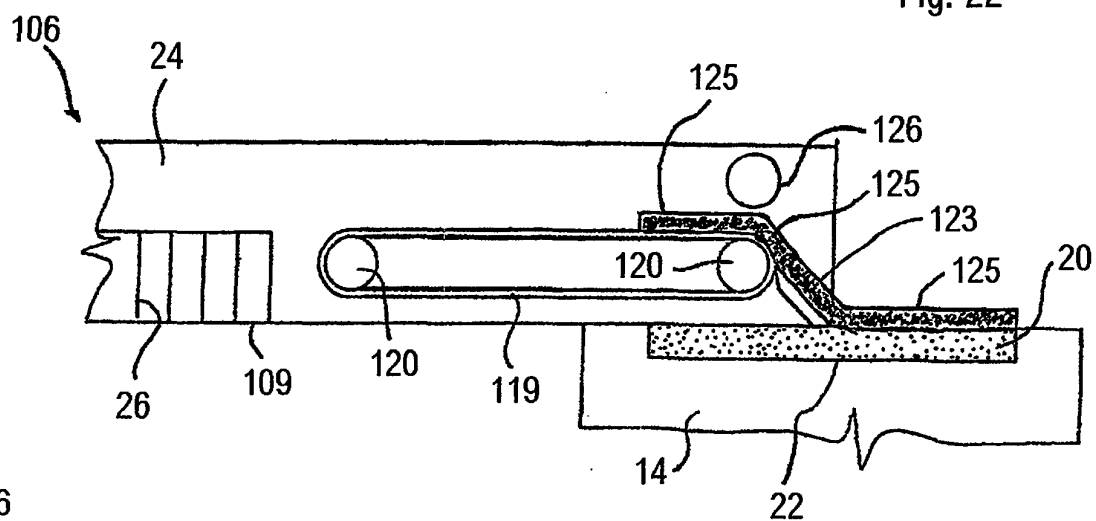


Fig. 23

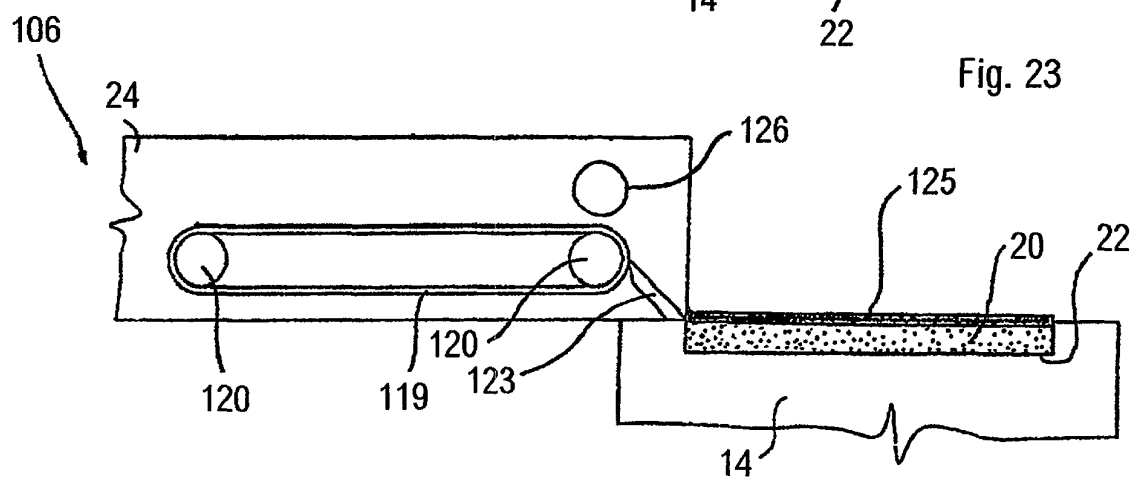


Fig. 24

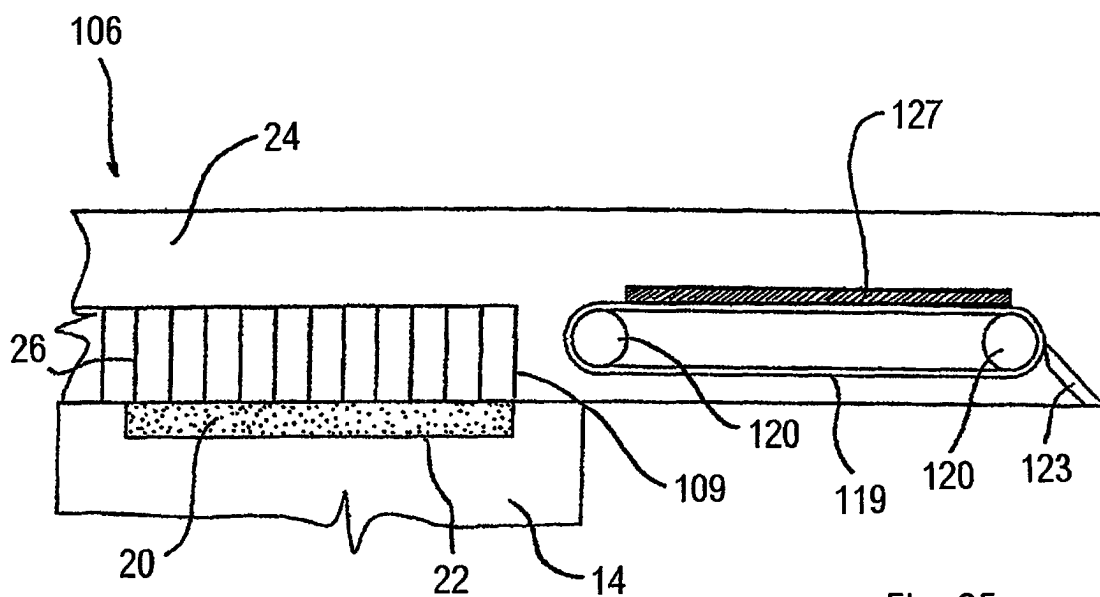


