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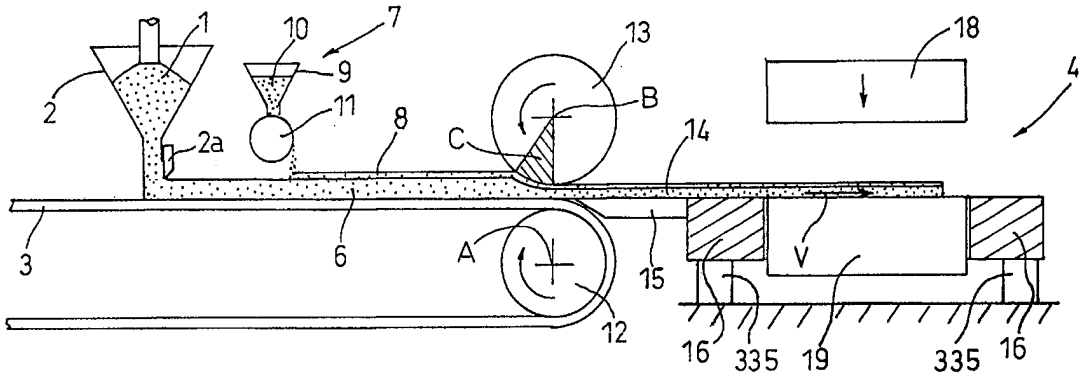
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(54) **Title:** MANUFACTURING OF POWDERED MATERIAL



(57) **Abstract**

A method for pressing powdered material to obtain tiles, comprising distributing powders (1) on flexible conveyor means (3) and advancing said powders along a direction of advance through a pressing station (13), containing said powders on said conveyor means (3) by containing means in said pressing station (13), pressing said powders (1) in said pressing station (13), characterized in that said containing means act on the powders to be pressed during said avancing and those containing means continue to act during said pressing. The compacted layer (14) is transferred towards mould means (4) and a portion (22) of the compacted layer (14) is severed and pressed by descending the punch (18) towards the bottom portion (19) at the mould means (4).

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Manufacturing of powdered material

The present invention concerns a system for manufacturing powder material, in particular for the production of ceramic tiles.

PCT/EP95/04560 describes a system for pressing ceramic tiles, wherein a continuous strip of powders having a predetermined thickness and width is formed, predetermined areas of said strip being compacted to obtain tiles, or pre-compacted semi-manufactured products which are precursors of the tiles to be formed. In the latter case there is provided pressing of semimanufactured products in a die to obtain corresponding tiles ready to be subsequently dried and fired.

US-A-3,540,093 describes an apparatus for manufacturing ceramic tiles, having substantially uniform compactness, homogeneity, density and thickness, wherein from a bottom end of a hopper, in which powders of ceramic material are contained, a vertical strip of compacted powders is formed by action of opposed pressing rolls, from said strip some pre-compacted products being subsequently severed by cutting and distributed on a horizontal conveyor from which the severed products are transferred to a die to obtain tile bodies.

GB-A-880,892 describes an apparatus for forming clay material in which a mass of clay, humidified in such a way as to result at a plastic state, is laminated between a pair of rolls to obtain a layer of plastic material and subsequently the layer is formed by a forming die, without substantial alteration of the volume, in such a way as to obtain a plurality of tiles interconnected by webs which are subsequently cut by rotating disks.

Prior art comprises also some apparatuses for making tiles in which powders are distributed in two superimposed layers during distinct strokes of a distributing trolley or distinct phases of the same stroke of a distributing trolley, the trolley being generally provided with grills and each one leading the powders of a determined layer at the matrix of

the press. An example of such a kind of apparatuses is described in IT-A-1,069,458.

Moreover, in such apparatuses there is a productivity much greater than the productivity obtainable loading in just one layer, since providing distinct strokes for each trolley, or distinct phases of the stroke of loading, is time consuming, since the various layers are loaded into a matrix of a respective die in different steps and in a certain interval of time.

An object of the present invention is to improve the existent apparatuses for working ceramic tiles.

In a first aspect of the present invention, there is provided a method for pressing powder material to obtain tiles, comprising:

- distributing powders on flexible conveyor means and advancing said powders along an advancing direction through a pressing station,
- containing said powders on said conveyor means by containing means in said pressing station,
- pressing said powders in said pressing station, characterized in that said containing means act on the powders to be pressed during said avancing and those containing means continue to act during said pressing.

In a second aspect of the present invention, there is provided apparatus for pressing powdered material to form tiles, comprising flexible conveyor means for receiving powders thereon from distributing means and for advancing said powders along an advancing direction through a pressing station, containing means for containing said powders on said conveyor means, pressing means for pressing said powders in said pressing station, characterized in that said containing means are arranged to act on the powders to be pressed during said advancing and those containing means continue to act during said pressing.

In a third aspect of the present invention, there is provided a method for pressing powdered ceramic material, comprising:

- moving, along an approaching direction, powders to be pressed and pressing means in such a way as to cause interaction between said powders and said pressing means with each other and to reduce significantly in volume of said powders;
- pressing said powders along a pressing direction transversally disposed with respect to said approaching direction;

characterized in that said pressing comprises acting on said powders with a pressing intensity which increases along said approaching direction.

Moving powders to be pressed comprises both moving powders toward pressing means and moving pressing means toward powders. Moving powders toward pressing means is particularly advantageous because allows to remarkably simplify the entire pressing cycle.

In a fourth aspect of the present invention there are provided forming means for forming ceramic material comprising moving means arranged to move, along a reciprocal approaching direction, powders to be pressed and pressing means to decrease significantly the volume of said powders, the pressing means being arranged to press said powders along a pressing direction transversally disposed with respect to said approaching direction, characterized in that said pressing means are suitable to act on said powders with pressing intensity which increases along said approaching direction.

In an advantageous embodiment, said pressing means comprises continuous pressing means, as rotating bodies, arranged to progressively press powders while said material advances.

In a further embodiment, the pressing means comprises swinging pressing means disposed along the approaching direction.

Owing to providing continuous pressing means combined with horizontally-disposed moving means for moving powders, it is possible to obtain an optimal compacting of ceramic material

without alteration of the stratigraphic distribution of the powders and with limited loads.

This allows to make ceramic tiles having valuable aesthetic effects in the surface even when an inexpensive ceramic support is used, bacause the aesthetic effects may occupy a thin surface layer of the ceramic tile.

Moreover, using continuous pressing means acting on a horizontal strip of powders allows to significantly reduce the width of the areas of the strip of powders to be pressed and furthermore to limit scrap material.

The forming of a continuous strip of pressed material renders possible feeding of the mould without using particular conveyor means: in fact the pressed strip may be advanced toward the mould by the action of pressing means acting on the belt conveyor means.

To this end, the continuous pressing means may comprise rolls, belt conveyor means, swinging orbital elements and others.

In a fifth aspect of the invention, there are provided mould means comprising:

- upper frame means provided with cavity arranged to receive powders to be pressed initially lying below them to compact them between a punch body and a bottom body, said upper frame means being coupled with vertical driving means;
- supporting and moving means comprising said bottom body;
- spacing means arranged to keep, between said upper frame means and said supporting and moving means, a distance at least equal to the thickness of said powders.

In particular, there may be provided pressing means with upper frame means and lower frame means which are respectively upper and lower with respect to the powders to be pressed. This allows an omogeneous pressing even in the areas of edge of the tile which has been forming, because the entire filling of the cavity of the mould is ensured, at least when the frame means act on a layer of compacted material having dimensions greater than the ones of the frame

means. Moreover the presence of the upper frame means causes the optimal severance of the areas of compacted layer to be pressed.

In a sixth aspect of the present invention, there is provided apparatus for distributing powders, comprising hopper distributing means to contain various types of powders arranged to form a layer, the hopper distributing means being upwardly provided with inlet means to receive various types of powders and downwardly with outlet means to exit the respective content, characterized in that said hopper distributing means comprise severing means which inhibits the mixing of the various types of powders.

In particular, the hopper distributing means comprises a plurality of hopper bodies between which said severing means is interposed.

In an advantageous embodiment, the outlet means relating to a certain type of powders come before, or after, the outlet means relating to another type of powders.

In a seventh aspect of the present invention, there is provided a method for distributing powders in more than one layer to respective pressing means, comprising exiting the types of powders from respective hopper distributing means and transferring toward a cavity of a matrix of said pressing means in an alternative feeding stroke of said pressing means, characterized in that said exiting takes place in a single and in the same portion of the feeding stroke and in that said types of powders preferably exit almost simultaneously from said hopper distributing means in said portion.

These last apparatus and method may be used in a belt pressing system, or in conventional pressing system.

In this way, it is possible, with conventional pressing means, to form a tile in more than one layer in a single loading stroke, substantially using the same time which is necessary for a loading in a single layer: this is obtained without substantial alteration of the structure of the press

with respect to the conventional systems.

In an advantageous embodiment, the apparatus for distributing powders comprises hopper distributing means composed of, at least, two parts of hopper between which severing means are interposed.

In a further embodiment, the severing means of the hopper distributing means comprises partitions which are independently movable along a direction which is substantially trasversal with respect to said advancing direction.

In a still further embodiment, between the at least two parts of hopper, disturbing means for disturbing the distribution of powders is interposed at a position where said powders are discharged.

Moreover, between said at least two parts of hopper, pressing means for pressing powders may be interposed at a position where said powders are discharged.

The disturbing means may be provided with arms fixed on a rotating shaft.

Moreover, the arms are preferably disposed along a helicoidal line.

In a particularly advantageous embodiment, said pressing means comprises roll-pressing means, possibly provided with superficial irregularities.

The pressing means may be produced in an elastically soft material.

Moreover, the severing means may be formed by a plurality of severing elements driven in a direction orthogonal to the feeding stroke.

As an alternative, said hopper distributing means are stationary and are below couplable with a grill cavity which is known and movable along a direction containing the feeding stroke.

In a further embodiment, near to an outlet section from which powders exit from said hopper distributing means, the hopper distributing means is provided with deflecting means to

provide the powders with a horizontal speed component to substantially reduce the effect of the horizontal speed component induced on the powders during the feeding stroke. Near to an outlet section of powders from said hopper distributing means, the hopper distributing means may also be provided with dosing means arranged to obtain a controlled flow of the powders.

In an eighth aspect of the present invention, there is provided apparatus for distributing powders on supporting means comprising hopper distributing means and conduit means leading near to said supporting means.

In a particular advantageous embodiment, the supporting means comprises conveyor means, in particular flexible conveyor means.

Said conduit means may extend into said hopper means, or outside them.

In a further embodiment, said conduit means extend between said hopper means and said conveyor means.

In a ninth aspect of the present invention, there is provided belt conveyor means arranged to convey powders on an external side thereof, said belt conveyor means being endless conveyor means and being provided, along said external side, with containing means arranged to contain powdered material to be pressed thereon.

In a tenth aspect of the present invention, there are provided distributing means for distributing powdered product to decorate ceramic tiles comprising conveyor means provided with hollow means which are open outwardly to contain parts of said product and closing means for closing said hollow means arranged to prevent said parts exiting from said hollow means along a predetermined portion of said conveyor means. This allows to decorate ceramic tiles by distributing thereon a decorating product which is dropped on the respective front side, or to decorate a layer of non-pressed powders, or to prepare dosed quantities of product to pour on a layer of non-pressed powders.

In a eleventh aspect of the present invention, there is provided a method for pressing powders of ceramic material interposed between upper mould means which are movable above said powders and lower mould means lodged below said powders to support them, the lower mould means defining a pressing area for pressing said powders, comprising the following steps:

- distributing said powders on said lower muold means by means of conveyor means which convey said powders in such a way that said powders extend beyond said pressing area;
- driving at least said upper mould means in such a way as to sever the powders exceeding said pressing area from the powders located inside said pressing area;
- subsequently pressing the powders in said pressing area between said upper mould means and said lower mould means while said conveyor means are located in a position operatively non-interfering with said mould means.

In an advantageous embodiment, the distribution of the powders is carried out by belt distributing means.

Thus, it is possible to carry out homogeneous loading of the powders without the need for modifying the conventional pressing means.

The pressing may be made after vertically moving between lower frame means, encircling lower pressing means of said lower mould means, and the lower pressing means.

The moving may comprise moving downward of said upper frame means.

The moving of the lower frame means and of the upper frame means may be made simultaneously, starting when both of the upper frame means and lower frame means are in contact with the powders to be pressed.

Moreover, the moving of the lower frame means and/or of the upper frame means is such as to sever from the powders a portion corresponding to the pressing area from which a tile is to be obtained.

The distribution of the powders to be pressed is preferably

obtained moving back the most advanced end of said belt conveyor means away from the mould means.

While said most advanced end is moved back, the active upper part of said belt conveyor means is advantageously held fast.

Moreover, between distributing means and the active upper part of said belt conveyor means a substantially constant relative speed is maintained.

In a twelfth aspect of the present invention, there is provided apparatus for forming powders of ceramic material interposed between upper mould means which are movable above said powders and lower mould means lodged below said powders to support them, the lower mould means defining a pressing area for pressing said powders, comprising distributing means arranged to distribute said powders on said lower mould means by conveyor means which convey said powders in such a way that said powders extend beyond said pressing area, the distributing means being arranged to move away from the mould means to allow pressing, driving means arranged to drive at least said upper mould means in such a way as to sever the powders exceeding said pressing area from the powders located inside said pressing area.

At least the various aspects of the present invention as defined above may form subject of independent claims, as well as dependent claims.

The invention will be better understood and carried into effect referring to the attached drawings, wherein:

- Figures 1, 2, 3, 4, are schematic side views, partially sectioned and interrupted, of an apparatus for forming ceramic tiles, respectively showing in sequence the phases of pre-compacting of powdered material and loading of the press, pressing and delivery of the pressed tiles;
- Figures 5, 6, 7, 8 are views corresponding to Figures 1, 2, 3, 4, but in a version of the forming apparatus;
- Figure 9 is a schematic side view, partially sectioned and interrupted, of continuous means for forming powders

comprising a plurality of pairs of rollers opposite to the strip of powders;

- Figure 10 is a top view of Figure 9, showing the obtaining of two parallel strips of compacted powders on the same belt conveyor means;
- Figure 11 is the transversal section XI-XI of Figure 10;
- Figure 12 is a section as in Figure 9, but in which on the rolls which are above the strips of powders, compacting belt means are rolled up;
- Figure 13 is a view as in Figure 7, but in an embodiment wherein the front part of the strip of powders is rotated downwardly;
- Figure 14 is an interrupted, schematic longitudinal section of a version of continuous forming means obtained with pressing elements orbitally movable and co-operating with a longitudinally movable controlling element;
- Figures 15 and 16 are enlarged sections of a detail of pressing mould in the severing area of the compacted material, respectively in the phase of pressing and at the begin of the phase of extracting the pressed tile;
- Figure 17 is a view as in Figure 13, but during the loading phase of the mould;
- Figure 18 is a plan view taken along the plane XVIII-XVIII of Figure 17, wherein the compacted layer has dimension greater than the mould cavities;
- Figure 19 is a schematic side view of a version of forming apparatus showing severing means of the strip of compacted powders;
- Figure 20 is a schematic side view, partially sectioned, of a further embodiment of pressing apparatus for pressing powders on a belt conveyor means, in a phase of pressing;
- Figure 21 is a view as in Figure 20, but in a phase of advancing the powders on the belt conveyor means;
- Figure 22 is the section XXII-XXII of Figure 20;
- Figure 23 is the section XXIII-XXIII of Figure 20;

- Figure 24 is the enlarged and interrupted detail of a portion of belt conveyor means whereon two types of powders are distributed in succession, upon each other;
- Figure 25 is the schematic, top view of a layer of powders distributed on a belt conveyor means and pressed by continuous pressing rolls;
- Figure 26 is the section XXVI-XXVI of Figure 25;
- Figure 27 is a section as in Figure 26, but with continuous pressing means having an endless belt structure;
- Figures 28, 29 are schematic side views as in Figure 27, but in further embodiments;
- Figure 30 is a section as in Figure 14, but in an embodiment with belt conveyor means provided with cavities or hollows arranged to receive powders to be pressed;
- Figure 31 is a schematic, interrupted, vertical section of pressing means for pressing a pre-compacted ceramic product;
- Figure 32 is a section as in Figure 31, but in an intermediate phase of pressing and finishing of the edge of a product during pressing;
- Figure 33 is a section as in Figure 30, but in a final phase of pressing;
- Figure 34 is a section as in Figure 30, but in a phase of extracting the pressed tile;
- Figure 35 is a schematic, interrupted, vertical section of a further embodiment of pressing means for pressing a pre-compacted ceramic product;
- Figure 36 is a section as in Figure 35, but in an intermediate phase of pressing;
- Figure 37 is a front view, partially sectioned, of belt means with powders distributed thereon, roll pressing means and side containing means for lateral containing of said powders;
- Figure 38 is a schematic and interrupted top view of

Figure 37;

- Figure 39 is a top view as in Figure 37, but without pressing means and in an embodiment with lateral containing means formed by swinging rigid side-walls;
- Figure 40 is a view as in Figure 38, but with containing means mainly obtained with exceed of powders;
- Figure 41 is the schematic section XLI-XLI of Figure 40;
- Figure 42 is a schematic view as in Figure 20, but in an embodiment with side containing means for lateral containing of the powders obtained with excess of powders;
- Figure 43 is the top view of Figure 42;
- Figure 44 is a schematic and interrupted vertical section of pressing means for pressing powders on a belt conveyor means, in a phase in which the pressing means are unengaged from the powders;
- Figure 45 is a section as in Figure 44, but during pressing;
- Figure 46 is a detail, enlarged and interrupted, of pressing means for pressing powders on belt conveyor means in a further embodiment;
- Figure 47 is a schematic, interrupted, side section of hopper distributing means arranged to distribute powders on belt conveyor means;
- Figure 48 is a section as in Figure 47, but relating to a version of distributing means comprising conduit means;
- Figure 49 is a section as in Figure 47, but relating to a further version of distributing means;
- Figure 50 is a left-side view of Figure 48;
- Figure 51 is a section as in Figure 47 but relating to another version of distributing means;
- Figure 52 is the section LII-LII of Figure 51;
- Figure 53 is a section as in Figure 51, but relating to a still a further version of distributing means wherein there are shown various conduit means in a position which is longitudinally aligned on the same plane;

- Figure 54 is a top view of Figure 53, with the conduit means shown in a non-longitudinally aligned position;
- Figure 55 is a section as in Figure 53, but relating to a further version;
- Figure 56 is the top view of Figure 55;
- Figure 56A, 56B and 56C are perspective views of embodiments of conduit means insertable into respective hopper distributing means for distributing powders;
- Figure 57 is an interrupted perspective view of hopper distributing means for distributing powders in a mould cavity;
- Figure 58 is a vertical section of hopper distributing means, in a further embodiment;
- Figure 59 is a view as in Figure 57, but in an embodiment of hopper distributing means arranged to distribute powders on belt conveyor means;
- Figure 60 is a section as in Figure 58, but in an embodiment of hopper distributing means arranged to distribute powders on belt conveyor means;
- Figure 61 is a schematic and interrupted section of the bottom portion of the hopper distributing means, but in an embodiment with deflecting means for deflecting powders;
- Figure 62 is a section as in Figure 61, but in an embodiment with pressing means for pressing powders interposed between consecutive outlets of hopper distributing means;
- Figures 63 and 64 correspond respectively to Figures 61, 62 but are referred to embodiments wherein powders are distributed on belt conveyor means;
- Figure 65 is a schematic, partially sectioned, interrupted side view of an apparatus for distributing ceramic powders on belt conveyor means;
- Figure 66 is a schematic, partially sectioned side view of belt means for distributing powders of decorating material for ceramic tiles;

- Figure 67 is a view as in Figure 66, but in a modified embodiment;
- Figure 68 is a schematic, partial and interrupted view of an embodiment of hopper distributing means for distributing powders into cavities of belt conveyor means;
- Figure 69 is a view as in Figure 67, but of in further version;
- Figure 70 is a schematic, partially sectioned view of an embodiment wherein roll means substitute the belt conveyor means;
- Figure 71 is an enlarged and interrupted detail of a portion of end of the belt conveyor means for conveying powders provided with a tension device of the lateral containing means;
- Figure 72 is the section LXXII-LXXII of Figure 71;
- Figure 73 is a longitudinal, schematic section of an embodiment of pressing apparatus with belt conveyor means;
- Figure 74 is a lateral, schematic, partially sectioned view of a further version of an apparatus for pressing tiles during the loading of powders in a pressing mould;
- Figure 75 is a partial section of Figure 74 showing the close mould;
- Figure 76 is a view as in Figure 74, but during pressing;
- Figure 77 is a view as in Figure 1 but during exiting of a formed tile;
- Figure 78 is a partial and interrupted section of a mould in an open-position during loading, in a version with upper frame means tapered downwardly;
- Figure 79 is a section as in Figure 78, but during closing of the mould for pressing;
- Figure 80 is a section as in Figure 78, but during exiting of a formed tile;
- Figure 81 is a view along the direction LXXXI-LXXXI of Figure 80;

- Figures 82, 83 and 84 correspond to Figures 75, 76 and 77 but in a version of mould provided with only lower frame means which are vertically drivable;
- Figure 85 is a section as in Figure 82, but in a version of mould with fixed lower frame means;
- Figure 86 is a section as in Figure 83, but in a mould as in Figure 85;
- Figure 87 is a schematic and interrupted longitudinal section of an apparatus for pressing powders during the phase of loading of the powders by belt means;
- Figure 88 is a section as in Figure 87, but during pressing;
- Figure 89 is a section as in Figure 87, but during delivering of a pressed tile;
- Figure 90 is a section as in Figure 87, but in an embodiment with a decorating layer of the powders facing the bottom of pressing means;
- Figure 91 is a section as in Figure 87, but in an embodiment of the pressing means with the lower frame means with sides tilted outwardly;
- Figures 92 and 93 correspond to Figures 88 and 89, but refer to the embodiment of Figure 91;
- Figures 94 to 96 show a sequence of loading phase, pressing phase and delivery phase in a further embodiment of apparatus for pressing wherein the powders are distributed with belt means co-operating with auxiliary containing belt means;
- Figures 97 and 98 are interrupted sections of severing means for severing a compacted layer of powders.

In the context of the following description, with the reference V is indicated the longitudinal direction of advance of loose or compacted powders on belt conveyor means. With the term "powders", each movable material at the solid state, including granular materials, ceramic glazes and clay compounds is indicated.

As shown in Figures 1 to 4, powders 1 are contained in hopper

distributing means 2 having an outlet section controlled by a dosing squegee 2a, which is adjustable in height and faces with a horizontal upper part of belt conveyor means 3, advancing the powders to be pressed at a press with mould means 4 for ceramic tiles 5 (Figure 4), in such a way as to form a strip 6, or main layer, of powders. Between the hopper 2 and the mould means 4, distributing decorating means 7 may be interposed to pour on the strip 6 a decorating layer 8, the decorating means possibly comprising further hopper means 9 containing a decorating granular material 10, having the outlet section facing the strip 6 and controlled by a rotating dosing roll 11.

The belt conveyor means 3 is partially rolled up on a roll 12 which defines an end of the belt conveyor means near to the mould 4, rotating about a first, substantially horizontal axis A, defining a vertical plane whereon, above the strip 6, a second axis B lies around which a second pressing roll 13 for pressing powders 6, 8 is rotatable. The strip of powders 6, 8 which passes on the belt conveyor means 3 between the rolls 12 and 13 is compacted to a greater or lower extent depending on the distance between the axes A and B, in such a way as to obtain, at the exit of the rolls 12, 13, from powders forming the strip 6, 8, a compacted layer 14, which is coherent, i.e. non-loose, and able to advance along a transferring plane 15 towards the mould means 4 under the action of a force exerted by the rolls 12 and 13. The mould means 4 are provided with lower frame means 16, substantially complanate with the transferring plane 15, and defining a lower cavity 17 (Figure 2) arranged to contain longitudinally consecutive portions of layer 14 of compacted powders and to allow their pressing between a punch 18 and a bottom portion 19 of the mould means 4. Advancing of the compacted layer 14 is controlled by the motion of the rolls 12 and 13: thus, at the end of the pressing cycle, the layer 14 is advanced by the said rolls untill the elimination, from the pressing area, of scrap materials 20 which may be collected by a

crusher 21 and introduced again into the process as powders. The diameter of the rolls 12 and 13 has to be sufficiently large so that the rolls are sufficiently resistent to flexing during pressing and define a pressing sector C having suitable width. As shown in Figure 2, the width of the sector corresponds to the angle C of incidence defined between the tangent to the roll in the contact area at the entry of the powders and a direction parallel to the plane of the strip: to be successful the angle C of incidence should be suitably low.

Referring to Figures 1 to 8, a pressing cycle comprises the following phases:

1) advancing the compacted layer 14 by driving the rolls 12 and 13 up to superimpose it to the lower cavity 17 (Figures 1 and 5);

2) approaching the punch 18 to the portion 22 of the compacted layer 14 which is above the lower cavity 17 and descending the punch 18 and the bottom portion 19, underneath the moving plane 15, defined by lower frame means 16 to sever said portion from the compacted layer 14 and insert it into the lower cavity 17 (Figure 2);

3) pressing of the portion 22 by descending of the punch towards the bottom portion 19 (Figures 3 and 7);

4) lifting the punch 18 and the bottom portion 19 in such a way as to be able to exit the tile 5 by exerting thereon a force by the compacted layer 14 which is arriving.

It is observed that in the embodiments of the Figures 1 to 4 the lower frame means 16 are not vertically movable.

In particular, referring to Figures 5 to 8, wherein the mould means are further provided with upper frame means 23 extending around the punch 18, the pressing cycle comprises the phases 1) and 3) as defined above, and the phases 2a) and 4a) described below:

2a) approaching the punch 18 and the upper frame means 23 to the portion 22 of the compacted layer 14 which is above the lower cavity 17 and descending the upper frame means 23 and

the lower frame means 16 underneath the upper plane of the bottom portion 19 to sever said portion 22 from the compacted layer 14 and insert it into the upper cavity 23a of the upper frame means 23, said upper cavity 23a having the same shape and dimensions as the lower cavity 17 of the lower frame means 16 (Figure 6);

4a) lifting the punch 18, the upper frame means 23 and the lower frame means 16 in such a way as to be able to exit the tile 5 exerting thereon a force by the compacted layer 14 which is arriving, or, as shown in Figure 8, by means of suitable extracting means 24, provided, for example, with suckers 25 and with rotating cleaning brush 26 for the punch 18.

In the phase 2a), the lowering of the lower frame means 16 takes place together with the lowering of the moving plane 15, and, preferably, the belt conveyor means 3 with respective rolls 12 and 13, in the direction shown by the arrow F.

In the phases 2) and 3), as well as in the phases 2a) and 3), the rolls 12 and 13 are still, i.e. they do not rotate about the respective axes A and B.

Figures 15 and 16 show the use of a mould such as that shown in Figures 5 to 8 to obtain a tile 5 having a spacing portion 25 of greater dimension and a front face 26 formed above.

As shown in Figure 15, in the pressing a transversal expansion of the tile 5 takes place to occupy the peripheral game G between the edge of the upper surface of the lower portion 19 of the mould and the internal surface of the cavity 23a. Moreover, during lifting of the frame means 16 and 23 after pressing, shown by the upwardly oriented arrow in Figure 16, an interference occurs between the edge of the pressed tile 5 and the corresponding edge of the compacted layer 14 with removal of powders 27 of the same layer. To prevent the powders 27 from obstructing the movement between the lower frame means 16 and the bottom portion 19, between said means and said bottom portion a hollow annular area 28

is peripherally defined, as shown in Figures 15 and 16.

Figure 9 shows that, in addition to the rolls 12 and 13, there may be provided further upper rolls 29 and lower rolls, parallel to each other and to rolls 12 and 13, the centrelines distance between the further upper rolls 29 and the corresponding further lower rolls 30 being progressively increasing moving away from the rolls 12 and 13 in such a way as to allow a more gradual compacting of the powders 6. In this way, the angle C of incidence is conveniently small for each upper rolls 29, so as to decrease the risk of heterogeneities in compactation which would arise from longitudinal movings of the powders.

Figure 12 shows that on the plurality of upper pressing rolls 13, 29 compacting belt means 31 are peripherally rolled up to render more homogeneous and progressive the compacting of the powders. The compacting belt means 31 allow to define carefully a predetermined value of the angle of incidence C and allow to exert on the powders 6, 8 a particularly gradual action.

Figures 13 and 18 show that the end area of the belt conveyor means 3 and the transferring plane 15 next thereto may be hinged by a transversal axis Z passing through the strip of powders 6, before the area of beginning of compacting, in such a way as to allow the compacted material 14 to follow the lowering and the lifting of the transferring plane 15 and of the lower frame means 16 in the phases of the pressing cycle described referring to Figures 5 to 8. To allow maintenance of the continuity of compacting, also the upper compacting belt means 31 must be free to rotate about the axis Z of a relatively wide angular sector.

Figure 18 shows that the lower frame means 16a may be open towards the moving plane 15, in such a way as to surround the bottom 19 only in three side, so as to limit the discharged material. In fact, in the pressing cycle, the areas of the layer of compacted material 14, which are subjected to the action of the upper frame means 23, cause an interruption of

the continuity of such a layer; when the moving plane 15, rotating about the axis Z, goes down with respect to the bottom 19, its edge nearest to the bottom 19 is no longer complanate thereto and thus only the portion 35 of the layer of compacted material 14, which are not subjected to the action of the frame means 23 and of the punch 18, are severed from the layer 14 along a fracture line Y.

As shown in Figures 10 and 11, the belt conveyor means 3 may be provided with projections acting as longitudinal severing means 36 for severing powders 6, said severing means being received into respective recess means 38 of the pressing rolls 13, 29, and with lateral containing means 37, or side-walls, in such a way as to obtain two parallel layers 14a of compacted material from two respective layers 6a of powdered material.

The recess means 38 may define pressing means 38a arranged to keep pressed, and, as a consequence, larger than their initial dimensions, the longitudinal severing means 36 and the lateral containing means 37 during pressing. This decreases the possibility of undesired moving of the severing means during pressing. Moreover, this supports the delivery of the pressed products 14 because, when the action of the pressing means 38a finishes, the longitudinal severing means 36 and the lateral containing means 37 assume again their initial dimensions, so detaching from the pressed products.

Near to the compacting area, there are provided, acting on the lateral containing means 37, lateral control means 39 limiting the deformations of the lateral containing means 37 during pressing, the lateral control means 39 advantageously comprising some rolls having vertical axes interacting with the lateral containing means 37 to avoid said lateral containing means 37 deforming outwardly during pressing.

Preferably, the lateral containing means 37 define side walls having wide-apart shape toward the outside of the belt conveyor means 3 in such a way as to support the delivering of the layer 14, 14a.

The severing means 36 and the lateral containing means 37 may be made in elastic material in such a way as to be able to lengthen in the rolling on the rolls of the end of the belt conveyor means 3. Preferably the containing means are made in elastomeric material. This further supports the delivering of the compacted material 14 from the side of the mould 4.

If it is necessary to avoid, for further increasing the homogeneity of the pressing and the speed of the forming cycle, the layer of powders 14 remaining still under the action of the pressing rolls 13, 29 in the time the punch 18 needs for forming tiles into the mould 4, the entire group defined by the front end of the belt conveyor means 3 comprising the roll 12 and the pressing rolls 13, 29 may be translated far away from the mould 4 in such a way as to maintain uniform the relative speed of the powders 6 with respect to such rolls. At the end of pressing, said group will be moved again near to the mould 4.

The same could be made with the distributors of decorating substances 7 and with the hopper 2.

Figure 14 shows that, to obtain the compactation of the layer 6, 8, it is possible to use a compacting means 40 provided with orbital motion, or provided with a swinging, or vibrating motion, generally generating a circular action shown by arrows F4 and such as to compress the powders 6 and advance together with them along a portion of route of the belt conveyor means 3. Underneath the belt conveyor means 3 there is a movable controlling block 41, whereon the belt conveyor means 3 rests, the block being free to move along the direction Y1 toward the mould means 4 when the compacting means 40 compresses the powders 6 and to return at the initial position, under the action of a return spring 42, when the compacting means 40 does not compress the powders 6. For this purpose, the movable block 41 is set up on rolls 43 interposed between the block 41 and a base body 44.

The compacting action of the compacting means 40 may also be obtained by a suitable vibrating-generator device: therefore

the action of the compacting means 40 on the powders 6 may take place in a vertical plane orthogonal to the belt conveyor means 3.

In an embodiment not shown, between the rolls 12, 13 and the mould means 4, further decorating means may be inserted to distribute decorating substances on the upper face of the layer 14 of compacted powders.

Moreover, the surface of the roll 13 may be suitably hollow, or in relief, to obtain reliefs or, respectively depressions, in the upper face of the strip 6, 8 in such a way as to be able to produce seats on the strip 14 suitable to receive further decorating substances.

Using of mould means 4 may take place without using of continuous pressing means 12, 13. Therefore the mould means 4 may be fed by powdered material.

In the embodiment with mould means 4 shown so far, the contact between the upper frame means 23 and the lower frame means 16 in the respective stroke downward to isolate the areas 22 is to be prevented in such a way as to maintain the layer 4 integral: for the purpose, as shown in Figure 17, between said upper and lower frame means there are advantageously spacing means 45, comprising for example mechanical controlling means, or electronic control means, such as to maintain a predetermined distance between the upper and lower frame means: in this way the action of first vertical driving means 46 for driving the upper frame means 23 and of second vertical driving means 47 for driving the lower frame means 16 is controlled. The first vertical driving means 46 are connected with a crossbar 48 of the press, while the second vertical driving means 47 are connected with the base 49.

Referring to Figure 19, between the continuous pressing means 12, 13 and the mould means 4, severing means 50 may be inserted to sever, from the layer 14, pre-formed elements to insert into the mould 4 by suitable forcing means, eventually incorporated into the severing means, which may be provided,

in addition to a motion in the plane which is transverse with respect to the layer 14, as shown by the arrow F2, also with a motion in a longitudinal direction shown by the arrow F3 and parallel to the direction V of advancing of the powders 6, 8. This allows not to interrupt the action of the pressing rolls 12, 13 when the mould means 4 are driven.

Advantageously, the severing means 50 may be constituted by rotating disks or by a pair of cutters lying in opposite side with respect to the compacted layer 14 to cause its cut or fracture along a predetermined fracture line.

As shown in Figures 20, 21 and 22 the belt conveyor means 3, in addition to being provided with lateral containing means 36, 37 for containing powders 6, 8 extending in a longitudinal direction, is also provided with transversal containing means 52 extending transversally between lateral containing means 37 of opposite sides of the belt conveyor means 3, or between the lateral containing means 37 of a side and longitudinal central severing means 36.

Thus the containing means 36, 37, 52 for containing powders on the belt conveyor means 3 define some cavities 53 arranged to receive dosed quantities 54 of powders from a hopper distributor 2. The powders 54 contained into the cavities 53 are pressed while they are on the belt conveyor means 3 by punch means 55 which penetrate into the cavities 53, so reducing the volume of the powders 54. Therefore, the belt conveyor means 3 moves, at least at the pressing station where there are the punch means 55, on longitudinal controlling and moving means 56 able to give a suitable resistence on the action of the punch means 55. The punch means 55 may be inserted internally into frame means 57 which press the containing means 36, 37, 52 preventing the exiting of powders therefrom during pressing.

The frame means 57 act in an analogous way as the press means 38a and allow to obtain the same advantages. The frame means 57 may be provided with seats 57a arranged to receive at least the transversal containing means 52 to prevent the

exiting of the powders therefrom. The containing means 52 may be made with the same material as the belt conveyor means 3, i.e. flexible, for example in elastomeric material, or may be made in rigid material, for example steel.

Preferably, when the punch 55 acts on the powders 54 to press them in the pressing station, the belt conveyor means 3 is still.

As shown in Figure 23, in the pressing station there may be provided lateral controlling means 58, such as the described rolls 39, and possibly incorporating the frame means 57.

As shown in Figure 24, there may be provided a plurality of hopper distributing means 2, 2a to pour different types of powders 1, 1a into the cavities 53 of the belt conveyor means 3. In this case, between a distributor 2 and the subsequent distributor 2a there are interposed roll pressing means 59 whereby the thickness of the type of powders, already poured into a cavity 53 by a distributor 2 upstream, is decreased to create space for the powders to be poured in the same cavity by a distributor 2a downstream.

The profile of the pressing means 59 may be corrugated to produce imprints of various depth in the powders.

Figure 25 and 26 show an embodiment of apparatus for pressing powders on belt conveyor means 3 wherein the powders 54 are pressed by a pair of rolls 12, 13 eventually co-operating with one or more further pair of rolls formed by an upper roll 29 and by a lower roll 30.

As shown, in particular, in Figure 26, the transversal containing means may be formed by transversal lips 52a projecting from the belt conveyor means 3 and having narrowing section going far from the belt conveyor means. In particular, the powders 54 may be distributed in a layer having initial thickness greater than the height of the lips 52a and the height of the lips 52a may such that, after pressing, the powders of a cavity 53 may result severed from the powders of the next cavities 53 by means of the lips 52a.

Figure 27 shows a further embodiment of the apparatus for

pressing powders wherein a non-pressed layer 6 distributed on belt conveyor means 3 is pressed by belt pressing means 58 comprising upper belt means 59 ring-rolled up on the roll 13 and on an auxiliary roll 60: between the rolls 13 and 60 there is lodged in an adjustable way a controlling block 61, whereon some rolls 62 are rolling-coupled, said rolls 62 being operatively interposed between an active part of the belt means 59 facing the powders, which have being pressed, and the controlling block 61. Below the belt conveyor means 3 for supporting the powders 6 there is advantageously provided an analogous controlling block 61a with respective rolling rolls 62a which are operatively interposed between the block 61a and the belt conveyor means 3.

The arrangement is such that the belt means 59 is tilted in the direction of advancing of the powders in such a way that between the belt conveyor means 3 and the upper belt means 59 a thickness of powders, which progressively decreases in the V-direction of advancing of the powders, is defined.

Figure 28 shows that, to feed a press 4 with pre-compacted elements 14, a roll means 15a may be used and that the powders 6, 8 may be pressed on the belt conveyor means 3 by belt pressing means 58a comprising the belt means 59 rolled up on the rolls 13, 60, without the adjustable block 61 and the respective rolling rolls 62. It is also shown that the tile obtainable from pressed powders 14 may be formed with the decorated face facing downwards, if the decorating substances 8 are distributed on the belt conveyor means 3 before the thicker portion of powders 6 forming the support is distributed thereon.

As shown in Figure 29, there may be provided hopper distributing means 2b severed in two parts by a partition 2c to pour decorating substances 10, 10a on the strip 3, or on a base layer 6 to correspondingly form decorating layers 8, 8a. Moreover, a portion of the upper part of the belt conveyor means 3 may be involved by the action of the pressing rolls 12a, 13a which compact the powders 6, 8, 8a, disposed

thereon. Preferably, the rolls 13a and 12a have large diametre to prevent the powders being pushed back on the belt conveyor means instead of being received between the rolls, pressed and advanced along the direction V.

Figures 25 to 29 show versions wherein powders to be pressed interact with pressing means on belt conveyor means in a particularly gradual way and therefore the risk of therir being pushed back on the belt conveyor means 3 thereby is greatly reduced.

Figure 30 shows that the space defined between the compacting layer 40 and the belt conveyor means 3 has a first portion R with decreasing height to decrease the thickness of the powders 6, 8 in the pressing and a second portion R1 having constant height to stabilize the pressed powders and prevent uncontrolled movings of the powders in the pressing.

The use of the portions R, R1 in sequence, having respectively decreasing and constant height in the direction shown by arrow V, is obtainable in the embodiments of Figures 9, 10, 11, 12, 13, 14, 17, 25, 26, 27, 28 with a suitable arrangement of the pressing means.

Moreover, there is provided a compacting belt 59a interposed between the powders 6 to be pressed and the compacting means 40, advantageously provided with transversal severing means 52b extending toward the belt conveyor means 3 to sever, from the top, the layer of powders 6 during pressing.

The compacting means 40 may be elastically coupled with supporting means through elastic harmonizing means 40a and may be also coupled with vibration generating means 40b.

With reference to Figures 14 and 30, it is observed that the compacting means 40 may also be provided only with a reciprocating motion in a direction orthogonal to the belt conveyor means 3 and, in this case, the belt conveyor means 3 has to be driven with intermittent motion, i.e. step by step.

Figures 31 to 34 show that the press 4 may have, close to the internal edge of the upper frame means 23, an annular edge-zone 23b being part of the cavity 23a and made in such a way

as to correspondly form an external edge of the tile 5; advantageously, the annular edge-zone 23b is provided with a cutting corner 23c to remove an exceeding portion of the pre-compacted product 14 when the upper frame means 23 descend toward the product 14 to be pressed.

Positioning means 63 bring the product 14 under the punch 18 in a central position with respect to the hollow defined by upper frame means 23 and extracting means 64 extract the formed tile 5 from the pressing area.

The extracting means 64 may be provided with a depressurizing element 65 extending along an edge of the tile 5 and provided with an opening 66 through which, for difference in pressure, the correspoding edge of the tile is caught with a force sufficient to keep caught the tile while it is moved.

As shown in Figures 35 and 36, the upper frame means 23 may be provided with a diverging area 23d which spreads toward the product 14 to be pressed in such a way as to fix it in the centre thereof when the frame means 23 are descended for the pressure.

In this embodiment it is not necessary to position the products 5 accurately under the punch 18.

In the embodiments shown in Figures 37 to 40, the lateral containing means for containing powders are boundless to the belt conveyor means 3 and act directly on the powders 6, 8, or 54; therefore the belt conveyor means 3 has not side walls or longitudinal severing partitions 36. The lateral containing means may comprise belt conveyor means 67 formed by a pair of belt means 68 rolled up on respective pulleys 69 supported to rotation about axes substantially orthogonal to the belt conveyor means 3 near to the pressing rolls 12, 13. Figure 37 and 38 show embodiments wherein the belt conveyor means 3 has not transversal severing means and, thus, from the powders 6, 8 a continuous pressed product 14 is obtained.

In the embodiment of Figure 39, the belt conveyor means 3 is provided with transversal severing means 52 and the lateral containing means for containing powders 54 are formed by

rigid side walls 70 which extend laterally to the cavity in which the said powders are contained and may swing between the position indicated with continuous line and the position with dashed line to unengaged from the powders 54 after pressing has taken place with one of the systems described so far.

In Figures 40, 41 the lateral containing means are formed by exceeding portions 71 of powders 6, 8 which contain the same powders up to the pressing area where the lateral roll containing means 39 laterally compact them during the action of compressing carried out by the rolls 12 and 13.

Figures 42 and 43 show that the lateral rolls 39 are not essential and may be eliminated: the powders 6, 8 are pressed with the punch 55 while they are contained by the exceed of the powders 71. Thus, only a central portion of the powders results pressed in a homogeneous manner to obtain the product 14, while the non-pressed powders 72 are circulated again. Each product 14 is subsequently transferred at a conveyor line 73 whereon a frame punch 74 is descended, said frame punch 74 cutting, from the product, the external portion of rejection 72a, so obtaining pressed and homogeneous products 14a.

Instead of the frame punch 74, mould means 4 already described in Figures 1 to 8 may be used.

Figures 44 and 45 show that the punch 55 may be provided with a cavity 75 to form the pressed products 14 preventing lateral leakages of powders during pressing.

Figure 46 shows an embodiment of pressing means for pressing powders wherein the powders 6, 8 are compacted between the belt conveyor means 3 and the upper belt means 59a between which a thickness of powders is defined, said thickness being progressively decreasing toward the V-direction of advancing of the powders. A plurality of plates 76, severed in two groups of plates hinged to form rings, acts on the belt means 3, 59a from the side opposite to the one in contact with the powders, said rings being an upper ring 77 of plates acting

on the upper belt means 59a and a lower ring 78 of plates acting on the lower belt conveyor means 3. Upper rolls 79 and lower rolls 80, defining planes of advancing of the plates 76, act on the rings of plates 77 and 78, from the side opposite to the one facing the belt means 59a and respectively 3.

It is observed that the belt means 3, 59a may be omitted and, in this case, the powders 6, 8 result in direct contact with the plates 76: the plates 76 disposed below the powders 6, 8 acting as conveyor means for the same powders.

The rolls 79, 80 may have axes in fixed position, i.e. they may be rotatably supported by side walls, not shown, or they may be rollingly coupled with controlling blocks like the blocks 61, 61a already described, in the latter case the respective axes being movable along the peripheral portion of the respective controlling blocks.

It is observed that the belt conveyor means 3 is provided with transverse lips 52b extending, inside the powders 6, 8 to be pressed, for a relatively small portion, i.e. such that the lips 52b remain inserted inside the thickness of the powders 6, 8 also at the end of the pressing. In such a case, the lips 52b define some predetermined fracture planes Z for the pressed powders.

Various manners in which powders may be distributed both on belt conveyor means 3 to convey powders and into mould cavities in a press for generally ceramic material are now described.

Figure 47 shows that in an apparatus for pressing ceramic tiles there are provided hopper distributing means 81 which pour various types of powders 6, 8, 82 contained thereinto, on the belt conveyor means 3 through a single outlet 81a, in such a way as to form on said belt conveyor means a formation of powders defining grains simulating the effect of natural stones.

To obtain the greatest variety of decorating effects, the types of powders 6, 8, 82 are introduced into the hopper 81

by respective conduit means 83, 84, 85 which are coupled with respective driving means inside the hopper distributing means 81, in such a way as to allow to vary the allocation of the powders inside the hopper distributing means and consequently vary the structure of the layer of powders 6, 8, 82 to compact.

Figures 48 to 50 show that the various types of powders, for example 6 and 8 in Figure, may be poured directly on the belt conveyor means 3, or near thereto, by respective conduit means 83, 84 and 85, while, from the outlet 81a of the hopper distributing means 81, the powders 8 exit.

Preferably, the conduit means 83 and 84 pour the powders 6 and 82 on the belt conveyor means 3 before the hopper distributing means 81. Moreover, as shown in Figure 50, the conduit means 83 and 84 are movable both vertically with respect to the belt conveyor means 3 and transversally with respect thereto.

In Figure 49, the hopper means 81 contains a type of powders 86 and the conduit means 83, 84 and 85 extend inside the hopper distributing means 81 to pour the respective powders 86 near to the belt conveyor means 3.

As shown in Figure 52, inside the hopper distributing means 81, the conduit means 84 which bring the powders 6 may be provided with a lower portion 87 oriented toward a wall 88 of the hopper distributing means 81 and movable with respect thereto. The conduit means 84 are coupled with respective driving means, not shown, able to lift and/or shift the conduit means 84 with respect to the wall 88. In this way, pouring of powders may be controlled in a transversal direction with respect to the belt conveyor means 3 and may also be interrupted, lifting the conduit means 84 up to obtain a condition of closing of the portion 87 thereof on the wall 88.

The conduit means 84 have preferably a transversal C-section which is open towards the respective wall 88 with diverging side-walls for a better penetration into the surrounding

powders 86.

Figures 53 and 54 show further conduit means 89 having a lower portion 90 acting on a further transversal intermediate wall 91 of the hopper distributing means 81. The vertically movings of the conduit means 84 and 89 define exiting section of the powders having variable width so as to obtain grains of various shapes and dimensions in the layer of powders to be pressed.

The further wall 91 defines, with the wall 88, an interspace I, not occupied by the powder 86, wherein the conduit means 84 are movable. There may be provided a still further wall 92, defining, with the further wall 91, a further interspace I1 wherein the conduit means 89 are movable.

With reference to Figures 51 to 54, it is observed that the single conduit means 84 and 89 may be used combined with the respective wall means 88 and 91 without hopper means 81.

Figures 55 and 56 show that in the hopper means 81 there may be disposed a plurality of walls 88, 91, 92 and 93, in a position transverse to the V-direction of advancing of the powders: between each pair of walls, 88 and 91, 91 and 92, 92 and 93 respectively, there may be interposed a plurality of adjacent closing means 94, each having a section, for example a C-section, open toward the most downstream wall in the V-direction of advance of the powders and provided with a closing front portion 95 oriented towards the respective wall of the hopper distributing means.

Also the walls 88, 91, 92 and 93 may be provided with end zones 96 facing the closing end 95 of the closing means 94.

Each closing means 94 is coupled with a respective driving device, not shown, to regulate its position in height and consequently define the width of openings for passing the powders between a closing position and a complete opening position.

The driving of the closing means 94 may take place also by means of a program controlled by a computer.

Figure 56A shows an element of the closing means 94 wherein

the closing portion 95 is defined by a tilted plane which ends in an edge substantially parallel, during using, to the belt conveyor means 3.

In Figure 56B, analogous closing means 94 end in a curved edge 95a and, in the embodiment of Figure 56C, there is provided an edge 95c having reciprocally converging rectilinear slopes.

The shape of the edge of the closing portions 95 may be varied in any suitable way, depending on the design which has to be obtained with the grains on the layer of powders.

The embodiments of the closing means of the Figures 56B and 56C allow a gradual coupling with the corresponding portion of wall 96, in such a way that, passing from a completely closing position to a completely opening position, a plurality of intermediate opening positions for passing the powders may be defined. This allows to grade the contrast effect between the various powders and to obtain grains having variable widths.

In the embodiment of Figure 58, there are provided, movably coupled on a moving plane 160 defined by frame means 165 of a conventional press, some hopper distributing means 161 comprising a first container 162 and a second container 163, not communicating and disposed in succession with respect to a feeding direction F1 of a hollow 166 defined by a matrix 164 in its lower position. The containers 162, 163 are provided with severing walls 167, 168, tilted to diverge toward the plane 160 to define some openings for exiting powders having dimensions adequate to the thickness of the layer to be formed with the powders contained in each containers. In particular, the first container 162 has an outlet section with greater width and thus contains powder 6 forming the layer with greater thickness in the tile 5, while the second container 163 has an outlet section with smaller width and thus the powders 8 contained thereinto may form the layer with smaller thickness of the tile 5.

The first container 162 pours the respective powders 6 on the

bottom of the cavity 166, while the second container 163 pours the powders 8 contained thereinto above the layer formed by the powders 6. The sides of the hopper distributing means 161 have scraping means 169 to prevent the leakage of powders on the plane 160 and to scrape the level thereof in the pouring inside the cavity 166. When the filling of the cavity 166 has been completed, a punch body is descended toward the matrix 164 to compress the soft layer 6 and 8. During pressing of powders, suitable quantities of powders are put again into the hopper distributing means 161 by feeding means not shown to restore the level of desired filling into the containers 162 and 163. Each feeding means may pour powder of a same type, or of the same dimensions, or of a same colour, or also powders of various type, dimensions and/or colour, depending on the structural features of the tile to be formed and on the design thereof.

Between the slopings 167 and 168, which may also be joined together, there may be lodged, below, a rotating disturbing element 174 such as to modify the distribution of a layer 6a disturbing it in such a way as to create an alteration of the interface zone 173. The disturbing element 174 is advantageously provided with arms 175 having constant, or also variable radial development along a respective rotating axis 176. The distribution of the arms 175 along the axis 176 may define an elicoidal line, to prevent sudden variations of the action of the said arms on the underneath layer of powders 6a.

Preferably, between the first container 162 and the disturbing means 174 there is interposed a compacting roll 177 for compacting powders 6a, having a lower generatrix lying under the opening for the distribution of the said powders. In the version of Figure 57 there are also provided partition means 169a which define the two containers 162 and 163 non-communicating at least in their upper portion. The hopper distributing means 161 have an end wall 170, which, analogously to the pair of lateral walls not shown, skims

over the surface of the plane of moving 160, in such a way as to prevent leakages of powders, and a wall 171 at the opposite side, which skims over the plane 160 too. The partition means 169a may be severed into a plurality of independent partition elements 172, included into the mass of powders 6, 8 contained into the different sections 162, 163 of the hopper 161 and movable vertically with respect to the moving plane 160 in such a way that the respective ends of said elements 172 may also be at different distances from the moving plane, or from the matrix 164 when it defines the cavity 166: thus a corrugated, or undulating profile is generated in the severing interface 173 of the layers of powders 6 and 8. The elements 172 may be vertically adjustable, or also be provided with reciprocating motion in vertical direction to vary the conformation of the interface 173 according to a predetermined program eventually controlled by a computer.

Thus the elements 172 may be coupled with vertical driving means, for example pneumatic means, electromagnetic means, or similars, depending on the aesthetic effect to be obtained. The elements 172 may also be only in the lower portion of the partition means 169a, so as to be able, anyway, to influence the formation of the layer of powders 6.

The elements 172 are also advantageously coupled with vertical guide means, not shown, and/or elastically supported by the body of the hopper means, for example by means of laminae springs.

In a version not shown, there may be provided also two or more severing means 167, 168, or 169a to limit different volumes of the respective hopper distributing means and to allow the obtaining of three or more layers of powders. There may also be provided severing means, not shown, oriented towards a direction forming an angle with the direction F1, possibly structurally analogous to the partition means 169a.

The devices of Figures 57 and 58 allow to obtain at least two layers 6, 6a and 8 having thickness and density which are

substantially uniform but having compound of the respective powders which is strongly variable into the thickness.

Figure 68 shows an apparatus as in Figure 57, but combined with belt conveyor means 3 provided with transversal containing means 52a and longitudinal lateral containing means 37.

Figure 59 shows an apparatus as in Figure 57, but co-operating with belt conveyor means 3 wherein the lateral containing of the powders 6, 8 is obtained by an excess of powders.

Figure 60 shows an apparatus as in Figure 58, but without compacting roll 177 and combined with belt conveyor means 3 for conveying the powders 6, 8 toward the pressing.

As shown in Figure 61, the lower discharging opening of the first container 162 is provided with deflecting partitions 178 for deflecting powders, oriented in such a way as to give said powders, during falling inside the cavity 166, a speed component opposite to the speed induced by the hopper distributing means; thus the powders fall freely into the cavity 166 without substantially be influenced by horizontal speed components which would cause a heterogeneity in density of the powders into the said cavity.

Above the outlet of the hopper distributing means 162 there may be provided dosing means 179, formed for example by a motorized roll with horizontal axis, peripherally provided with grooves 180, driven in such a way as to allow controlled passing of predetermined quantity of powders, to form the layer in contact with the matrix 164.

Figure 62 shows that the compacting roll 177 of Figure 58 may act as disturbing means when it is peripherally provided with corrugatings 181, as hollows or reliefs, such as to give the layer of powders 6 suitable superficial alterations. Preferably, the roll 177 is made of elastically soft material, to not interfere with the moving plane 160, and with the frame 165, when the hopper distributing means are not on the cavity 166 in the feeding stroke.

Figure 63 shows an apparatus for distributing powders as in Figure 61, but combined with belt conveyor means 3 for conveying powders provided with containing means 36, 37, 52a.
Figure 64 shows an apparatus for distributing powders as in Figure 62, but wherein the powders are poured on belt conveyor means 3 provided with transversal containing means 52 for containing powders, said transversal containing means 52 defining cavities 53 in the belt conveyor means 3.
Figure 65 shows an apparatus for forming, on belt conveyor means 3, a layer of powders composed of base powders 6 and decorating powders 8. The powders 6 are contained into hopper distributing means 200 provided, along a wall area 202a, with an inlet 201 whereinto powders 8 are poured, said powders 8 having been distributed on distributing belt means 213 forming a predetermined design, as will be better explained below.
When the belt means 3 and 213 are advanced along the respective advancing directions V and V1, the powders 8 are progressively poured into the inlet 201 where a deflector 203 of the hopper distributing means 200 incorporates them with the powders 6. When the speed of the belt conveyor means 3 is substantially equal to the speed of the distributing belt means 213 the design is reproduced on the base powders 6 substantially corresponding to the one which has been defined on the distributing belt means 213.
To avoid alterations of the conformation of the layer 6, 8 before the respective powders are left on the belt conveyor means 3, it is suitable that the hopper distributing means 200 are provided with a section 204 for discharging on the belt conveyor means 3 with section which is substantially uniform.
Figure 66 shows a further embodiment of an apparatus for distributing powders on belt conveyor means 3 wherein the hopper distributing means 200 have a shape comprising a section converging downward and an outlet section 205 which pours the powders 6 into collecting means 206 defined by an

end 207 of the distributing belt means 213 and by wall means 208 which define together a conduit 209 wherein powders 6, 8 flow towards the belt conveyor means 3.

Preferably, the conduit 209 has a section with constant width to prevent the powders from being altered when passing therethrough.