Fig. 25

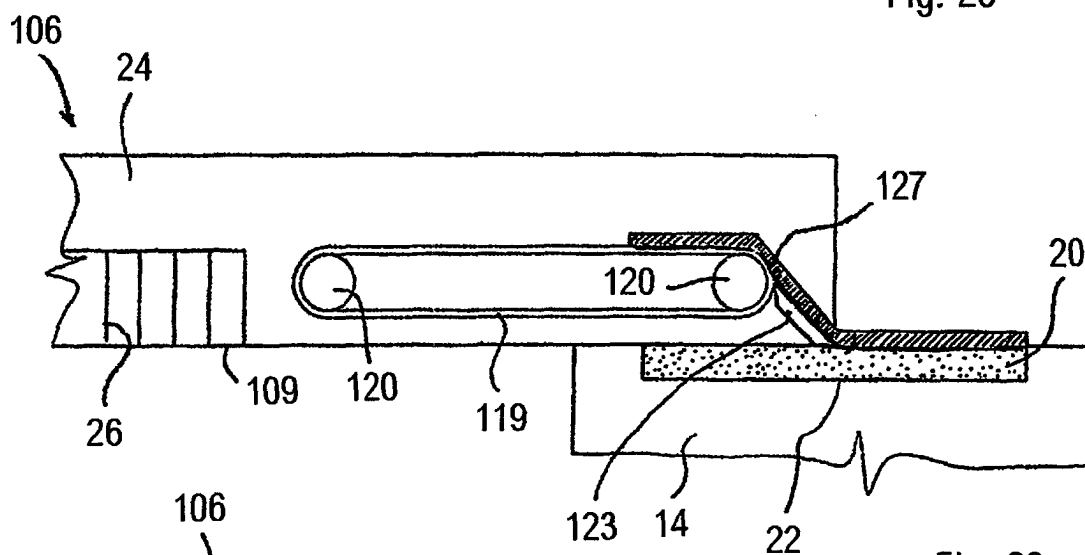


Fig. 26

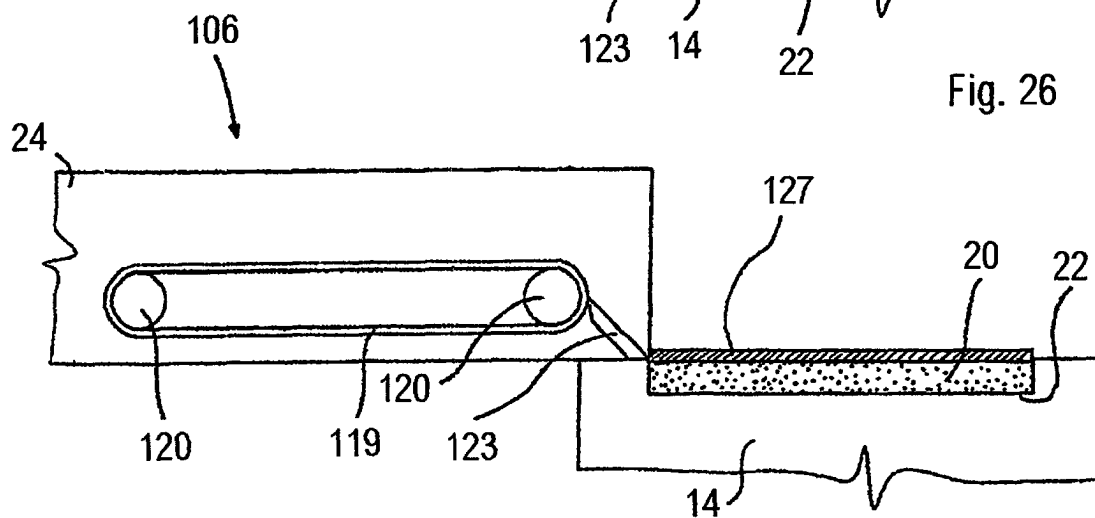


Fig. 27