The distributing belt means 213 may have recesses, or cavities, 210 arranged to contain decorating powders 8a.

When the belt means 3, 213 are driven, the powders 8, 8a are poured into the conduit 209 and amalgamated on a side of the powders 6, in such a way as to result incorporated in, or resting on, said powders when the latter are poured on the belt conveyor means 3.

The disposition of the belt means 3 and 213 is such that the powders 8, for gravity, tend to detach from the cavities 210. However, if a tendency to adherence of the powders 8, 8a to the belt means 213 would occur, there may be provided, near to the initial portion of the return part of the belt means 213, detaching means 211, formed for example by a vibrating body, which shake the belt means 213 and support the detaching of the powders 8, 8a therefrom.

Figures 67 to 70 show embodiments of rotating distributing means 212 arranged to pour powders 8 on a support S, which may comprise indifferently, depending on the cases, belt conveyor means 3, ceramic supports, one or more layers of powders 6, 8 to be pressed.

The rotating distributing means 212 may be formed by distributing belt means 213, or by a cylindrical distributing body 214, and are preferably provided with recesses 215 arranged to contain the powders 8 and such as to define a predetermined design.

The powders 8 are distributed into the recesses 215 by hopper means 163 which pour the said powders on an upper portion of the distributing means which move underneath its outlet opening. The powders are maintained inside the recesses 215 by containing means 216 which cover the portion of

distributing means which changes, during motion, its position bringing the recesses 215 from the initial position wherein they face upwardly, to the discharging position wherein they face downward. The containing means 216 may be formed by wall means 217, having for example the shape of a shell, which cover an end 218 of the belt means 213, or, as shown in Figures 69, 70, by a flexible means, as belt means 218a rolled up on return means 219 in such a way as to have a part 220 which covers the portion of distributing means 212 which inverts its position with respect to a horizontal plane.

There may be provided detaching means 211 for detaching powders which may also act as element whereon the containing belt means 218 is rolled up.

Figure 71 shows that the lateral containing means may be formed by belts 100 rolled up on the belt conveyor means 3. Advantageously, the belts 100 are rolled up on rolling means 101 different from the roll 12 whereon the belt conveyor means is rolled up, with the transversal containing means 52a. In this way it is possible to lengthen the belts 100 in the portion comprised between the detaching zone from the belt conveyor means 3 and the respective rolling means 101 in such a way as to decrease the section S1 with respect to the section S2 which the belts have in the remaining portions.

Preferably, the belts 100 are pressed on the rolling means 101 by anti-sliding means 102. The belts 100 are so detained between the pressing means 38a which keep them on the belt conveyor means 3 and the rolling means 101 whereon they are kept by the anti-sliding means 102. In this way, the peripheral speed of the rolling means 101 may be greater than the peripheral speed of the roll 12 so as to determine an elongation on the belts 100 with reduction of transverse section.

This allows to support the extraction of the pressed product 14 form the cavities obtained on the belt conveyor means 3.

Figure 72 shows that the belts 100, when they are kept between the rolls 12 and 13 with interposition of the belt

conveyor means 3, have a section S3 lowered toward the belt conveyor means 3 and widening towards the powders during pressing. Therefore, at the end of the action of the rolls 12 and 13, the section S3 would tend, anyway, to go far away from the pressed powders and have the initial section S2 supporting the delivery of the pressed product 14.

As shown in Figure 73, the conduit 209a may have a section having a width decreasing in the direction of advance of the powders along the conduit 209a in such a way that, when exiting from the conduit the powders are already pressed in a compact layer 14a, which may be conveyed by belt conveyor means 15b, for example to feed a press, not shown.

The conduit 209a is defined between an end of belt distributing means 213 for distributing powders 8 and an active part 208a of a pressing belt 3c rolled on respective rolls 12b and 309a. The rolling roll 309a is supported near to the outlet opening of the hopper means 200, whereto also the powders 8 of the conveyor belt 213 flow.

The powders 6, 8 which descend along the conduit 209a, are progressively pressed as a consequence of the decreasing of the section of the conduit 209a and are pressed at the exit from the conduit 209a between the roll 12b and the roll 13b whereon an end of the conveyor belt 213 defining portion of the conduit 209a is rolled.

Figure 77 shows a continuous strip of powders 6, 8 distributed on an endless conveyor belt 3a wound at an end which is far from mould means 4, on a first roll 309 and, at an end 311 (Figure 76) near to the mould means 4, on rolling means 12a, which may be constituted of an idle roll having suitably small diametre, or by a rolled end whereon the conveyor belt 3a may move. The rolling means 12a is mounted on slider means 313, movable along a dirction F1', which is horthogonal with respect to a vertical axis of the mould means 4, i.e. parallel to the direction V of advancing of the powders 6, 8, between a position outside the mould means 4, shown in Figure 76, and a position inside the mould means 4

shon in Figure 74. It is observed that the moviment along the direction F1' of the nearest end 311 defines a loading stroke A of the mould means 4, wherein the portion 317 (Figure 75) of the strip 6, 8 is poured on a distributing plane 314 defined by an upper surface 318 of a matrix 19, or lower punch means, of the mould means 4 and by a further upper surface of the lower rame means 16 which surround it. The portion 317 is poured on the plane 314 with a stroke of the conveyor belt 3a which extends for a portion A comprising the matrix 19 in such a way that the portion 317 occupy completely the matrix 19: in particular, the portion 317 is limited by tilted side-walls 319 which slope from the upper surface thereof 317 forming a corner Q, which must result at least lying along the vertical line (shown as dashed line) conducted from the plan-edge of the matrix 19, or which may also lie externally thereto.

The conveyor belt 3a has an active part whereon the powders of the layer 6, 8 rest and a neutral part 320 which has, along one of its intermediate zones, a first return roll 321 and a second return roll 322, having rotating axes fixed in a vertical direction, which allow the neutral part 320 to define a loop 324, in the rolling around a stretching roll 32, having axis movable along a vertical direction indicated with F2'.

The lower frame means 16 are supported onto lower driving means 324' and analogously, upper frame means 23, surrounding the punch 18, are coupled with respective upper driving means 327. Form the upper frame means 23 project toward the lower frame means 16 some spacing means 328 having an height corresponding about to the thickness of the portion 317 of the strip 6, 8.

As shown in Figure 76, the spacing means 328 may be peripherally conformed in such a way as to define a close chamber 332 extending around the matrix 19 and around the punch 18 in such a way as to allow the forced suction of the powders unrelated to the forming of the tile 1.

At the nearest end 311 forcing means 329 are supported, said forcing means 329, as shown in Figure 77, during advance of the nearest end inside the mould means 4, forcing from the opposite side toward the outlet a tile 5 formed in the previous cycle of pressing, when they are in the respective position lowered toward the belt conveyor means 3a, wherein they also act advantageously - with their internal face tilted 331 - as closing element of the most advanced portion of the strip 6, 8.

The forcing means 329 are movable from the lower position to a non-operative position lifted with respect to the powders 6, 8 and to the distributing plane 314, as shown in Figure 74, to allow the strip of powders, which have to be pressed, to descend from the belt conveyor means 3a during loading of the matrix 19.

In the embodiment of Figures 74 to 77, operation is as follows.

1) With the mould means 4 in opening position, the nearest end 311 is introduced between the punch 18 and the matrix 19 while the distance between the nearest end 311 and the external end 310 grows progressively, the rotation axis of the roll 309 being kept in a fixed position and the belt conveyor means being kept stationary with respect to the rolling means 12a: this may be obtained providing blocking means for blocking the belt conveyor means 3a along the stretching roll 323. Alternatively, the blocking means may act on the roll 309 as indicated with 348. Therefore, when the active part of the belt conveyor means 3a advances toward the mould means 4, the rolling roll 323 lifts along the direction indicated with F3'.

2) The direction of the motion of the nearest end 311 is inverted, said nearest end 311 beginning to move in the direction indicate by the arrow F1' while the portion 317 of the layer of powders 6, 8 to be pressed is poured on the distributing plane 314. To support the descending of the powders of the layer 6, 8 from the belt conveyor means 3a,

preventing mixings of the powders, there are advantageously provided slide means 333 acting as connection between the top of the belt conveyor means 3a and the distributing plane 314. In this phase, shown in Figure 74, the axis of the external roll 309 is still in fixed position, the active part of the belt conveyor means 3a does not translate, while the non-active part 320 is progressively rolled on the rolling means 12a making progressively descend the stretching roll 323 in the direction indicated by the arrow F2'.

3) At the end of distributing the portion of layer 317, both the nearest end 311 and the external end 310 are simultaneously moved away from the pressing means 8, maintaining substantially constant the respective inter-axis, in such a way as to advantageously prevent powdered material to be pressed being further poured also outside the distributing plane 314. In this phase, also the hoppers 2, 7 have to come back together with the belt conveyor means 3a and the rolling means with rolls connected therewith, in such a way as to prevent accumulations, or scarsities of powders in the said layer and to assure that the density of the layer remains substantially constant. Because the belt conveyor means 3a does not have to rotate in this phase, with respect to the rolling means 12a, there are provided further blocking means acting agaist the said belt conveyor means, in particularly advantageously obtained making act the forcing means 329 as a clamp which clamps the belt conveyor means 3a on the rolling means 12a.

4) The mould means 4 may close on the zone 317 of the layer 6, 8, as shown in Figure 75, first approaching the punch 18 and the upper frame means 23 on the portion 317, then making descend the upper frame means 23 and the lower frame means 16 below the distributing plane 314 and after that pressing the tile making the punch 18 execute a stroke of pressing.

5) At the end of pressing, the pressing means are brought back at the initial position to define a distributing plane 314, the end 10 and 11 are positioned at the respective

initial positions and the cycle restart at the step 1).

As shown in Figures 78 to 80, both the matrix 19 and the respective frame means 16 are fixed and could be constituted as a single body. However, since the face of the matrix 19 facing the portion 317 is generally provided with reliefs or hollows defining the mark of the tile 5, it is advantageously, also in this embodiment, that the matrix is severed from the respective frame means.

The upper frame means 23 are provided with an edge 334 tapered toward the layer 6, 8 in such a way as to define thereon, when the punch 18 descend toward the powders to be pressed, the portion 317 to be subjected to pressing.

It is observed that the spacing means 328 may also not define a chamber 332, but be simply formed by isolated bodies distributed along the sides of the upper frame means 23 in a substantial uniform manner to prevent undesired flexions determined by forces exerted because of the action on the powders during pressing, as shown with reference to 328a in Figure 81.

In pressing, after loading of the powders, according to manners analogous to the ones disclosed in the previous steps 1), 2) and 3), the mould means 4 are neared making the punch 18 and the respective frame means 23, 334 descend toward the distributing plane 314 until the tapered edge 334 rests on the distributing plane 314 so isolating the portion 317 to be pressed. Thus the punch 18 is further lowered to compact the zone 317 and obtain the tile 5.

Subsequently, the mould means 4 are opened and, when the nearest end of the conveyor belt 3a is driven to enter into the mould means 4, the forcing means 329 scrape the distributing plane 314 cleaning it of the non-pressed material before pouring thereon the powders to be pressed in the subsequent stroke.

Figures 82 to 84 show an embodiment of apparatus which is particularly suitable for pressing tiles having a layer 8 which is decorating, continuous or interrupted, in direct

contact with the distributing plane 314 and a layer 6 with greater thickness, superimposed thereof. Such tiles are then formed with the front facing downward: this occurs particularly when the layer 8 is non-uniform, being for example formed by zones 8a having whatever distribution, also irregular, with thicknesses which may be strongly etherogeneous, this being able to give valuable aesthetic effects, particularly when the decorating layer 8 is formed by translucent material.

In this embodiment, there are provided only the lower frame means 16, the punch 18 being peripherally free. In pressing, after loading according to previous steps 1) to 3), the punch 18 is descended in approach on the portion 317 of powders and the lower frame means 16 are lifted by respective driven means 324' in such a way as to cover the lower edge of the punch 18 to isolate peripherally the portion 317 and prevent lateral leakages of powders in pressing. During lifting of the frame means 16 the portion 317 is also severed exerting a cutting action on the layer 6, 8 to be pressed.

At the end of lifting of the lower frame means 16, the punch 18 is further lowered to press the portion 317 and obtain the pressed tile 5.

Figures 85 and 86 show a further version wherein the body of matrix 19 is not initially in a fixed position resting on the floor, but in a position lifted with respect thereto and the lower frame means 16 are supported by supporting and fixing elements 335 in a position fixed with respect to the floor. Thus, after loading according to manners of the previos steps 1) to 3), when the punch 18 is approached to the portion 317, both the punch 18 and the matrix 19 may descend downward simultaneously and in a synchronized way, while the lower frame means 16 rimain still on the fixing elements 335.

Descending of the punch 18 and of the matrix 19 is completed when the punch has descended below the upper edge of the lower frame means 16 to isolate the portion 317. The matrix 19 finishes its stroke on the floor, stopping so its

descending downward, while the punch 18, continuing to descend, carries out the pressing of the tile 5.

As shown in Figure 87, pressing means comprises a punch 18 encircled by upper frame means 23 and a bottom portion 19 encircled by vertically movable lower frame means 16 having an upper wedge portion 350 defining the cavity 17 into which the powders 6, 8 are delivered. The belt 3a is moved away from the cavity 17 in such a way as to let the powders 6, 8 fall in a substantially vertical plane, as indicated by arrows W. Any excess of powder 351 is discharged from the lower frame 16 by the wedge portion 350. Then, the punch 18 descends on the powders contained in the cavity 17 as indicated in Figure 88.

As shown in Figure 90, the lower frame means 16 in a further version have a flat upper end portion defining an upper surface 352 on which a squegee 353 is slidable to eliminate the excess of poders 251 when moved in the direction of arrow F1". In this embodiment it is advantegeous if the decorating layer 8 is located under the layer 16 definig the body of the tile to be pressed, so that movements of the squegee 353 do not mix the powders forming the decorating layer.

As shown in Figures 91 to 93, in a variation of the apparatus according to Figures 87 to 89, the frame 16 is fixed and the bottom portion 19 is movable in a vertical direction.

As shown in Figures 94 to 96, in a further embodiment of the apparatus, the powders 6, 8 are peripherally contained in ring means 354 from which the powders are delivered into the cavity 17: to this end, the ring means 254 is indexed in a direction opposite to the direction in which the conveyor 3a is moved, so that the powders 6, 8 are delivered into the cavity 17 in a substantially vertical plane.

The ring means 254 is provided with apertures 255 through which the punch 18 passes when pressing of the powders 6, 8 is required.

The various devices, apparatus and means indicated and described with reference to the mentioned Figures may also be

used isolately, or in the possible combinations with other devices, apparatuses and means herein indicated and described, or combined with devices, apparatuses and means different to the ones indicated and described.

CLAIMS

1. Method for pressing powdered material to obtain tiles, comprising the steps of:
- distributing powders on flexible conveyor means and advancing said powders along an direction of advance through a pressing station,
- containing said powders on said conveyor means by containing means in said pressing station,
- pressing said powders in said pressing station, characterized in that said containing means act on the powders to be pressed during said avancing and those containing means continue to act during said pressing.

2. Method according to claim 1, wherein said containing means are movable, with respect to said conveyor means, along a plane substantially parallel to said conveyor means.

3. Method according to claim 1, or 2, wherein said distributing comprises distributing a layer of powders having an extension greater than the extension of the powders to be pressed in such a way that said pressing comprises pressing a central portion of said layer and wherein said containing is carried out by containing means formed by non-pressed powders surrounding said central portion.

4. Method according to anyone of the preceding claims and further comprising, after said pressing, severing portions from said pressed powders in such a way as to obtain, from said portions, corresponding tiles.

5. Method according to anyone of the preceding claims, wherein said distributing comprises distributing said powders in different zones of said conveyor means.

6. Method according to anyone of the preceding claims and

further comprising further pressing said powders after said pressing.

7. Method according to claim 6, wherein, before said further pressing, zones of said powders are severed from said layer (14) in a descending portion of stroke of a body of punch (18) and of a bottom portion (19) of said further pressing means (4).

8. Method according to claim 6, wherein, before said further pressing, zones of said powders are severed from said layer (14) in a descending portion of stroke of said upper frame means (23) and of a moving plane (15) whereon said layer (14) rests.

9. Apparatus for pressing powdered material in such a way as to obtain tiles, comprising flexible conveyor means for receiving powders thereon from distributing means and for advancing said powders along an advancing direction through a pressing station, containing means for containing said powders on said conveyor means, pressing means for pressing said powders in said pressing station, characterized in that said containing means are arranged to act on the powders to be pressed during said advancing and those containing means continue to act during said pressing.

10. Apparatus according to claim 9, characterized in that said conveyor means are selected in a group comprising belt conveyor means, articulated-plate conveyor means.

11. Apparatus according to claim 9, or 10, wherein said containing means comprise at least a pair of containing elements co-operating with said conveyor means.

12. Apparatus according to anyone of the claims 9 to 11, wherein said containing elements comprise at least a pair of

wall means obtained in said conveyor means.

13. Apparatus according to anyone of the claims 9 to 12, wherein said containing means comprise a pair of rolling means acting on edge zones of said conveyor means.

14. Apparatus according to anyone of the claims 9 to 13, and further comprising severing means to sever from the pressed powders portions defining tiles.

15. Apparatus according to anyone of the claims 9 to 14, wherein said pressing means are arranged to press only a central portion of said powders.

16. Apparatus according to anyone of the claims 9 to 15, wherein said pressing means comprise roll pressing means which define a passing section for said material which decreases along an advancing direction (V) of the material.

17. Apparatus according to claim 16, wherein on a portion of said roll pressing means compacting belt means (31) are rolled up.

18. Apparatus according to claim 17, wherein said compacting belt means co-operate with controlling means and with rolling means interposed between said compacting belt means and said controlling means.

19. Apparatus according to anyone of the claims 9 to 15, wherein said pressing means comprise at least a compacting means (40) provided with swinging motion.

20. Apparatus according to anyone of the claims 9 to 19, wherein, downstream of said pressing means (12, 13; 12, 30, 13, 29; 12, 30, 13, 29, 31; 40, 41) there are provided further pressing means (4) for further compacting said

material.

21. Apparatus according to claim 20, wherein said further pressing means (4) comprise lower frame means (16, 16a), whereon the compacted layer (14) rests, arranged to receive a bottom body (19).

22. Apparatus according to claim 21, wherein above said lower frame means (16a) there are provided upper frame means (23), driven to descend together with a punch body (18) and with said lower frame means (16a), up to a position below the bottom body (19).

23. Apparatus according to claim 21, wherein said lower frame means (16a) are open along a side facing said pressing means (12, 13; 12, 30, 13, 29; 12, 30, 13, 29, 31; 40, 41).

24. Apparatus according to claim 20, wherein between said pressing means (12, 13; 12, 30, 13, 29; 12, 30, 13, 29, 31; 40, 41) and said further pressing means (4) there is interposed a moving plane (15) which is coupled with coupling means which allow it to follow the lowering and the lifting of said frame means (16, 16a, 23).

25. Apparatus according to claim 24, wherein said coupling means comprise hinging means along an axis (Z) transversally passing through said strip (14).

26. Apparatus according to anyone of the claims 9 to 25 wherein said distributing means comprise hopper distributing means.

27. Apparatus according to anyone of the claims 9 to 26, wherein said distributing means comprise belt distributing means.

28. Method for pressing powdered ceramic material, comprising:

- moving, along a reciprocal approaching direction, powders to be pressed and pressing means arranged to decrease significantly the volume of said powders;
- pressing said powders along a pressing direction transversally disposed with respect to said approaching direction;

characterized in that said pressing comprises acting on said powders with pressing intensity which increases along said approaching direction.

29. Forming means for forming ceramic material comprising moving means arranged to move, along a reciprocal approaching direction, powders to be pressed and pressing means to decrease significantly the volume of said powders, the pressing means being arranged to press said powders along a pressing direction transversally disposed with respect to said approaching direction, characterized in that said pressing means are conformed to act on said powders with pressing intensity which increases along said approaching direction.

30. Mould means comprising:

- upper frame means provided with cavity arranged to receive powders to be pressed initially lying under them to further compact them between a punch body and a bottom body, said upper frame menas being coupled with vertical driving means;
- supporting and moving means for said powders comprising said bottom body;
- spacing means arranged to keep, between said upper frame means and said supporting and moving means, a distance at least equal to the thickness of said powders.

31. Apparatus for distributing powders, comprising hopper

distributing means to contain various types of powders arranged to form a layer, the hopper distributing means being provided, above, with inlet means to receive various types of powders and with outlet means to exit, below, the respective content, characterized in that said hopper distributing means comprise severing means which oppose the mixing of the various types of powders.

32. Method for distributing powders in more than one layer to respective pressing means, comprising exiting types of powders from respective hopper distributing means and transferring toward a cavity of a matrix of said pressing means in an alternative feeding stroke of said pressing means, characterized in that said exiting takes place in a single and in the same portion of the feeding stroke and in that said types of powders preferably exit almost simultaneously from said hopper distributing means in said portion.

33. Apparatus for distributing powders on supporting means comprising hopper distributing means and conduit means leading near to said supporting means.

34. Belt means arranged to convey powders at an external side thereof, said belt means being close as a ring and provided, along said external side, with containing means arranged to contain powdered material to be pressed thereon.

35. Distributing means for distributing a powdered product to decorate ceramic tiles comprising conveyor means provided with hollow means which are open outward to contain parts of said product and closing means for closing said hollow means arranged to prevent said parts exit from said hollow means along a predetermined portion of said conveyor means.

36. Method for pressing powders of ceramic material

interposed between upper mould means which are movable above said powders and lower mould means lodged below said powders to support them, the lower mould means defining a pressing area for pressing said powders, comprising the phases of:

- distributing said powders on said lower muold means by means of conveyor means which convey said powders in such a way that said powders extend beyond said pressing area;
- severing, with said mould means, the powders exceeding said pressing area from the powders located inside said pressing area;
- subsequently pressing the powders in said pressing area between said upper mould means and said lower mould means while said conveyor means are disposed in a position which is operatively non-interfering with said mould means.

37. Apparatus for forming powders of ceramic material interposed between upper mould means which are movable above said powders and lower mould means lodged below said powders to support them, the lower mould means defining a pressing area for pressing said powders, comprising distributing means arranged to distribute said powders on said lower muold means by means of conveyor means which convey said powders in such a way that said powders extend beyond said pressing area, the distributing means being arranged to go away from the mould means to allow the pressing, driving means arranged to drive at least said upper mould means in such a way as to sever the powders exceeding said pressing area from the powders located inside said pressing area.

FIG. 1
1
2
2a
3
4
6
7
8
9
10
11
12
13
14
15
16
18
335
A
B
C
V

FIG. 2
1
2
2a
3
4
6
7
8
9
10
11
12
13
14
15
16
17
18
19
22
335
A
B
C

FIG.3
2
3
1
2a
10
11
9
7
6
8
12
A
13
B
15
14
16
335
19
18
17
4

FIG.4
2
3
1
2a
11
10
9
7
V
8
6
12
A
13
B
15
14
16
17
335
19
18
21
335
5
20
4

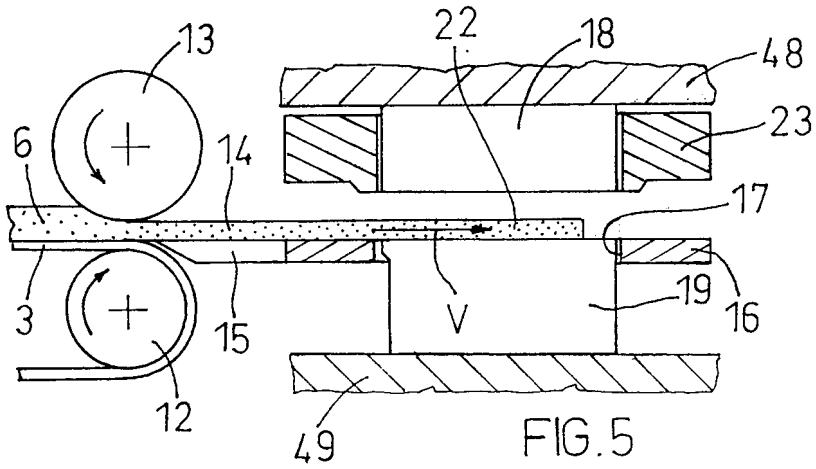


FIG.5

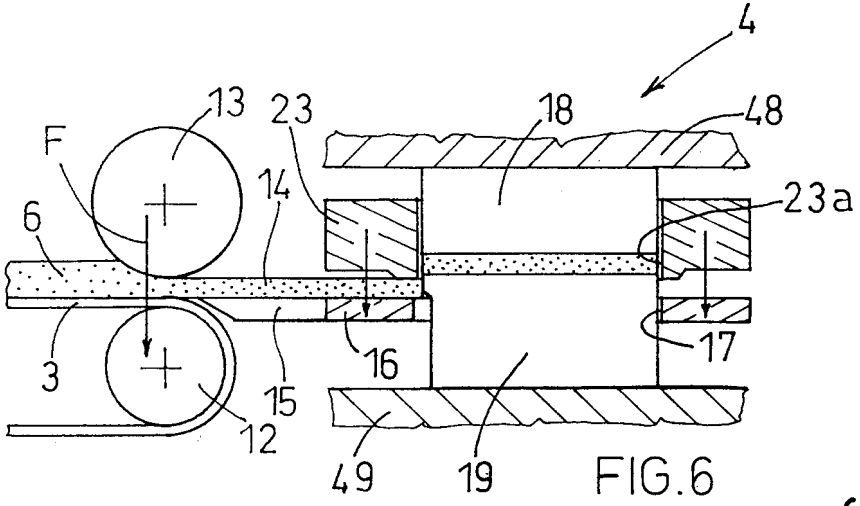


FIG.6

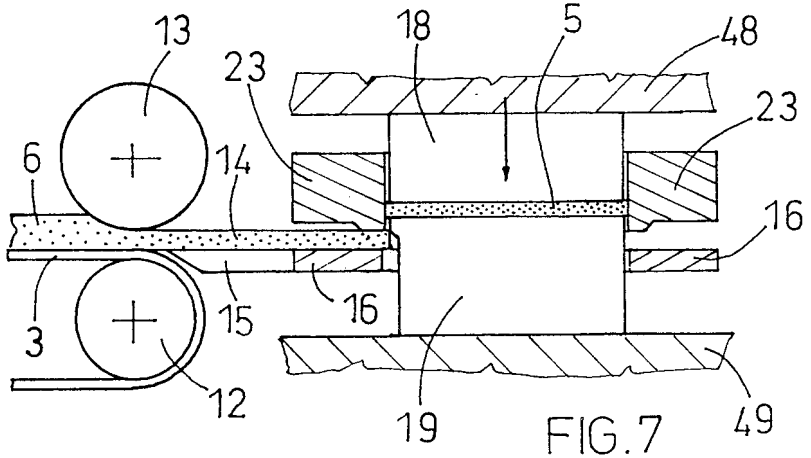


FIG.7

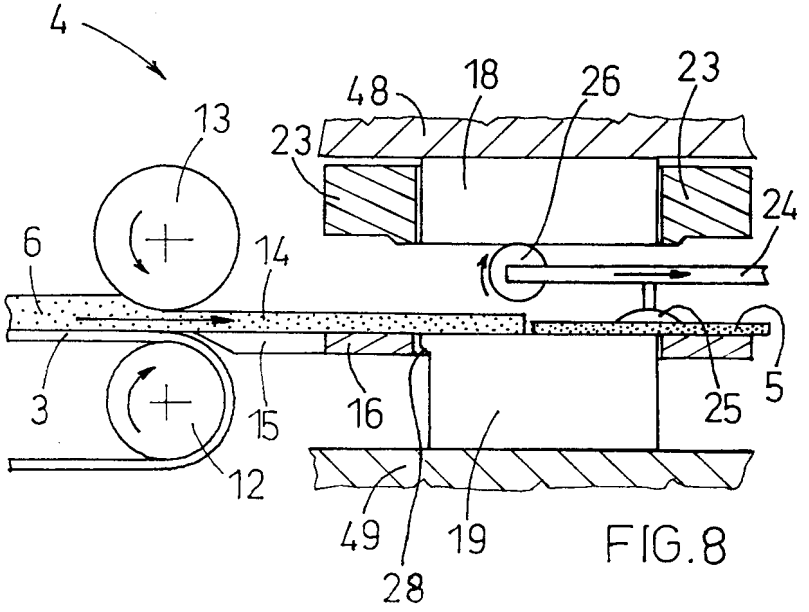


FIG.8

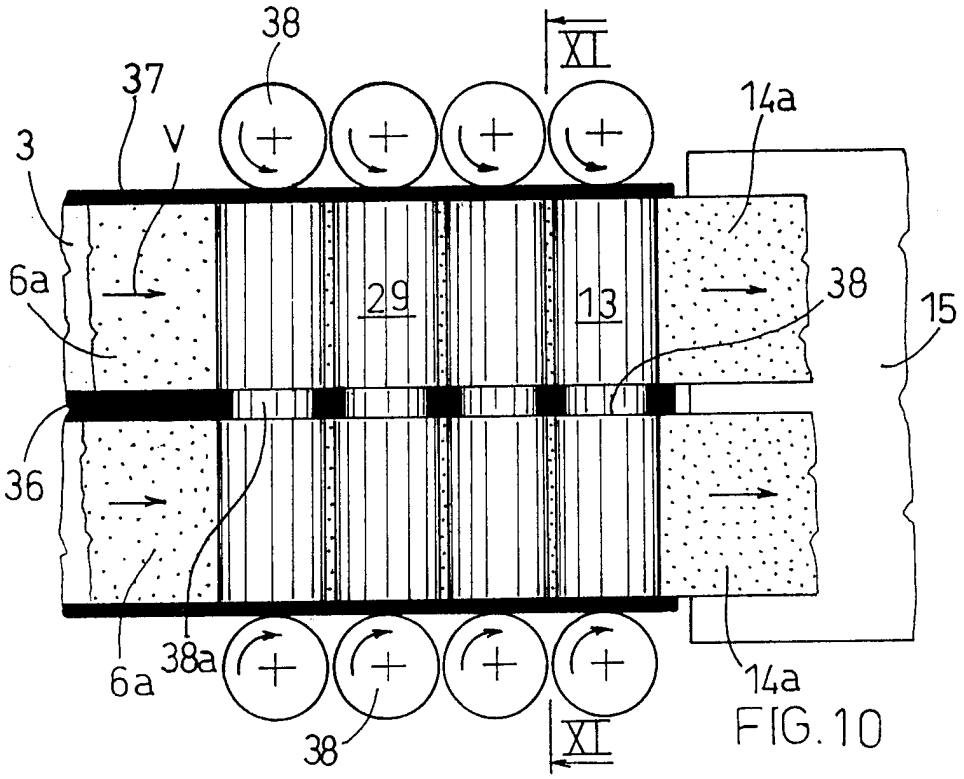


FIG.10

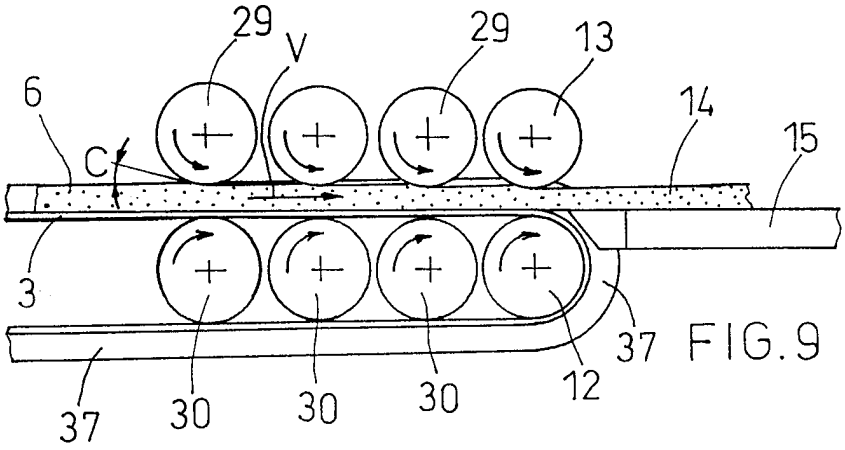


FIG.9

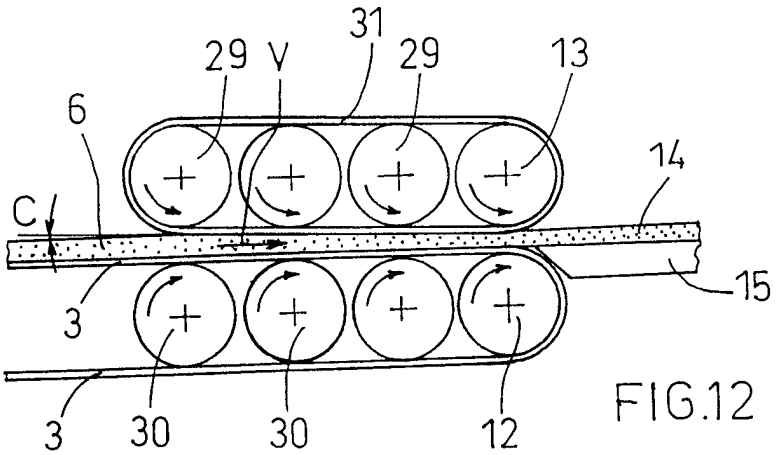


FIG.12

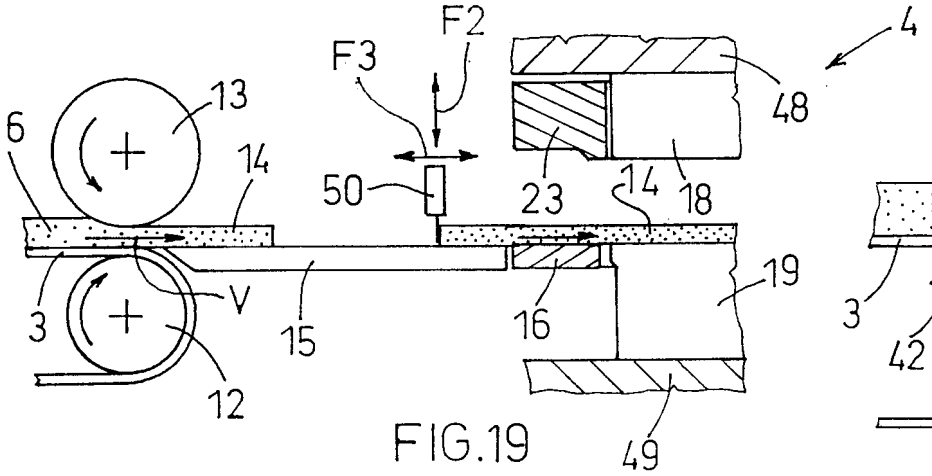


FIG.19

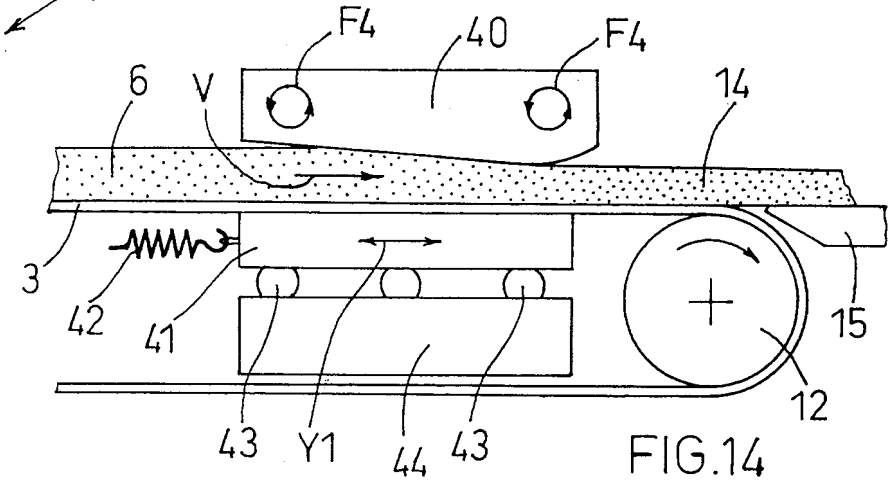


FIG.14

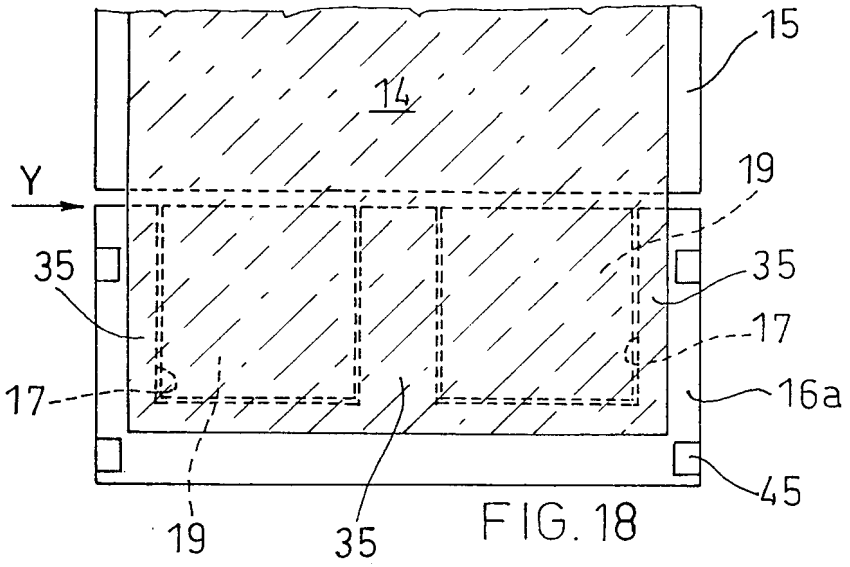


FIG. 18

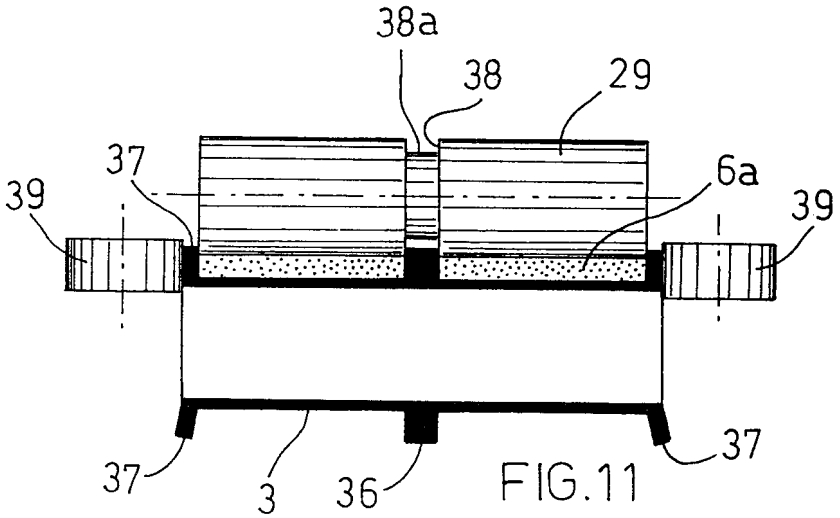


FIG.11

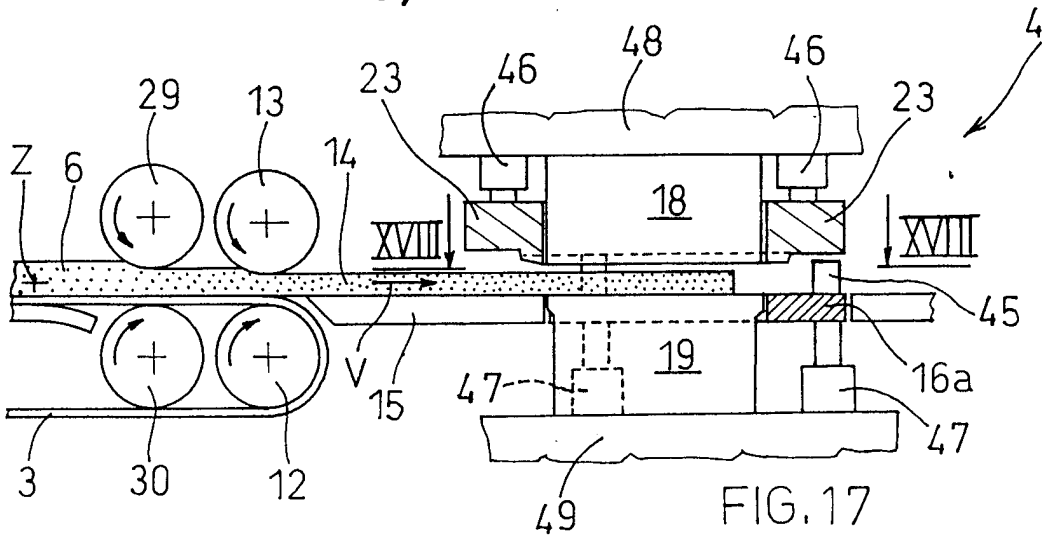


FIG.17

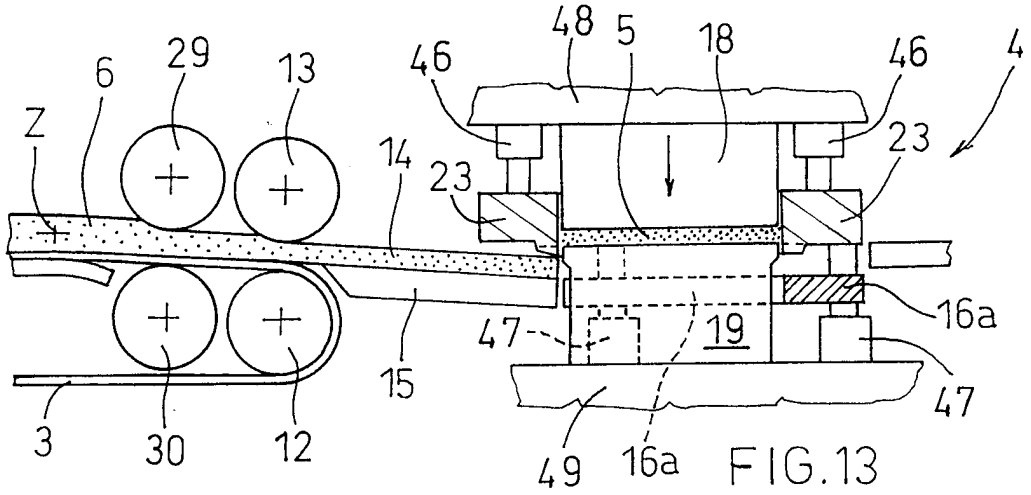


FIG.13

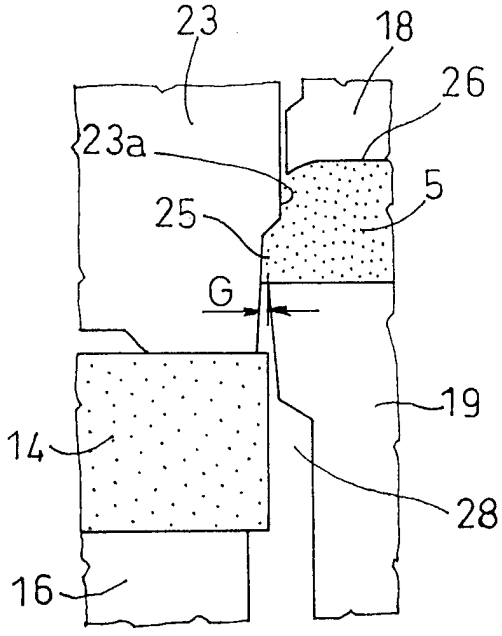


FIG.15

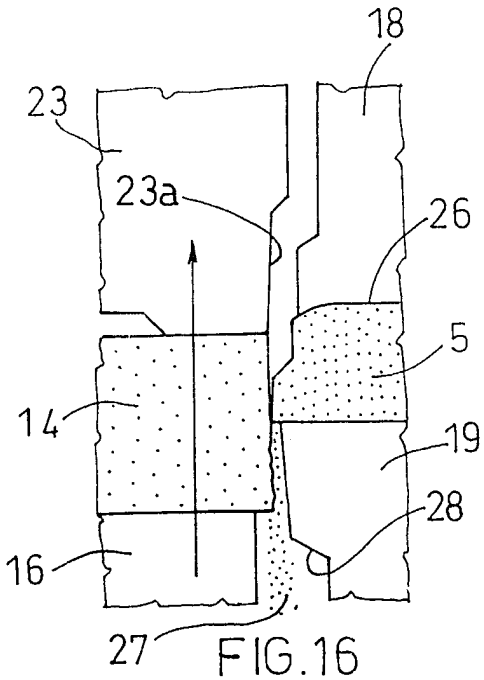


FIG.16

52
53
36
1
53
54
2
XXII
XXII
52
54
X XIII
X XIII
56
53
55
52
57
12
14
15
18
19
23
4

FIG.20

52
53
1
3
53
54
2
52
54
V
56
57
57
55
52
57a
57
14
52
12
15
14
18
19
23
4
5

FIG.21

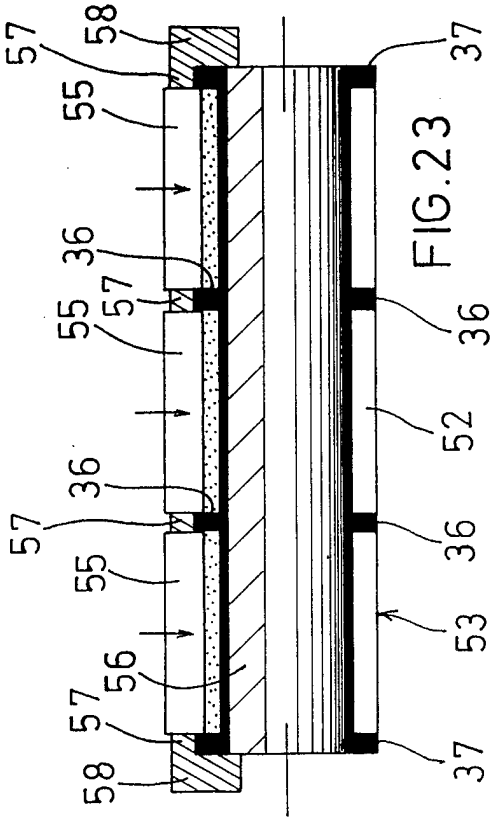


FIG.23

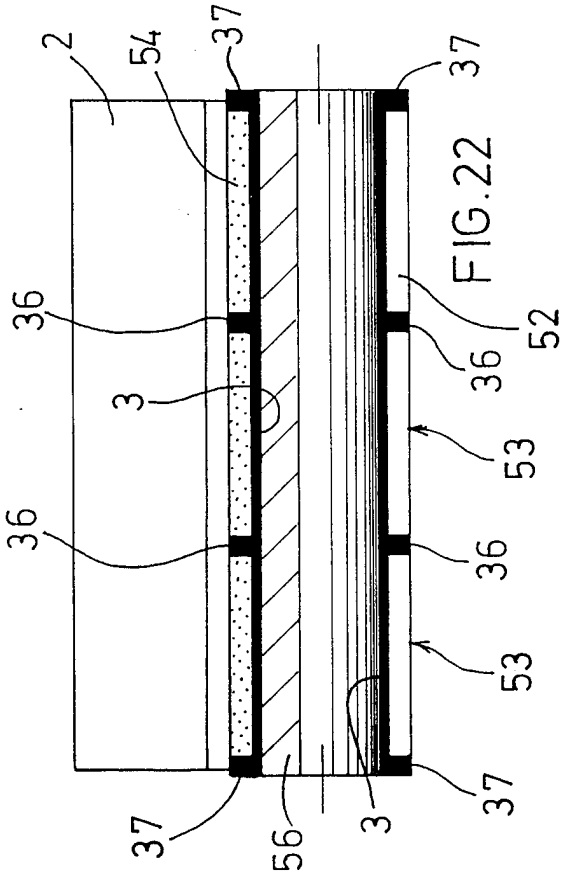


FIG.22

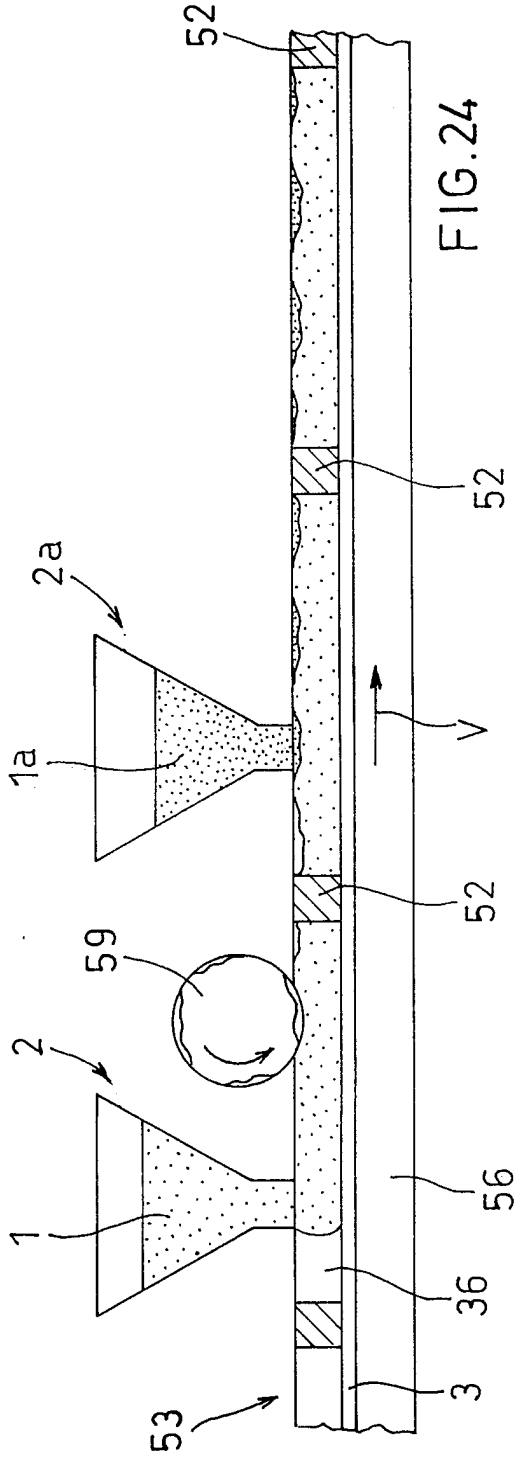


FIG.24

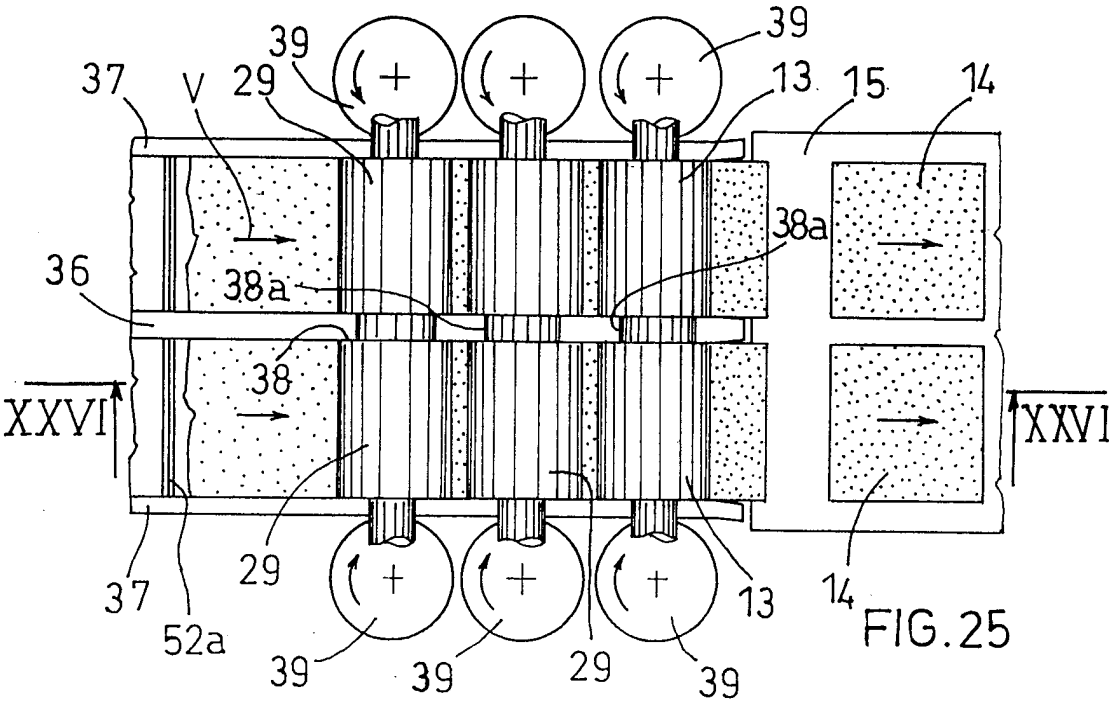


FIG.25

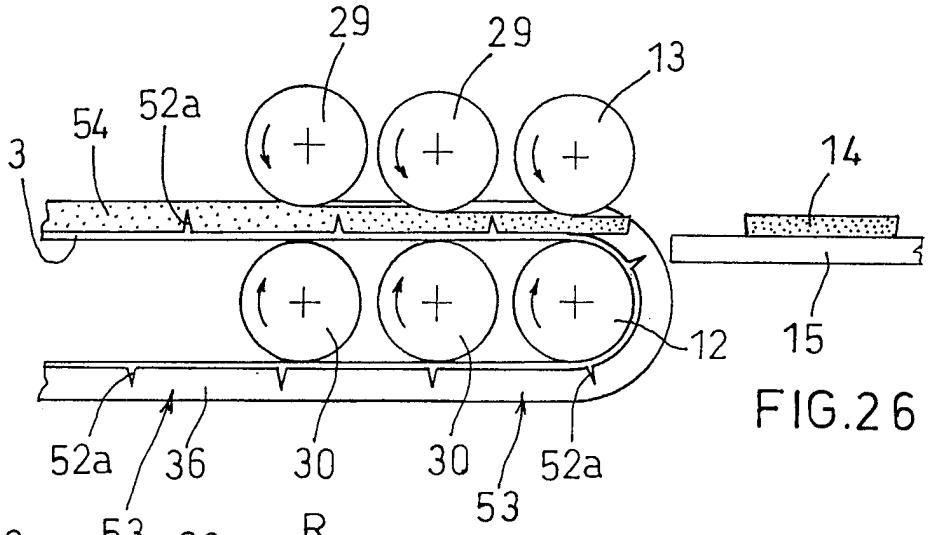


FIG.26

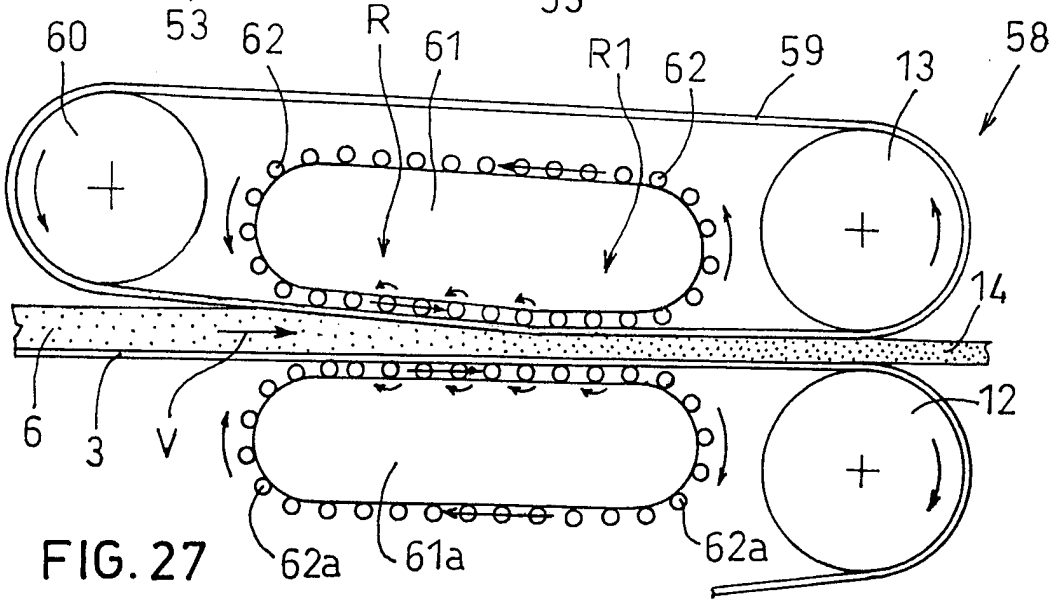


FIG. 27

7
10
11
9
52a
8
36
2
1
2a
6
56
58a
60
59
53
12
13
14
15a
16
18
19

FIG. 28

52a
53
36
2
52a
6
1
10a
2a
52a
2c
2b
10
2a
8a
56
52a
12a
8
13a
12
14

FIG. 29

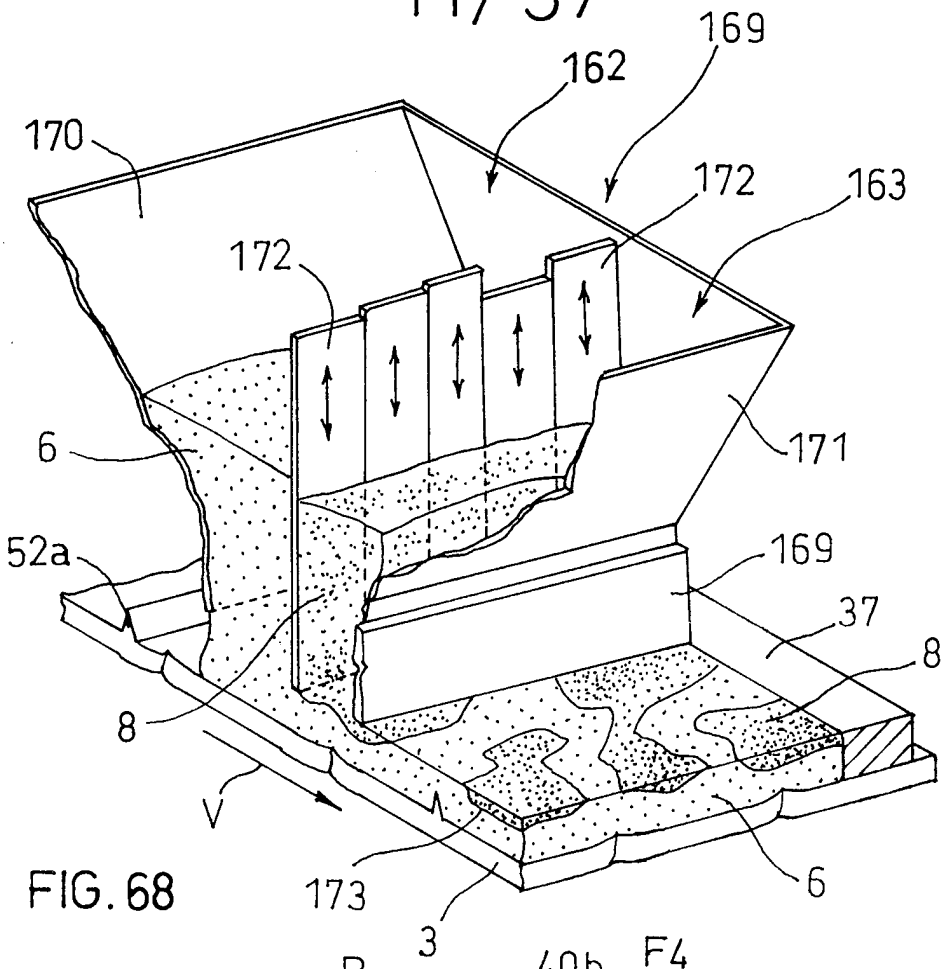

169
162
170
172
163
172
171
6
52a
169
37
8
8
V
173
6
3

FIG. 68

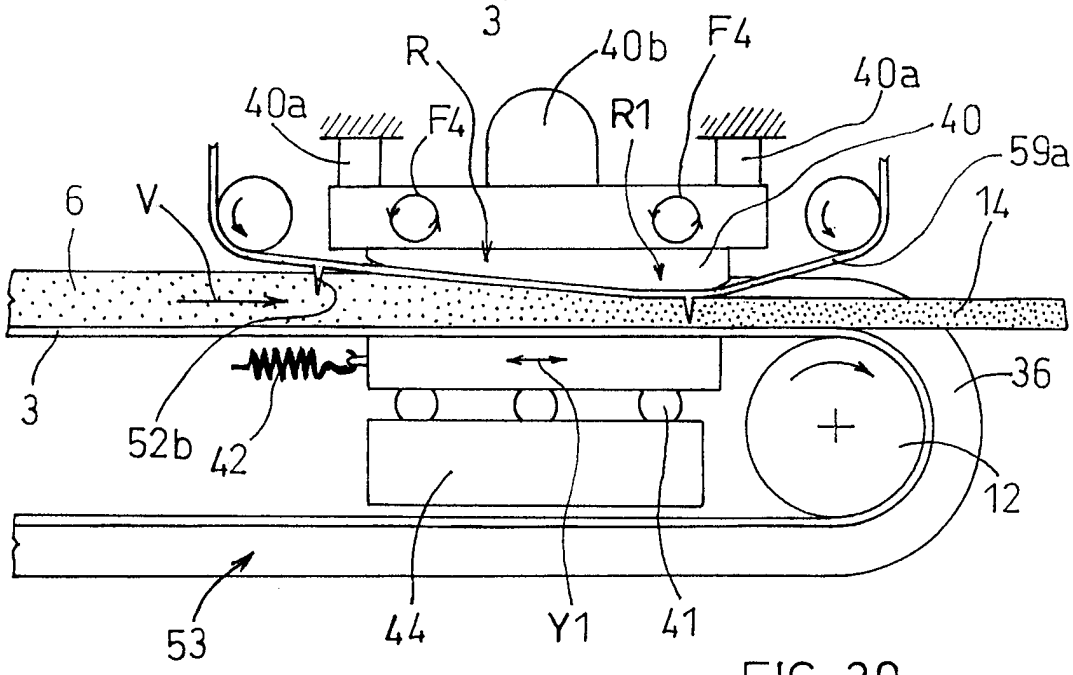

R
40b
F4
40a
40a
F4
R1
40
59a
6
V
14
3
36
52b
42
12
53
44
Y1
41

FIG. 30

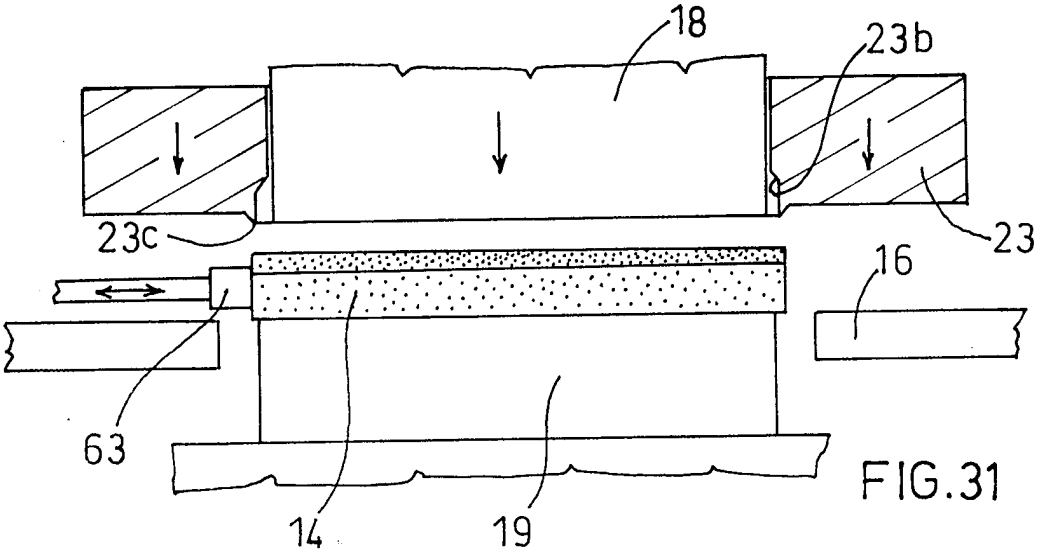


FIG.31

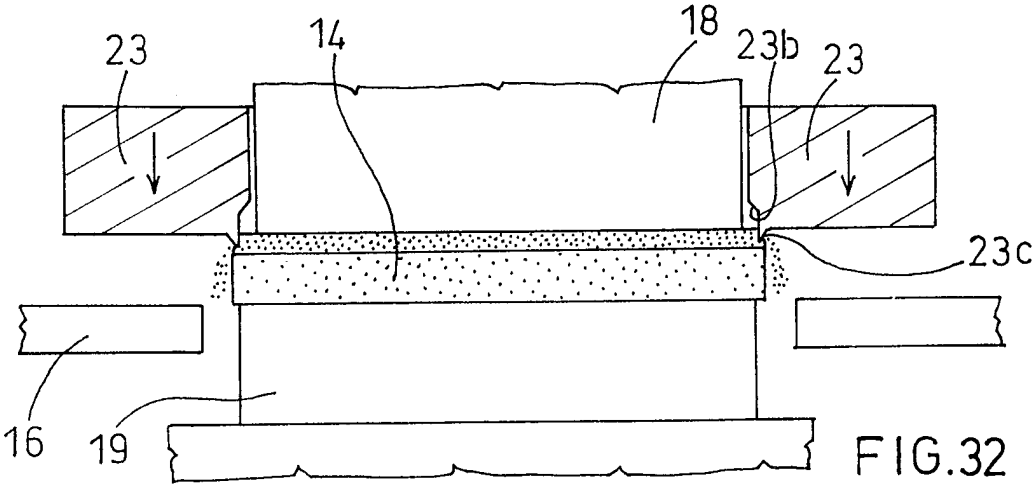


FIG.32

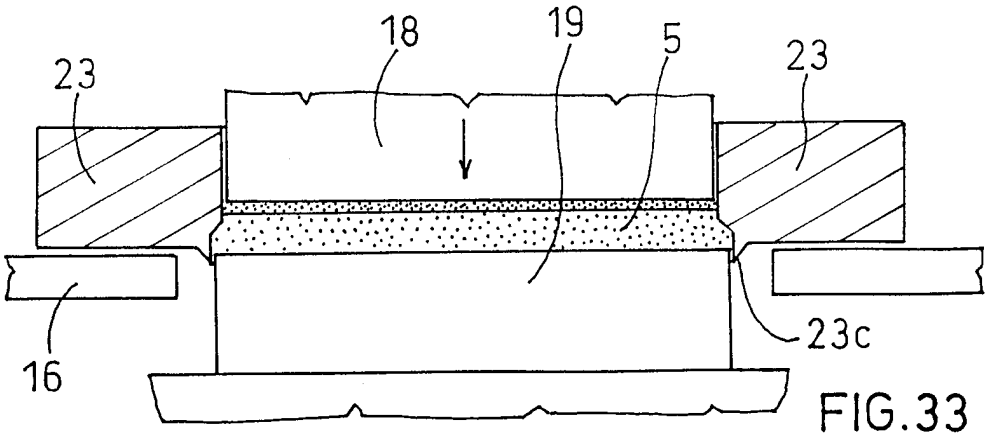


FIG.33

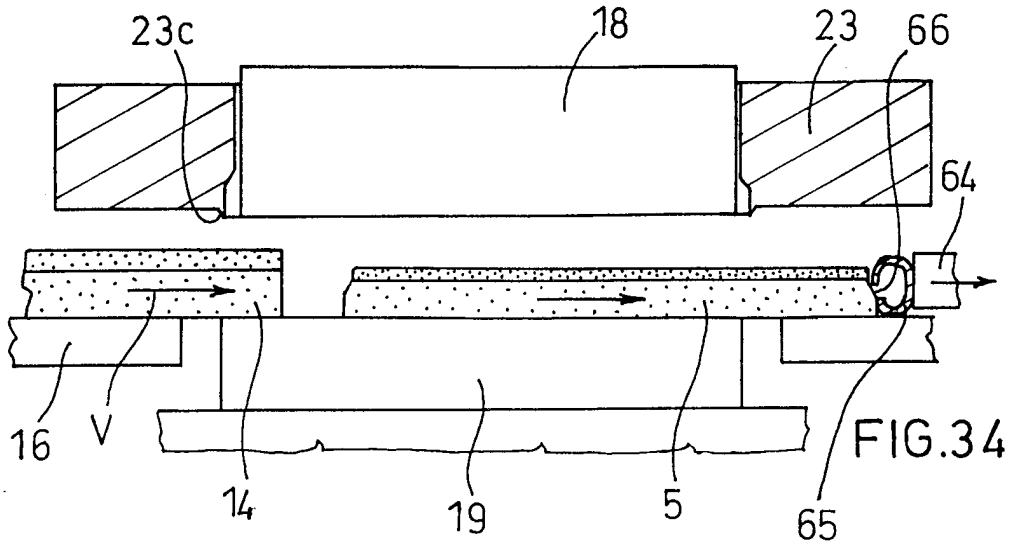
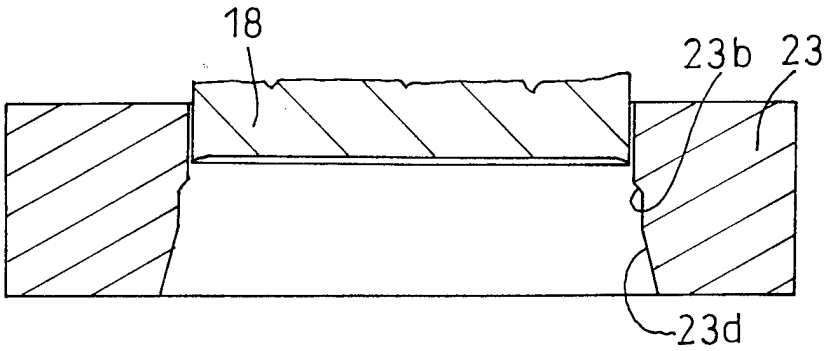


FIG.34



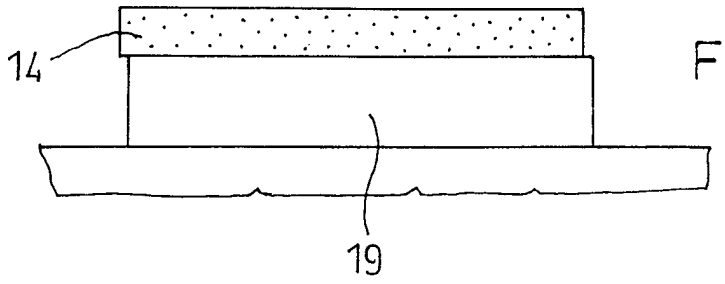


FIG.35

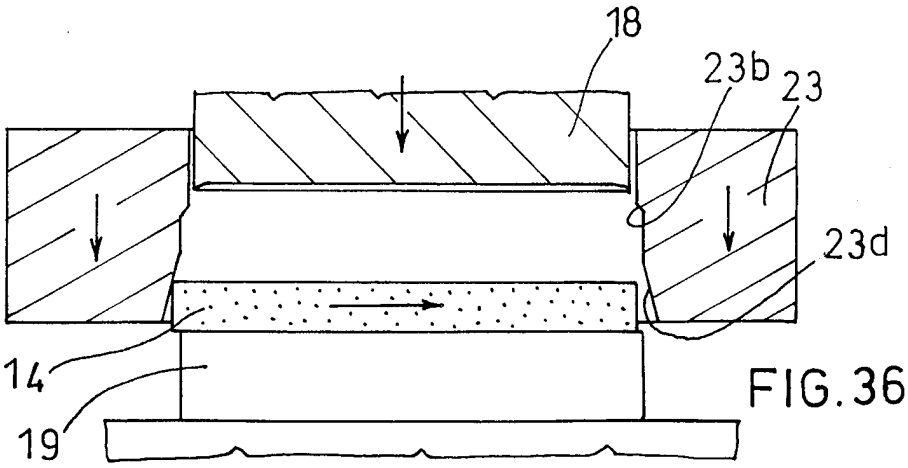


FIG.36

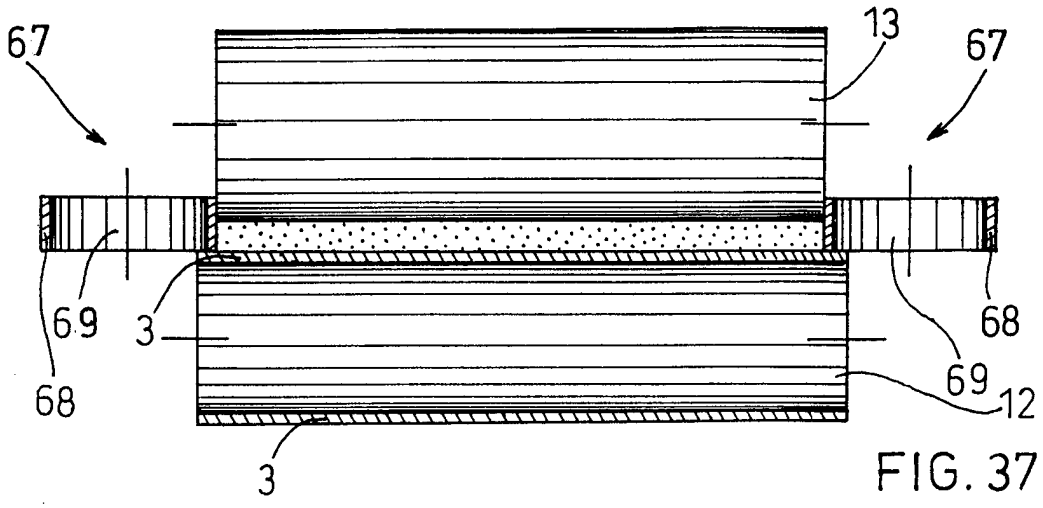


FIG. 37

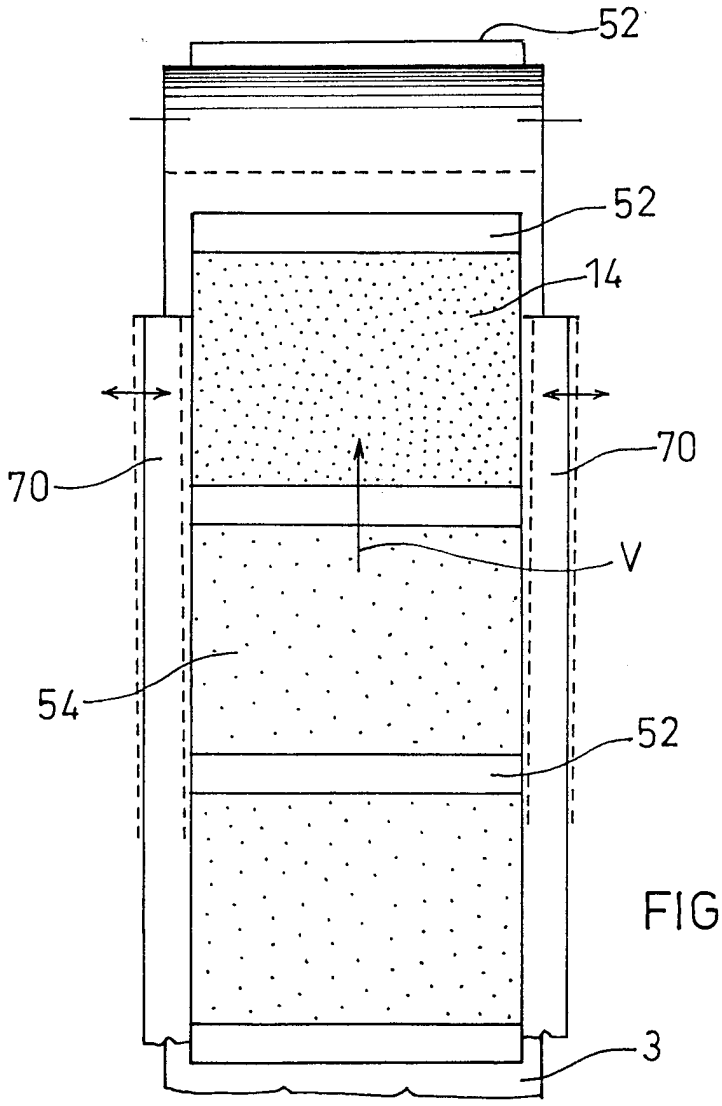


FIG. 39

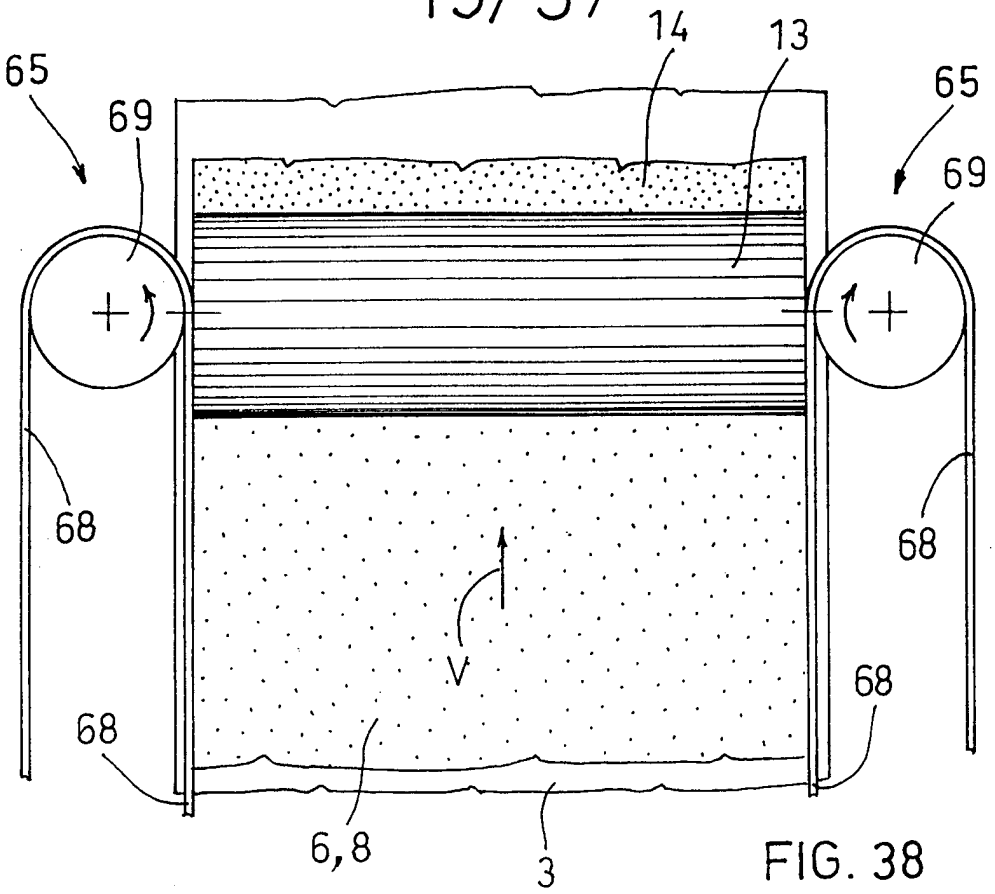


FIG. 38

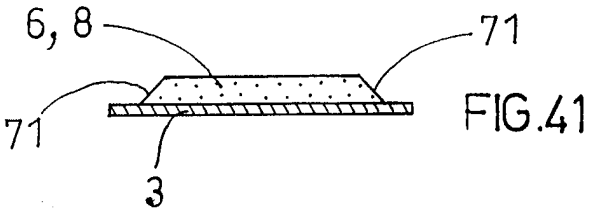


FIG.41

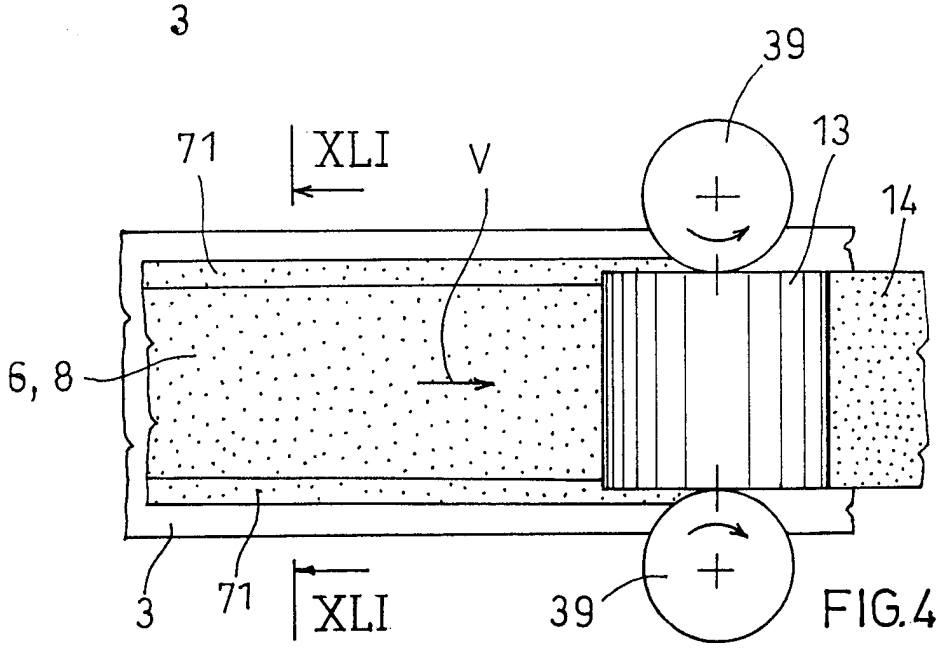


FIG.40

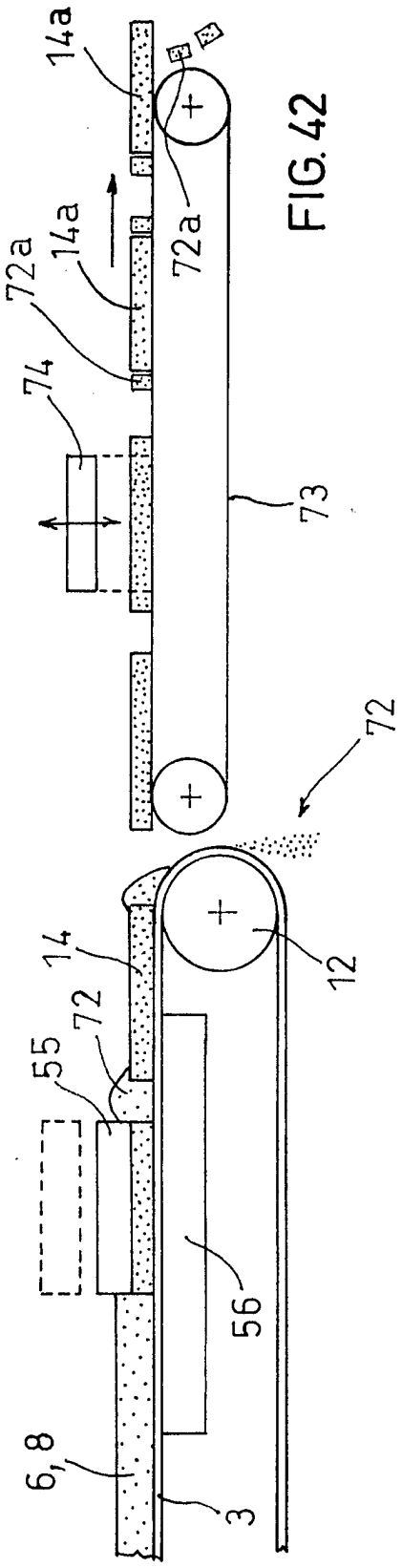

14a
72a
14a
72a
74
73
72
12
14
72
55
56
6,8
3

FIG. 42

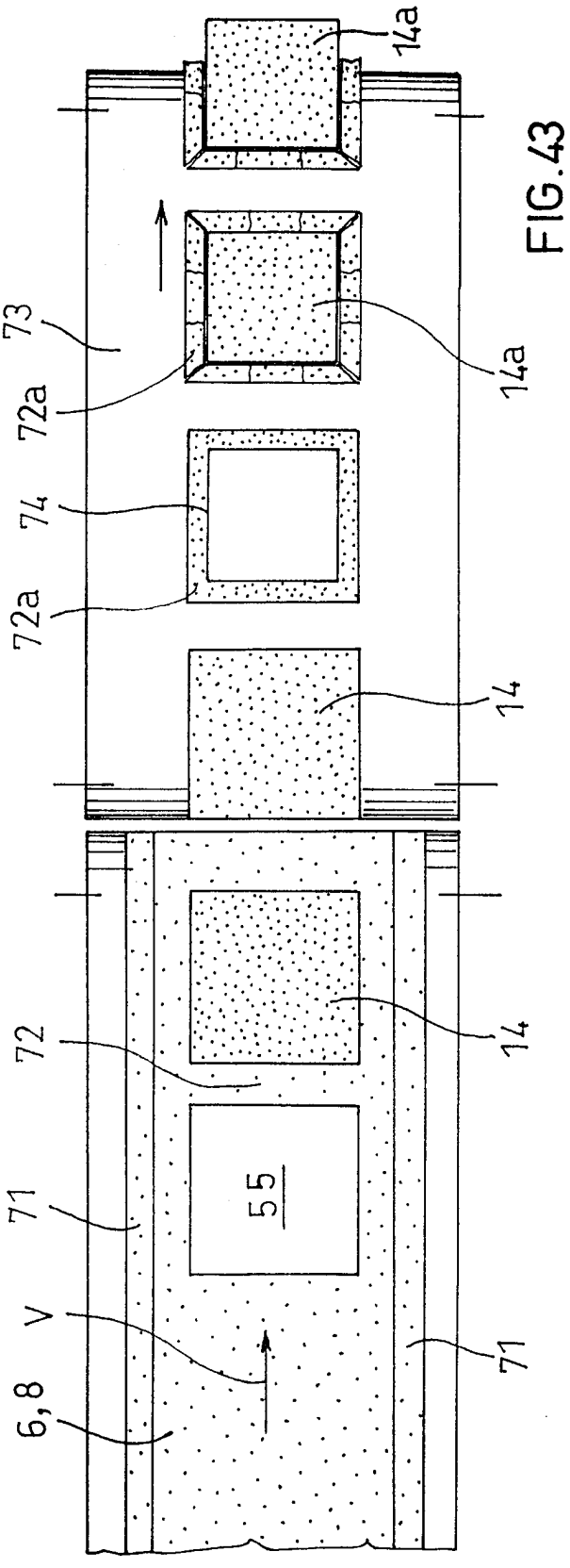

14a
14a
73
72a
74
72a
14
72
14
71
55
V
6,8
71

FIG. 43

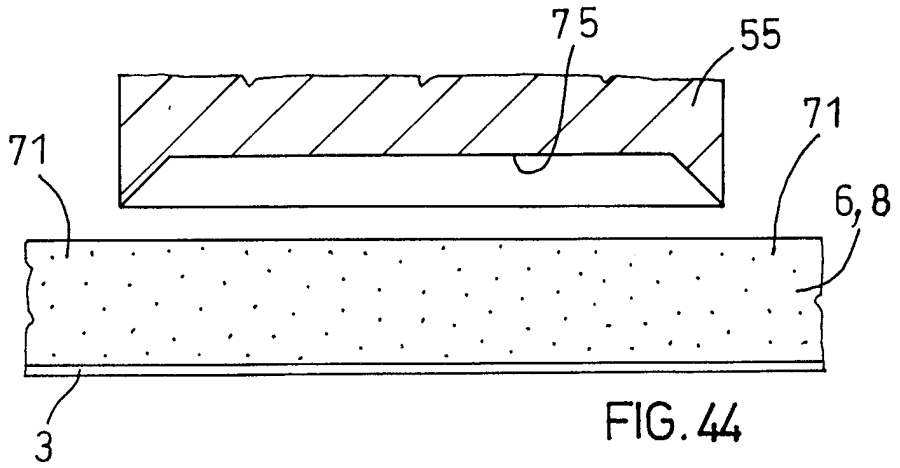


FIG.44

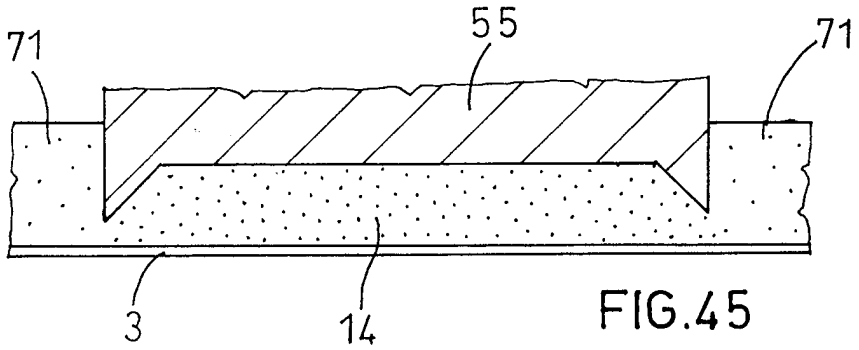


FIG.45

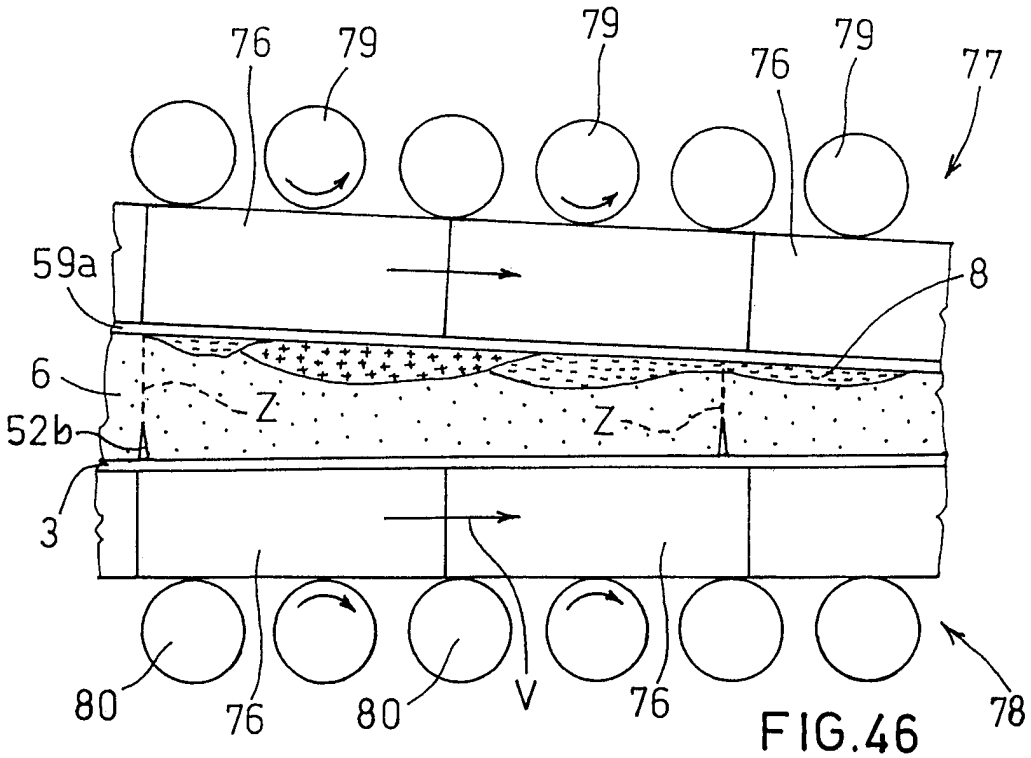


FIG.46

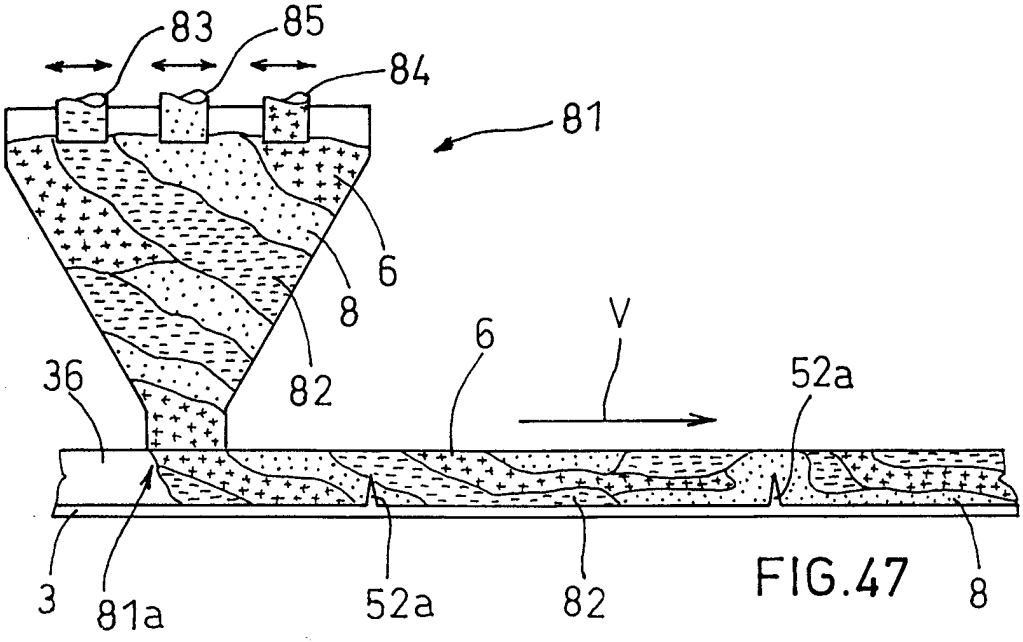


FIG.47

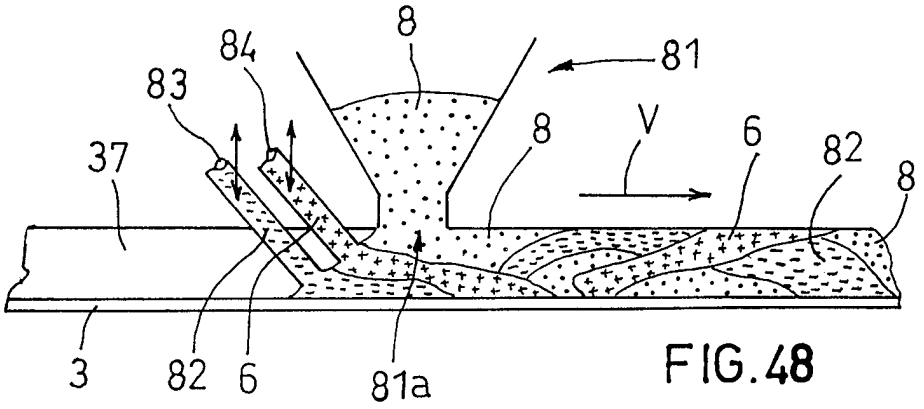


FIG.48

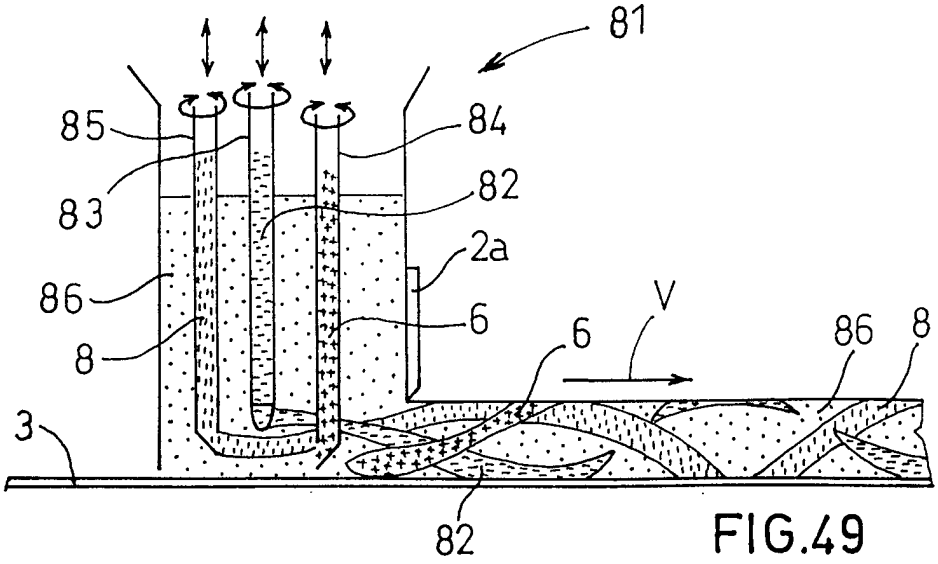


FIG.49

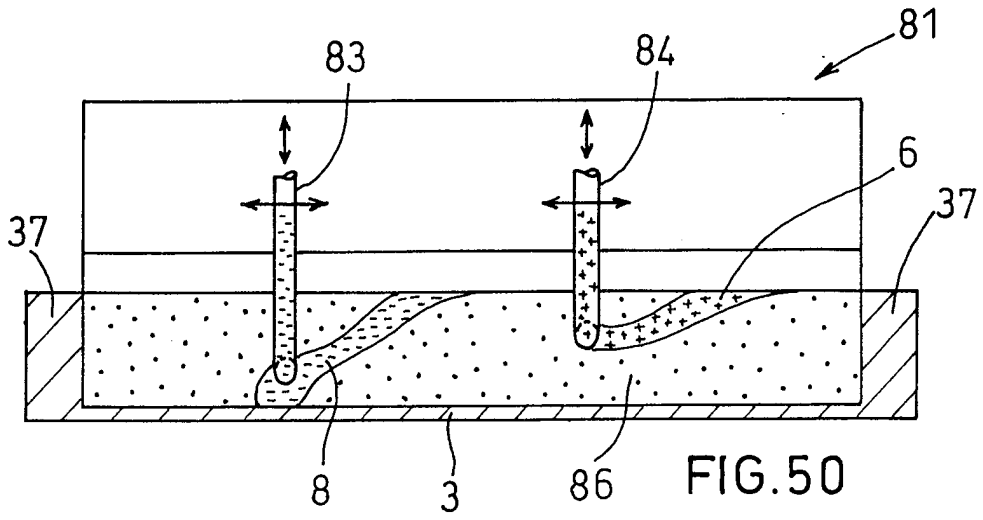


FIG.50

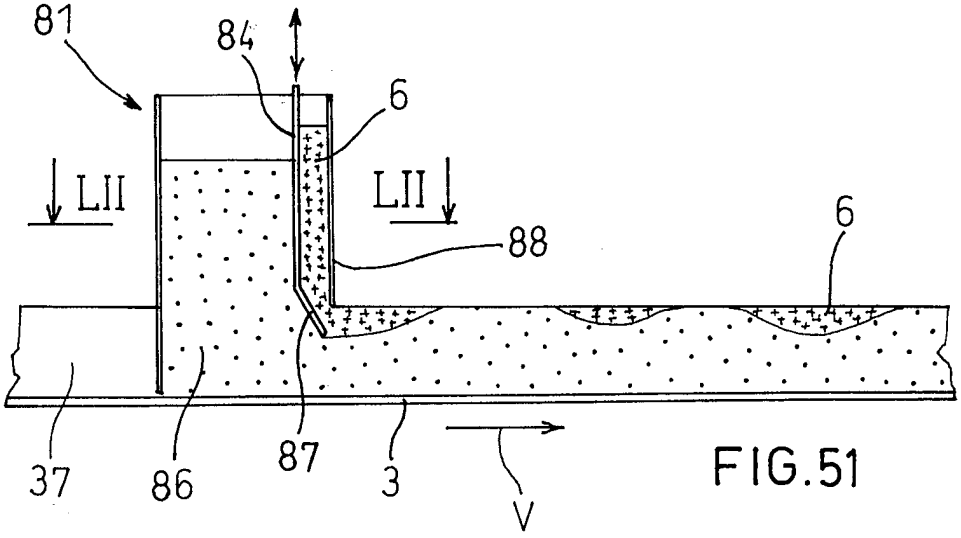


FIG.51

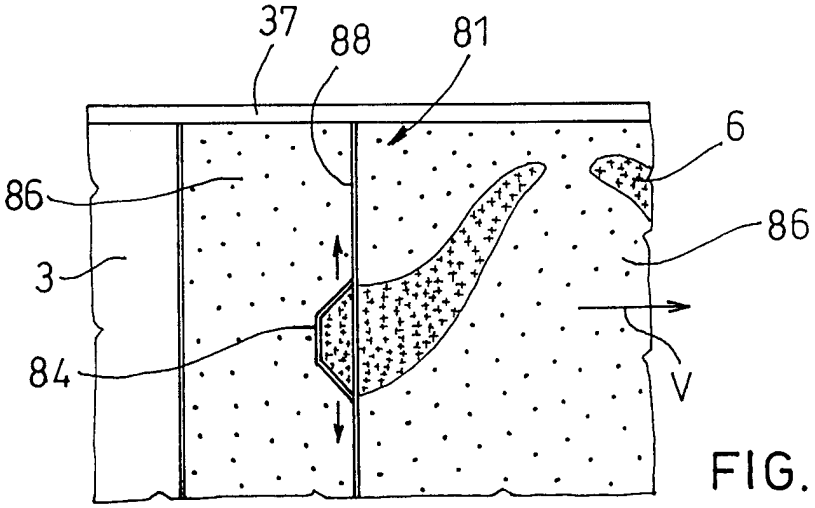


FIG.52

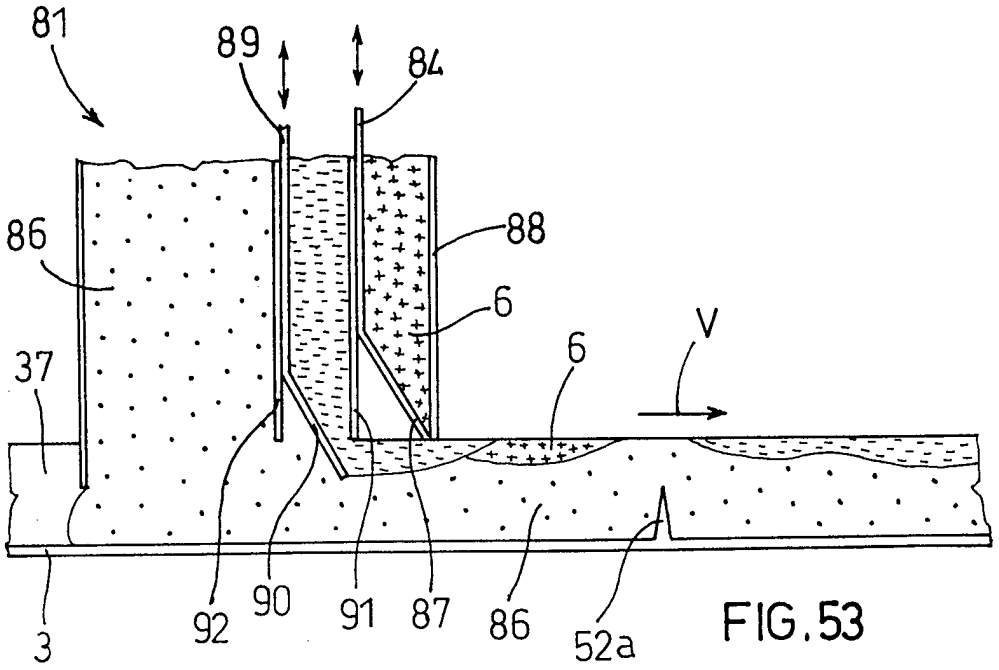

81
89
84
86
88
6
37
6
V
3
92
90
91
87
86
52a

FIG.53

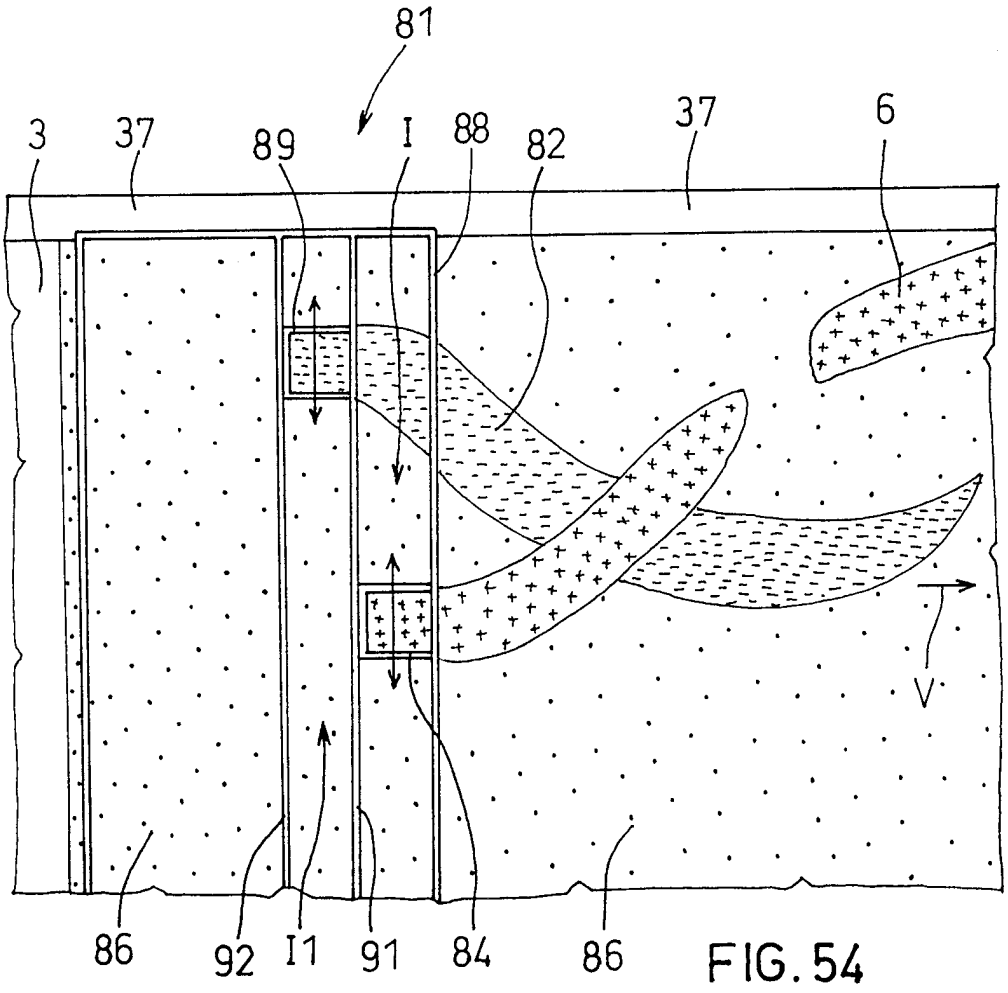

81
3
37
89
I
88
82
37
6
V
86
92
I1
91
84
86

FIG.54

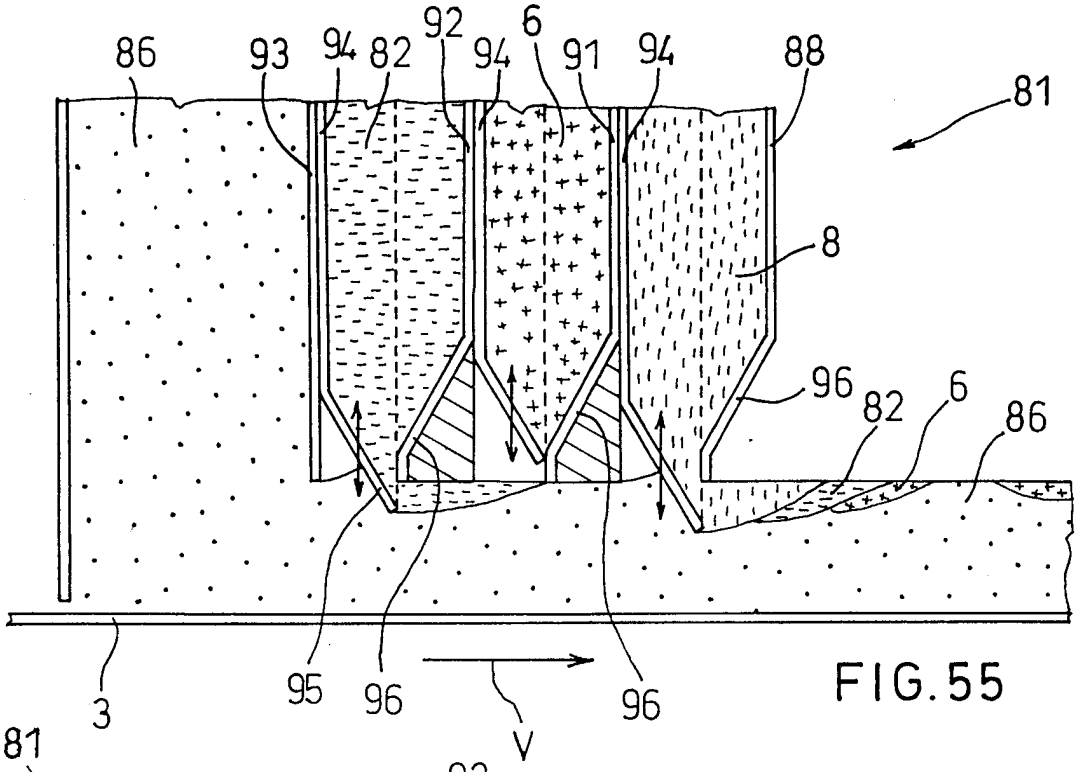

86
93
94
82
92
94
6
91
94
88
81
8
96
82
6
86
3
95
96
V
96

FIG.55

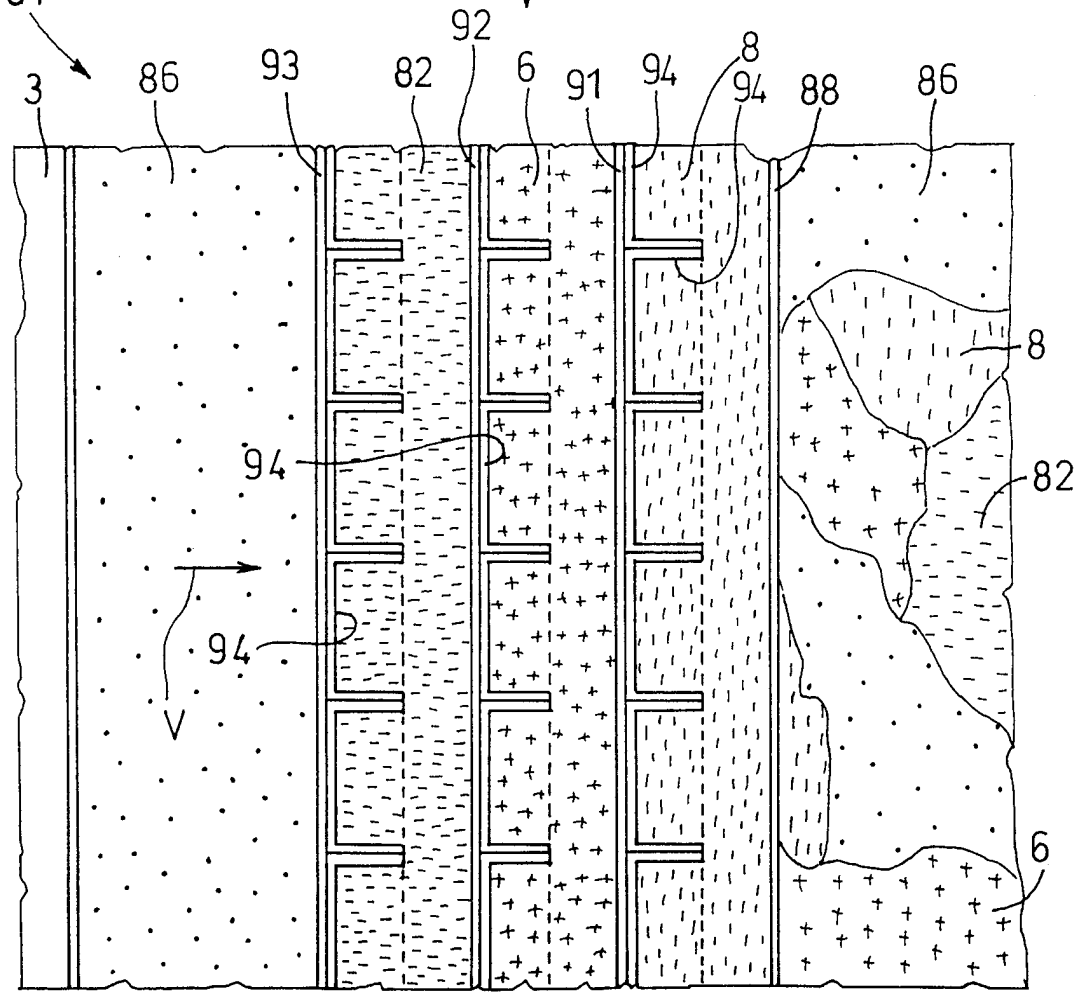

81
3
86
93
82
92
6
91
94
8
94
88
86
8
94
82
94
V
6

FIG.56

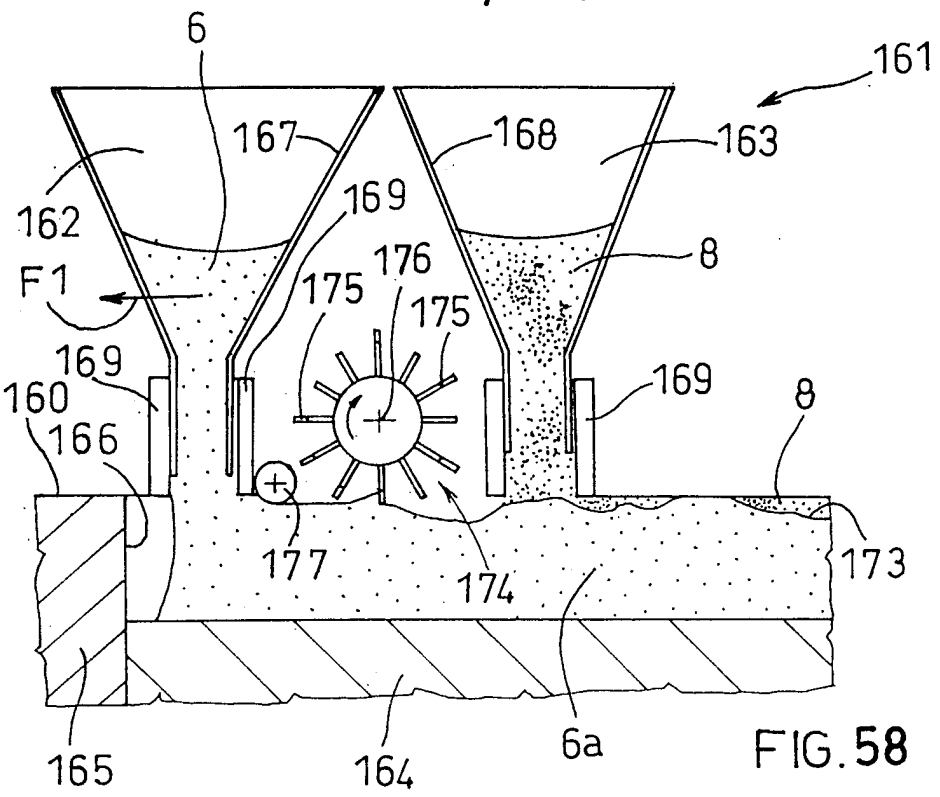

6
161
167
168
163
162
169
8
F1
175
176
175
169
169
160
8
166
177
174
173
165
164
6a

FIG. 58

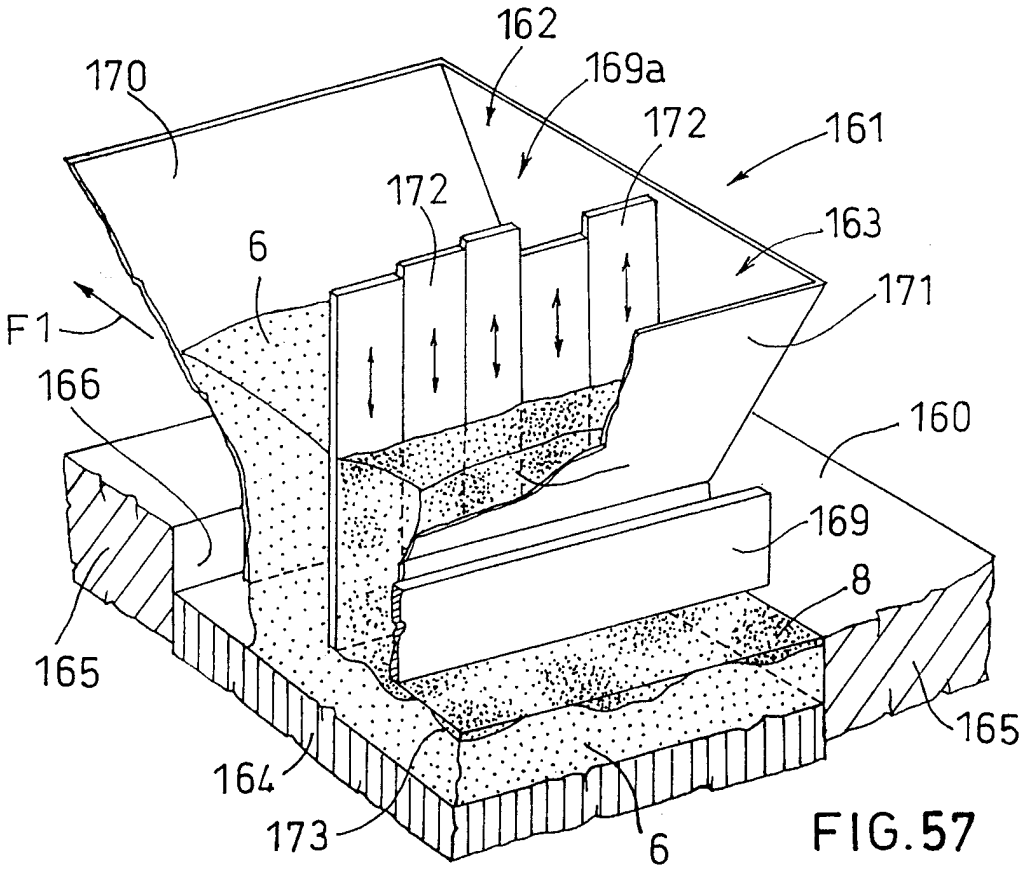

162
170
169a
172
161
172
163
6
171
F1
166
160
169
8
165
165
164
173
6

FIG. 57

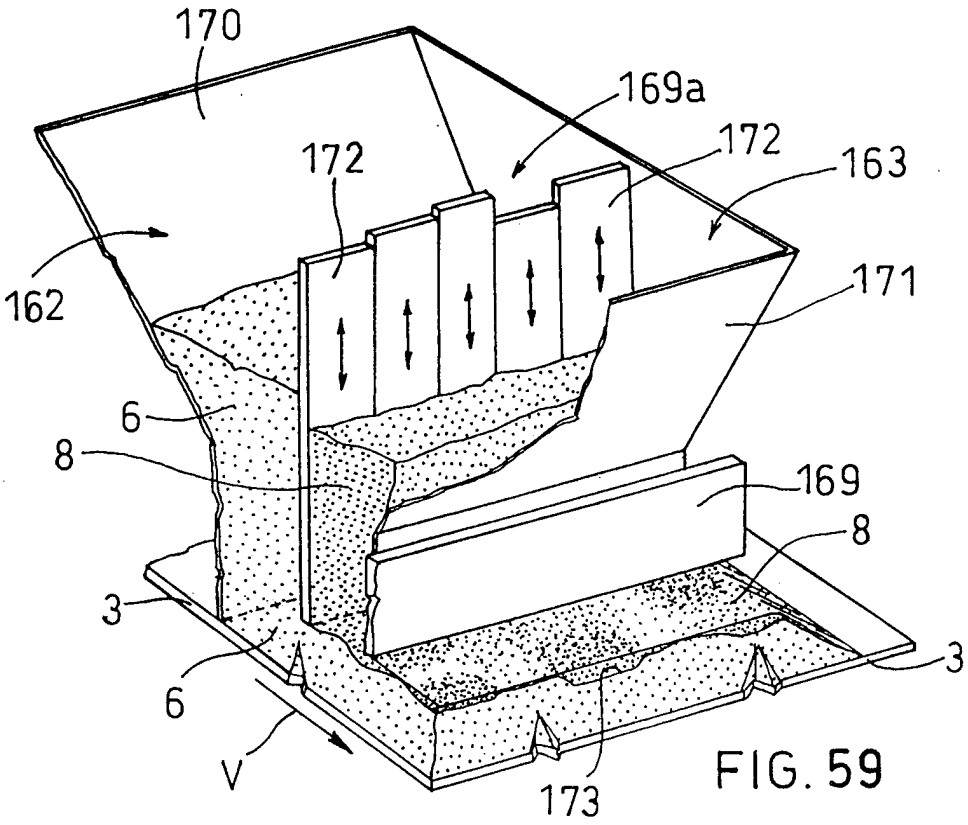

170
169a
172
172
163
162
171
6
8
169
8
3
3
6
V
173

FIG. 59

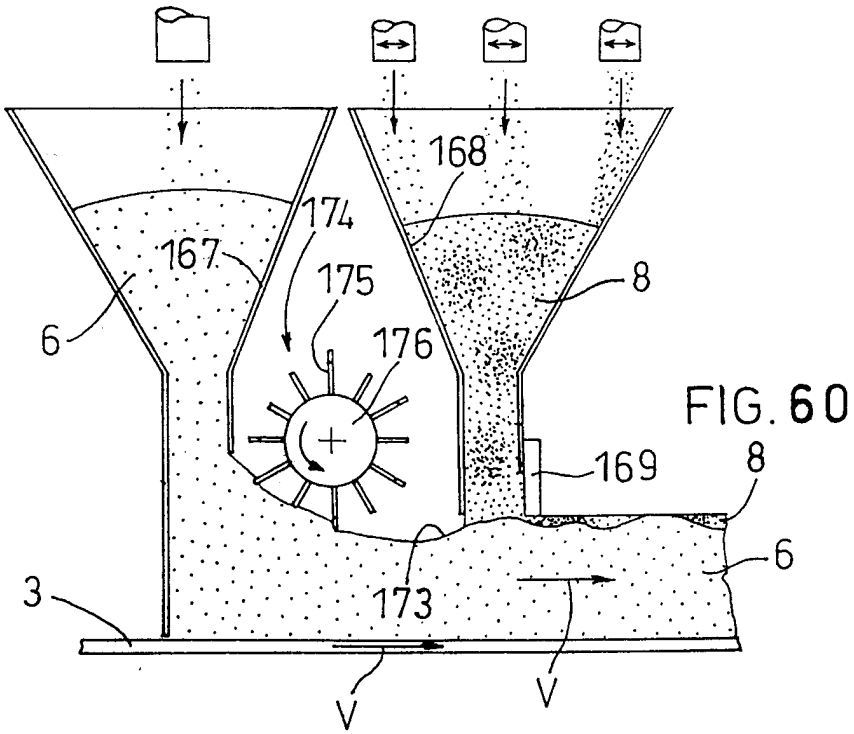

168
174
167
175
8
6
176
169
8
6
3
173
V
V

FIG. 60

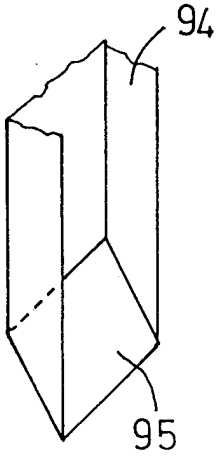


FIG. 56A

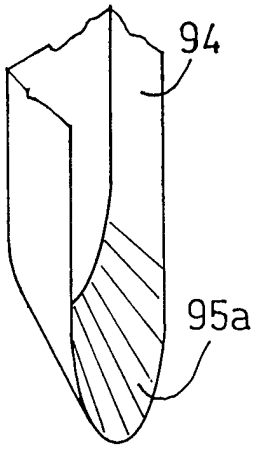


FIG. 56B

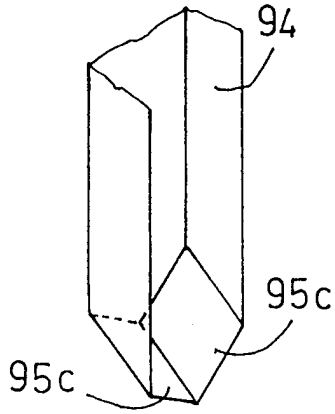


FIG. 56C

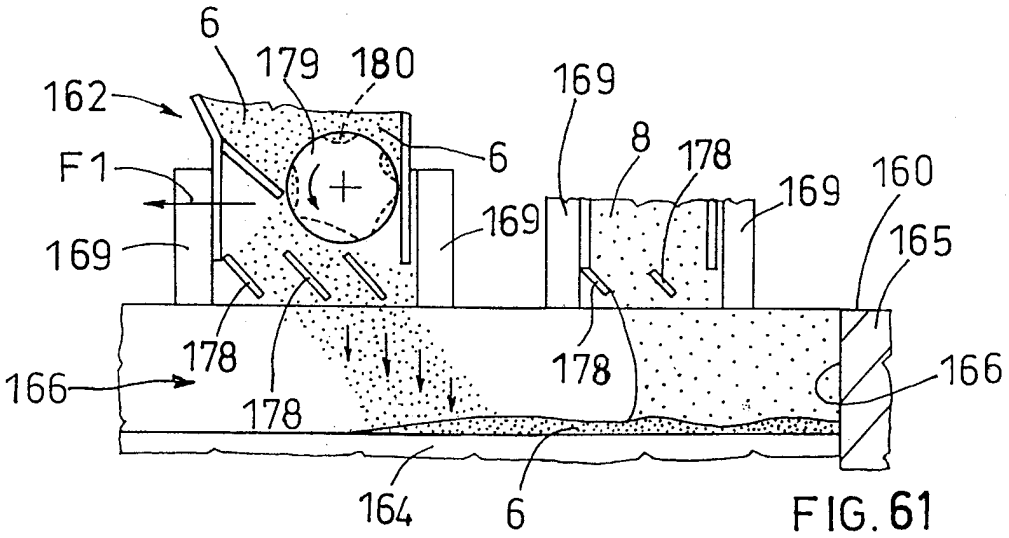


FIG. 61

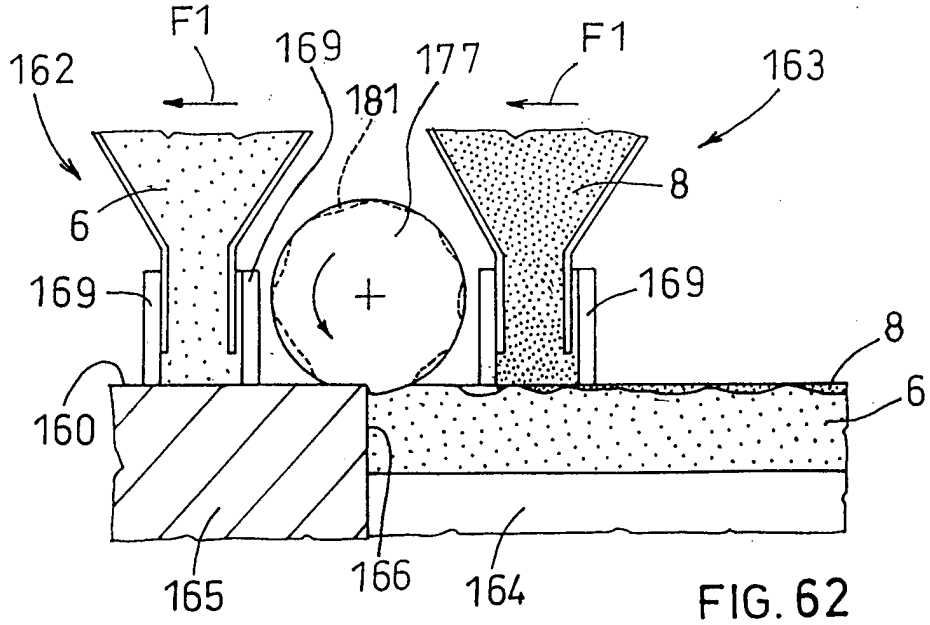


FIG. 62

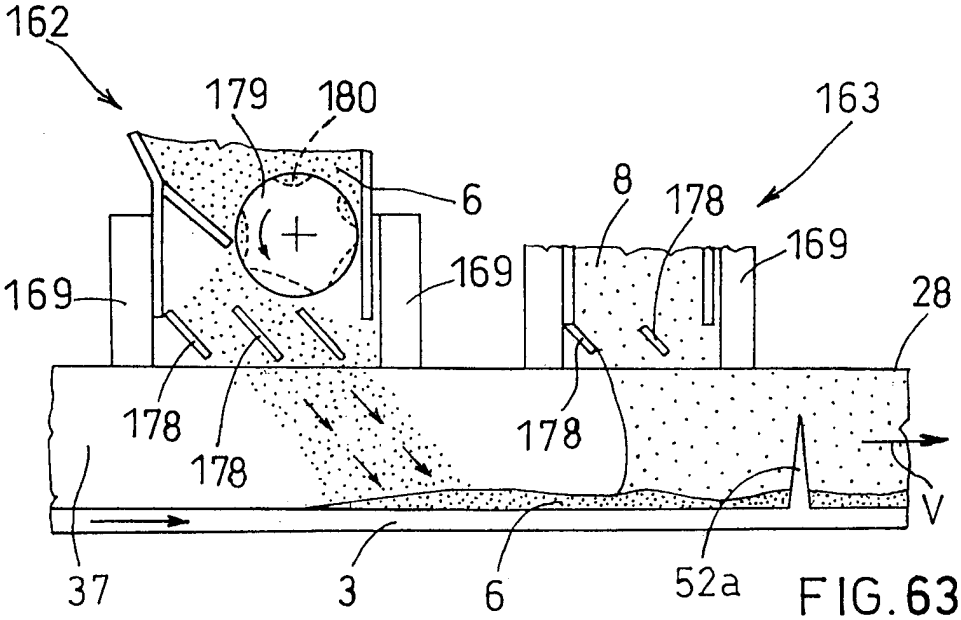

162
179
180
163
6
8
178
169
169
169
28
178
178
178
V
37
3
6
52a

FIG.63

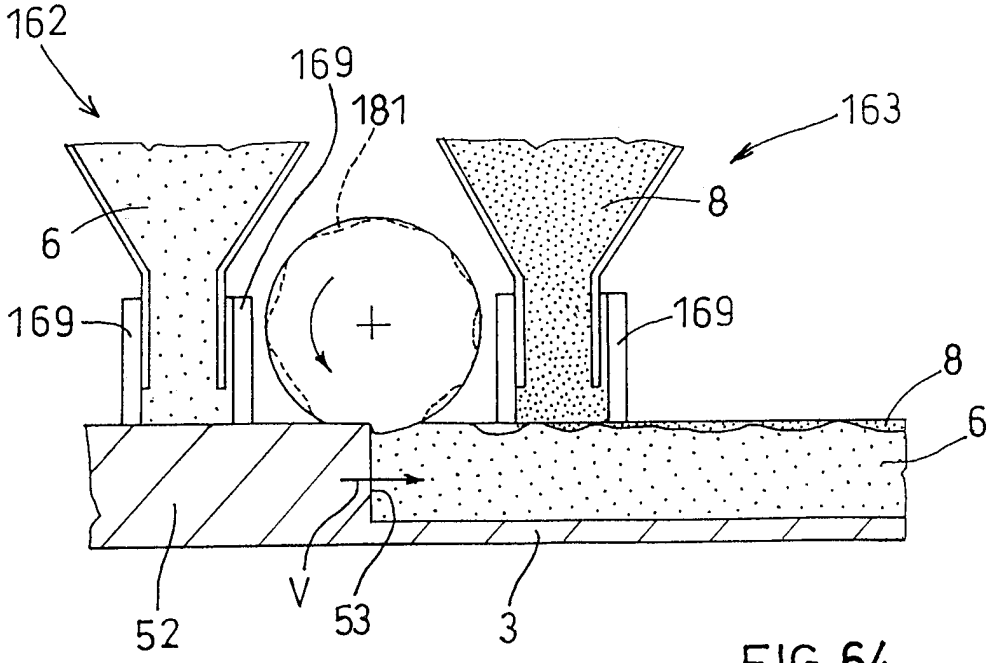

162
169
181
163
8
6
169
169
8
6
V
53
3
52

FIG.64

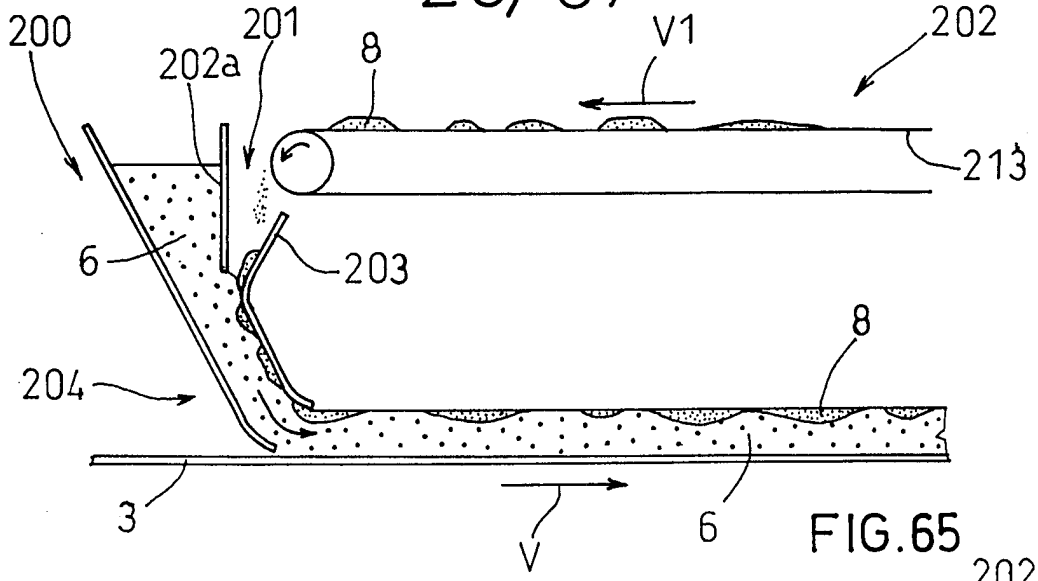


FIG.65

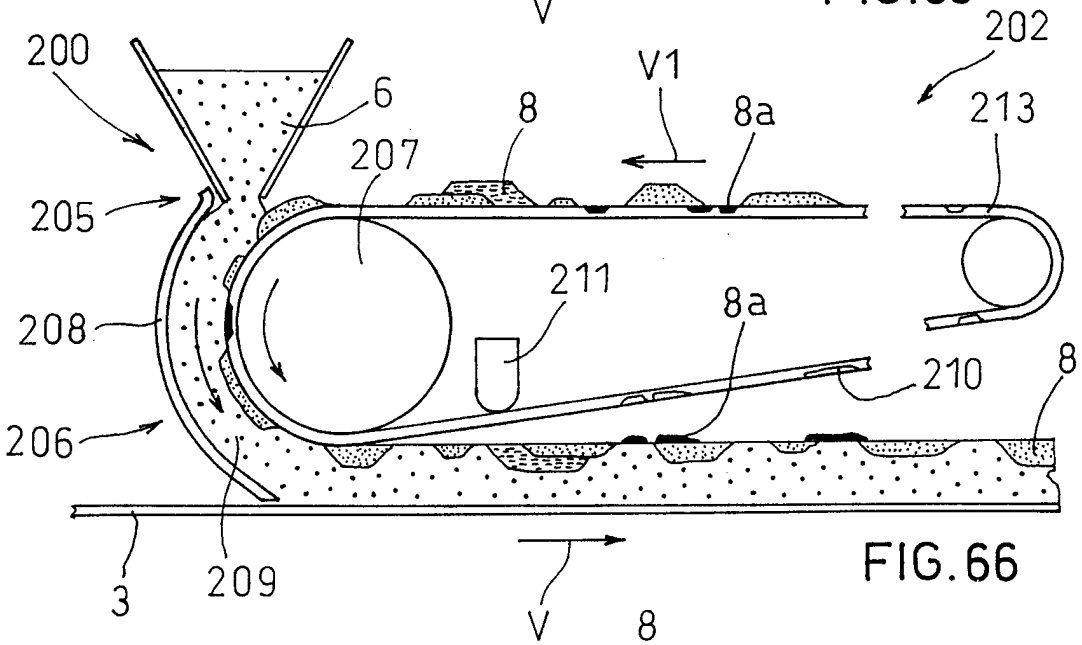


FIG.66

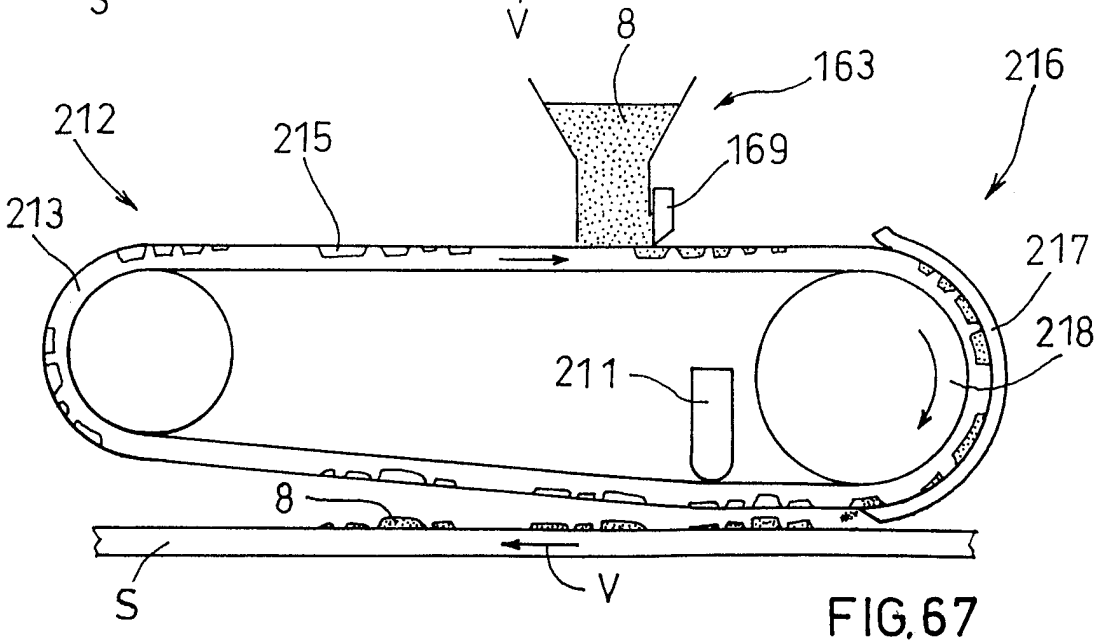


FIG.67

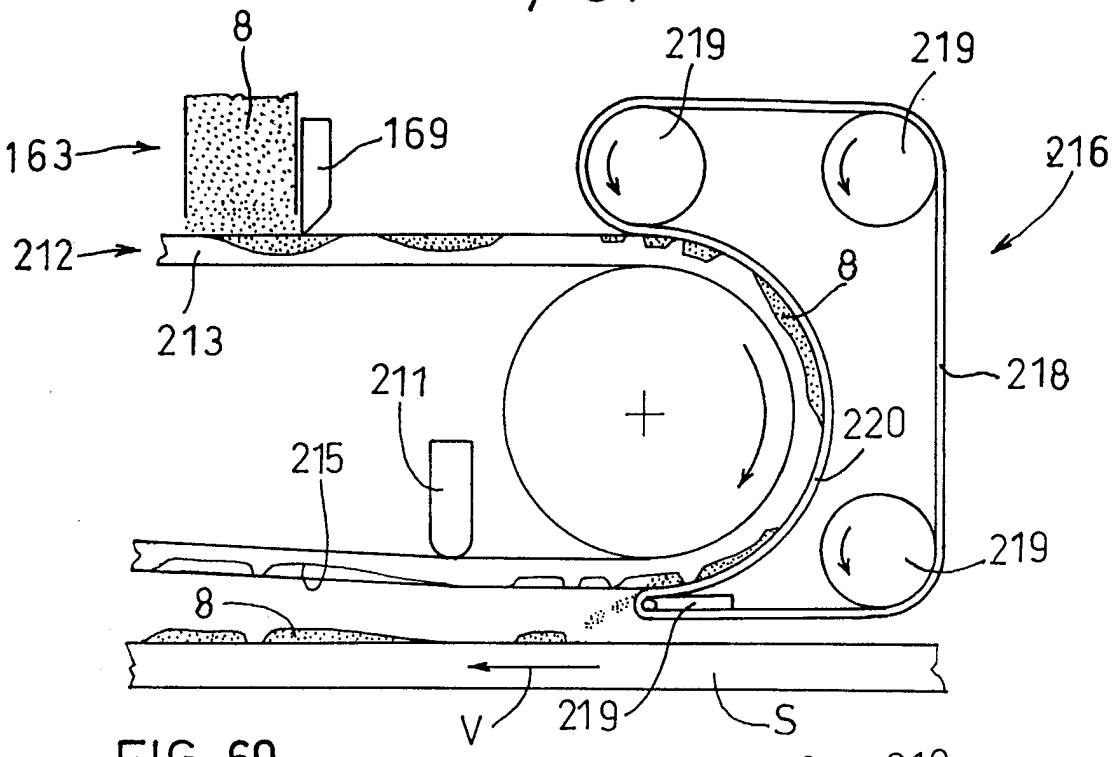

8
219
219
163
169
216
212
8
213
218
211
220
215
219
8
V
219
S

FIG. 69

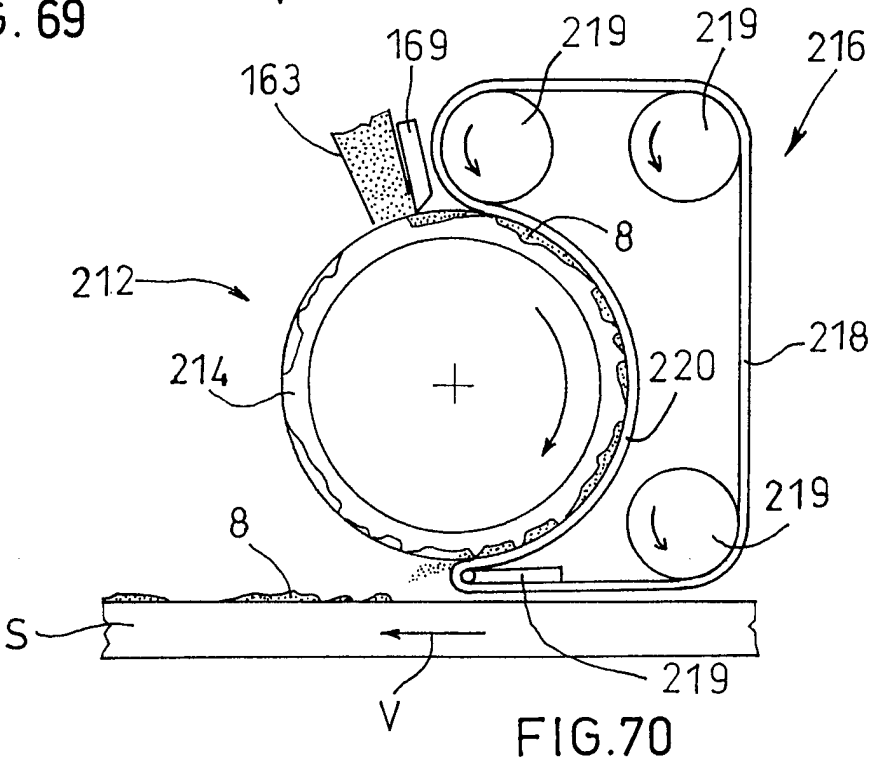

169
219
219
216
163
8
212
218
214
220
219
8
S
219
V

FIG.70

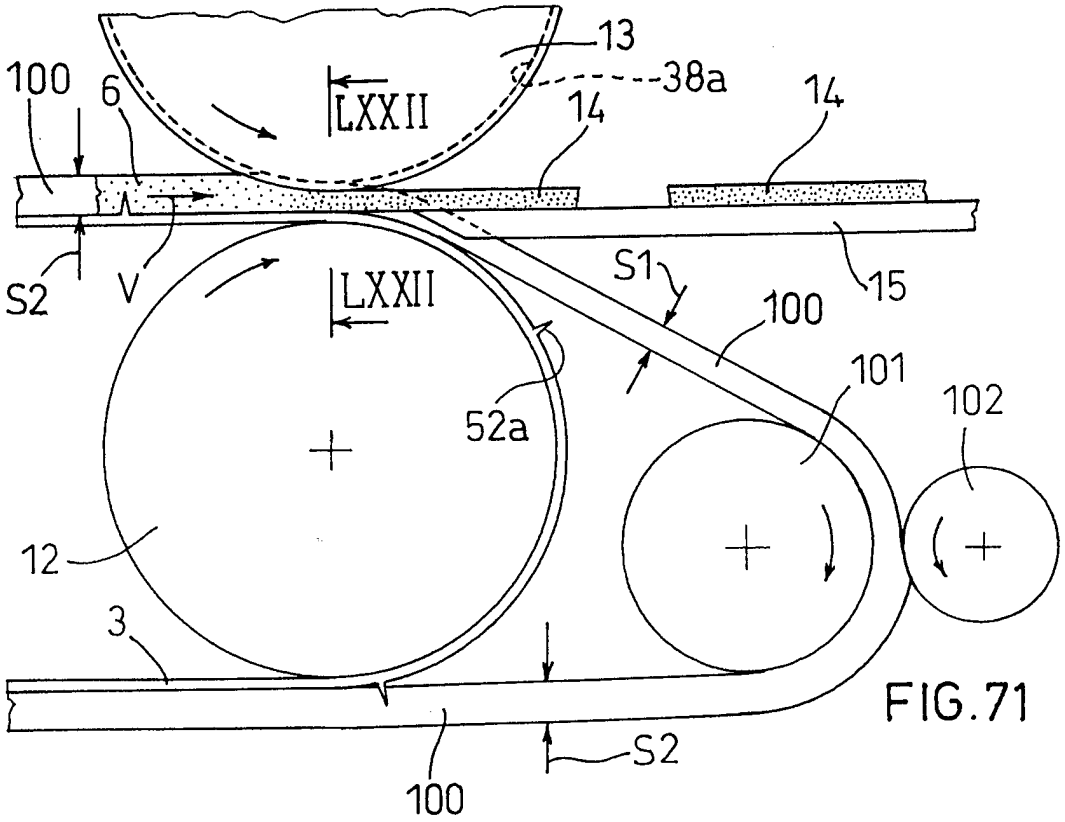


FIG.71

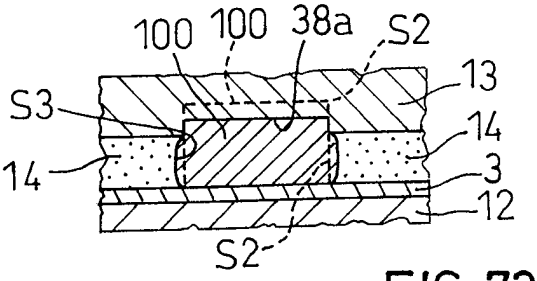


FIG.72

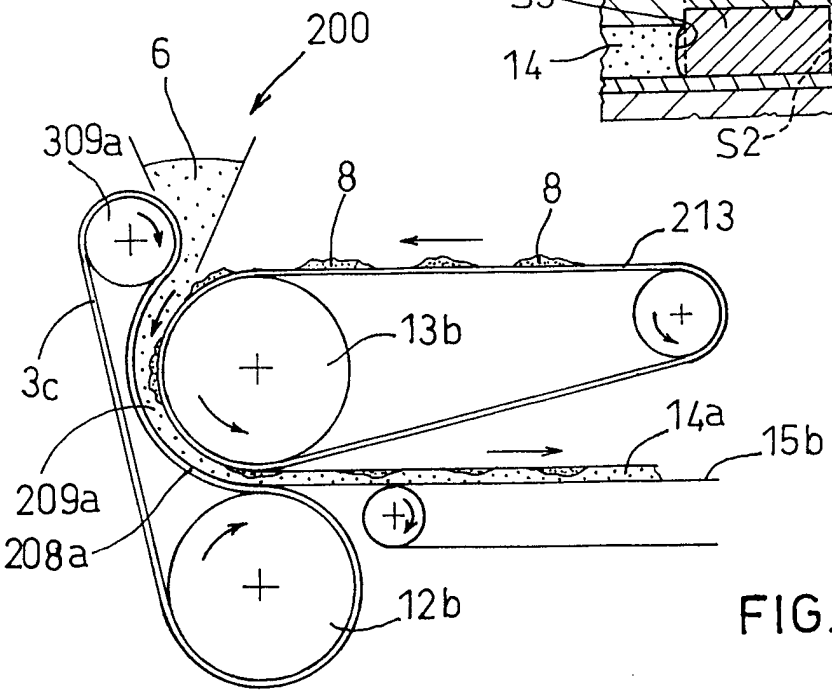


FIG.73

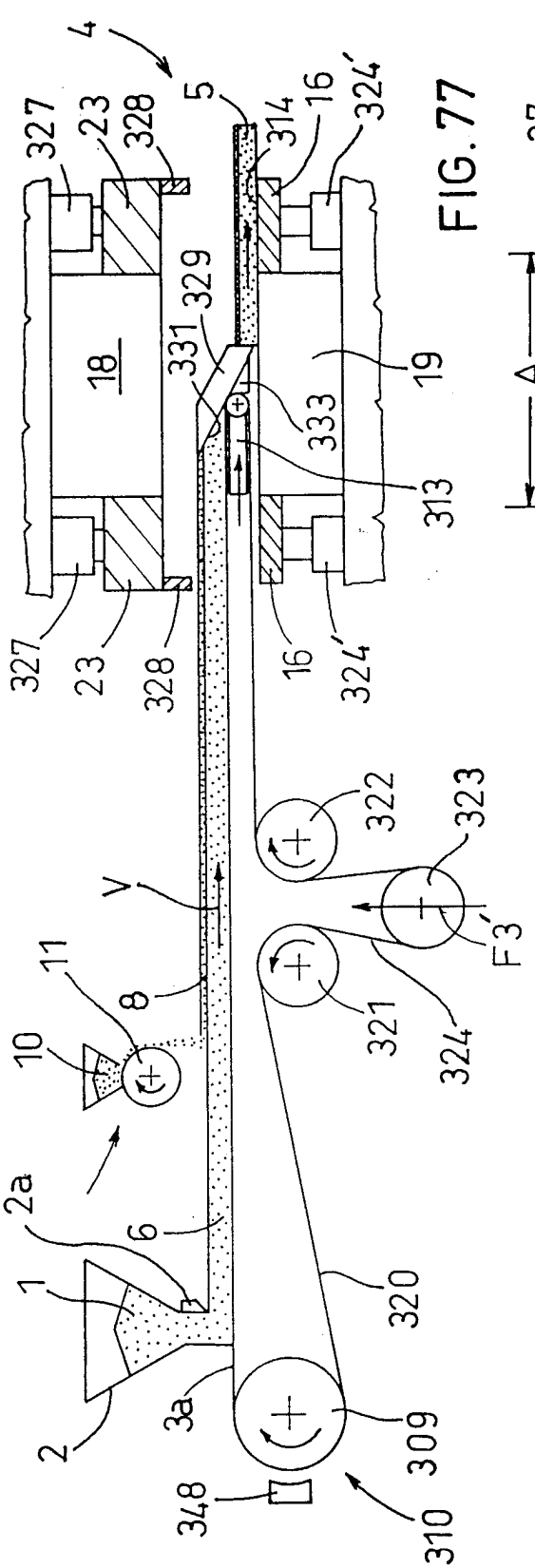

4
5
327
23
328
314
16
324'
329
331
333
18
19
313
322
323
F3'
V
11
8
10
321
324
2a
6
1
320
2
3a
309
348
310

FIG. 77

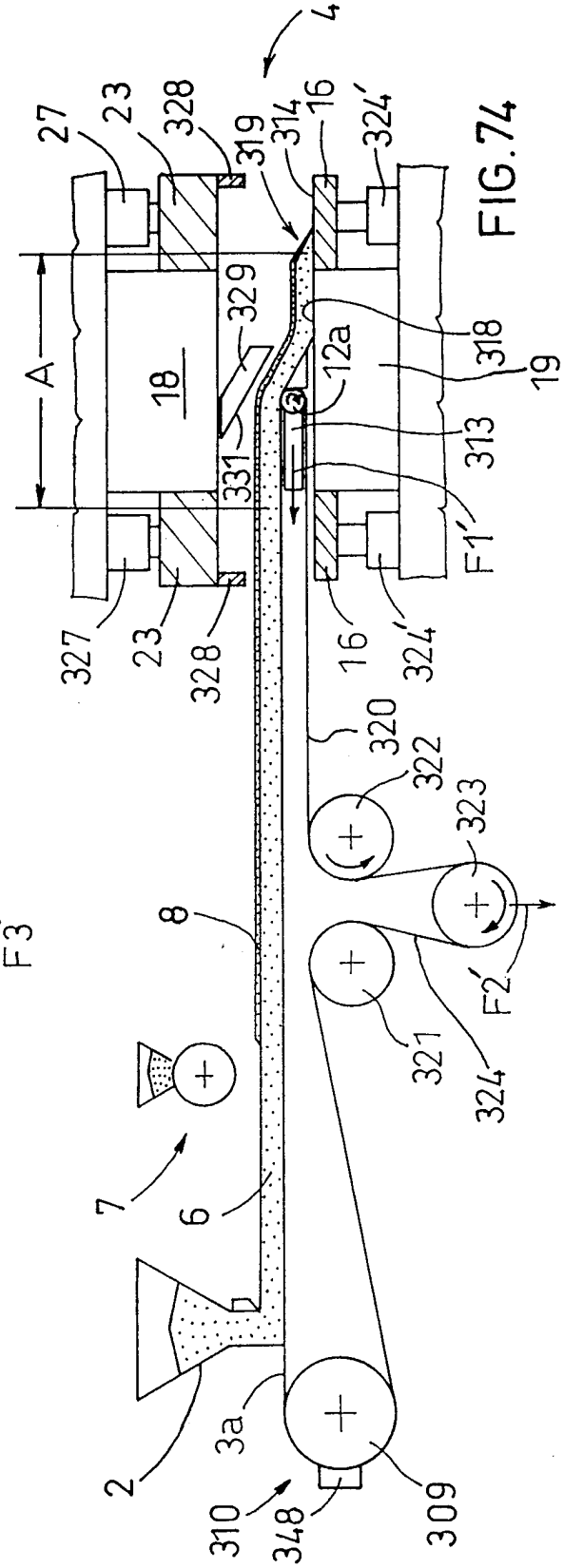

4
27
23
328
319
314
16
324'
329
A
18
12a
318
19
331
313
F1'
322
323
F2'
320
8
7
6
321
324
2
3a
310
348
309

FIG. 74

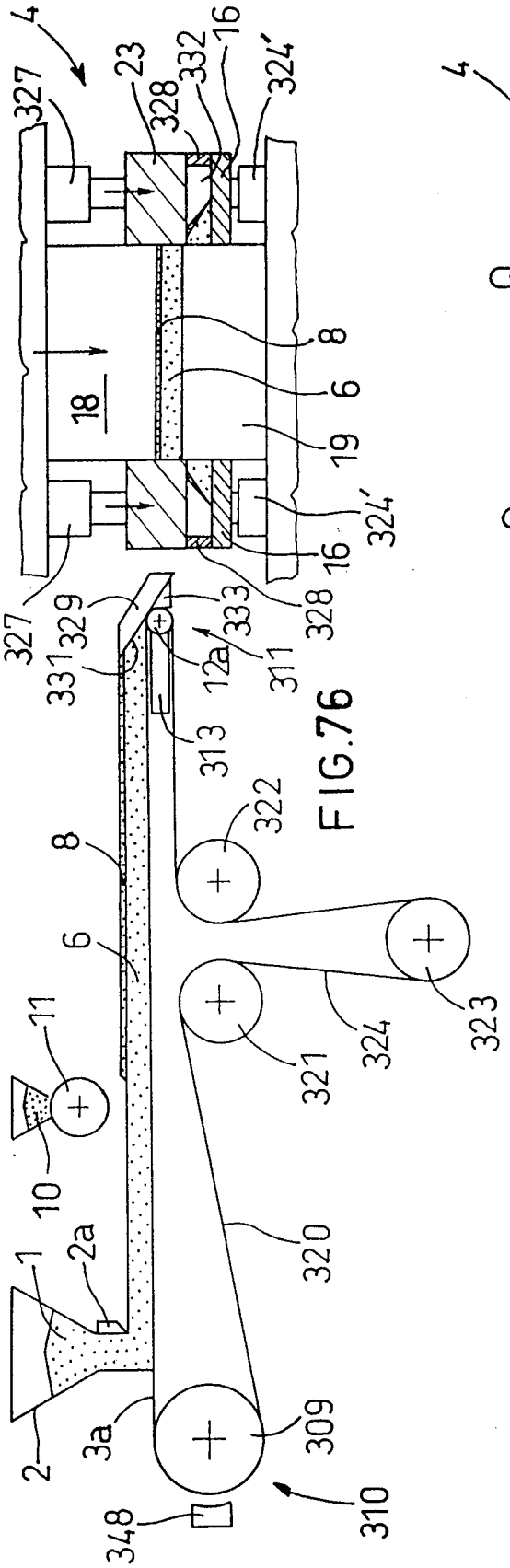

4
327
23
328
332
16
324'
18
8
6
19
324'
16
327
329
331
333
328
311
12a
313
322
8
6
11
10
1
2a
2
3a
348
309
310
320
321
324
323

FIG.76

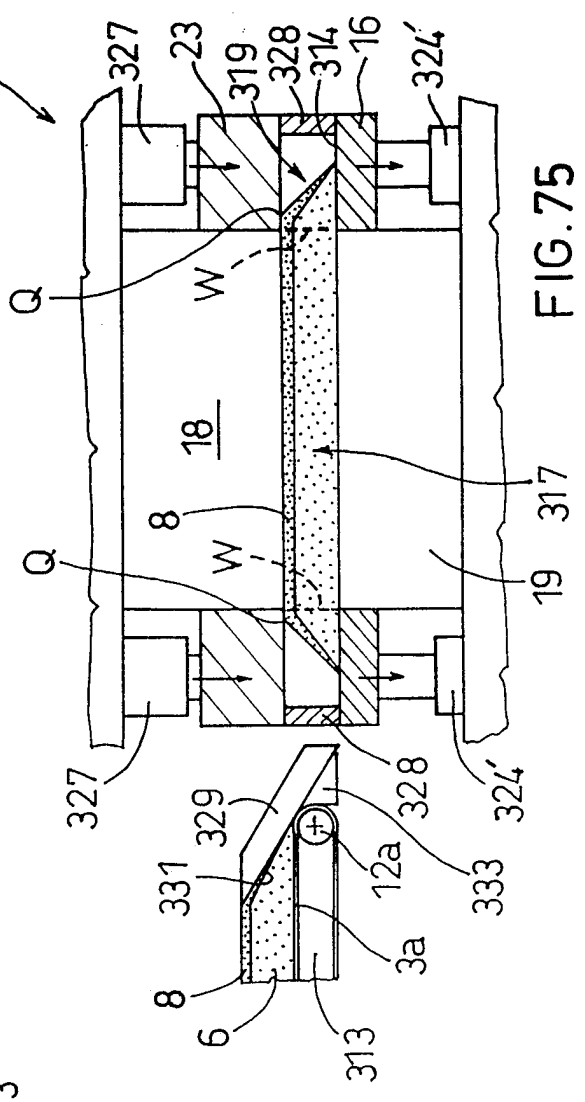

4
327
23
319
328
314
16
324'
Q
W
18
8
317
19
Q
W
327
328
324'
329
331
333
12a
3a
8
6
313

FIG.75

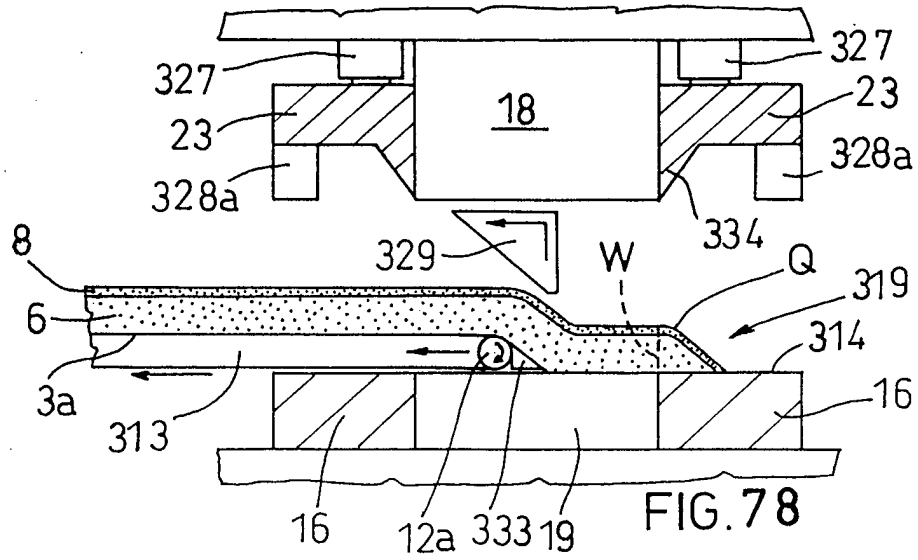


FIG.78

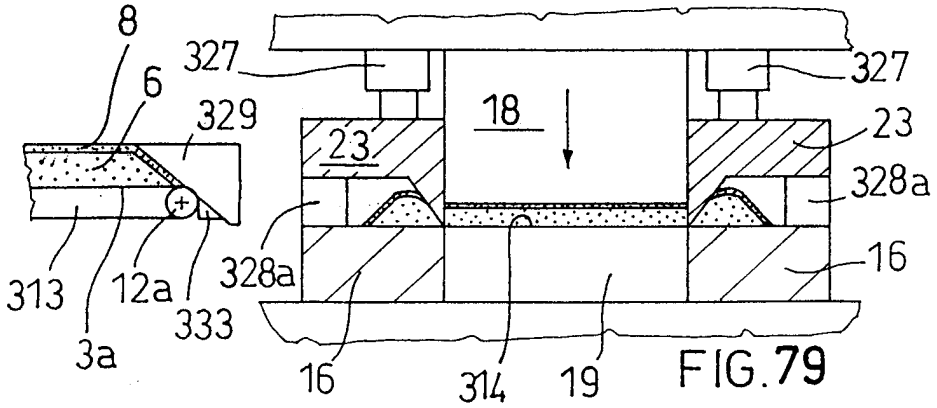


FIG.79

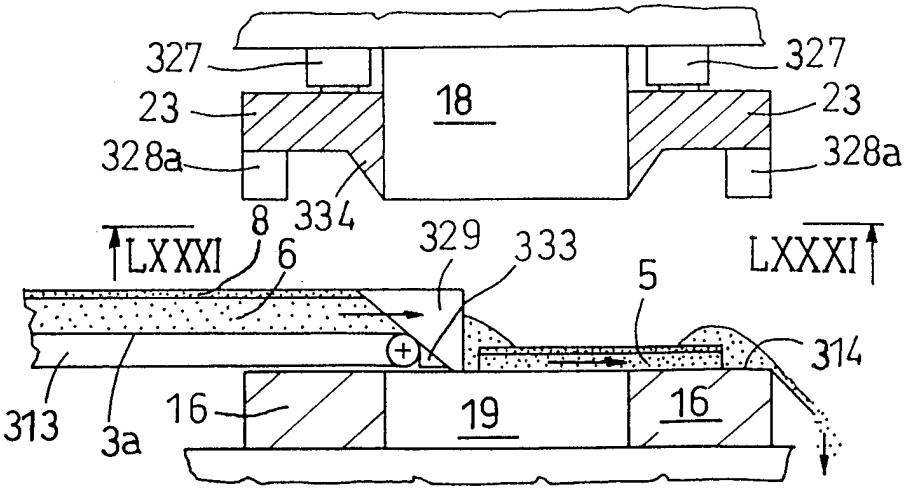


FIG.80

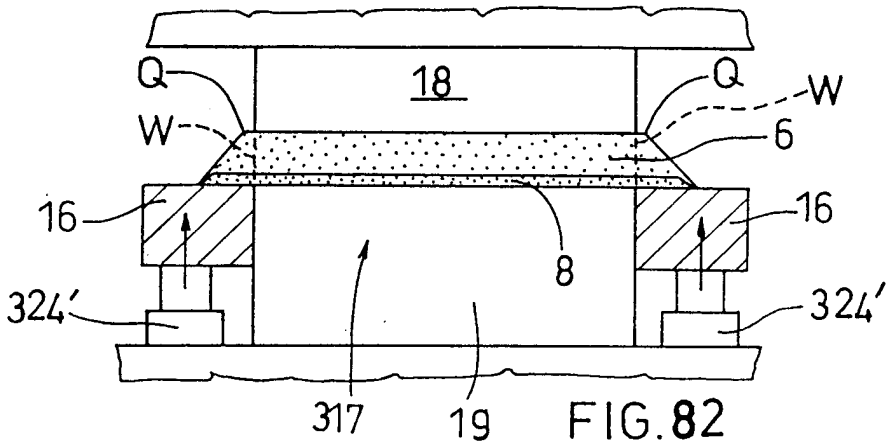


FIG.82

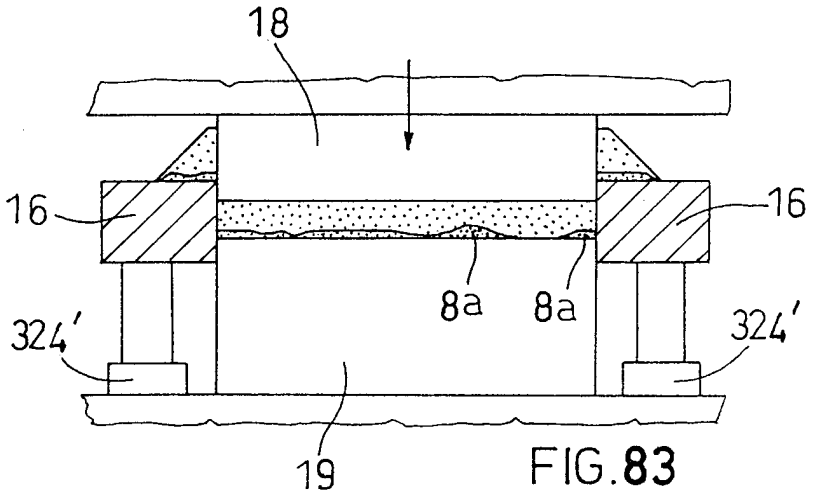


FIG.83

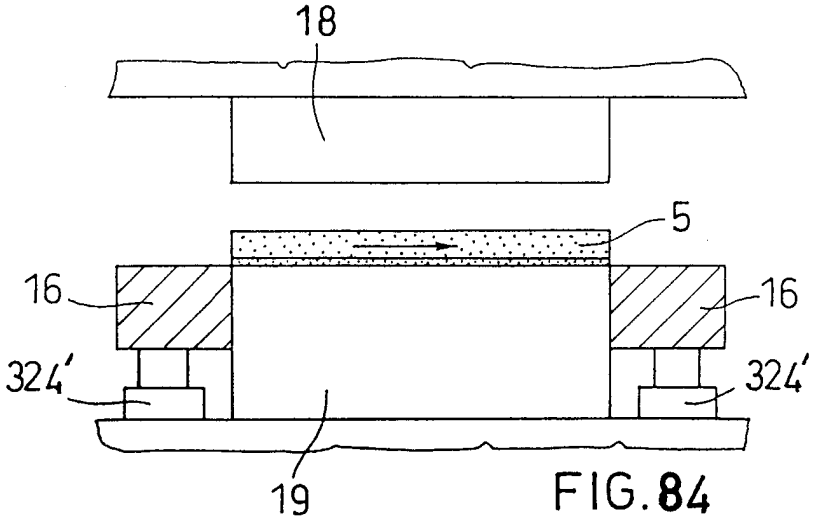


FIG.84

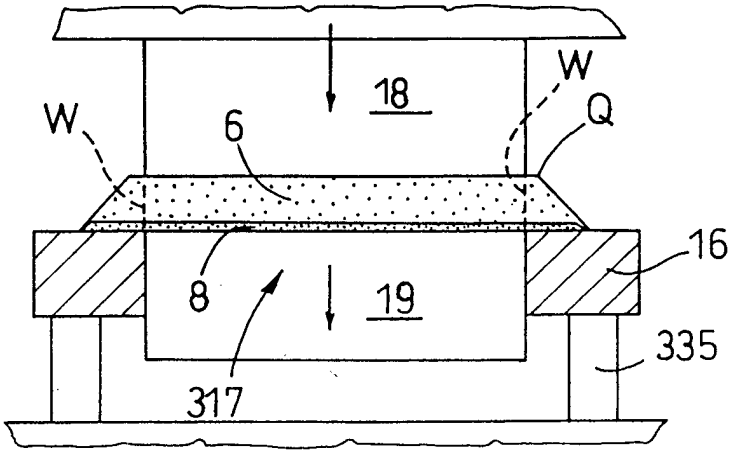


FIG.85

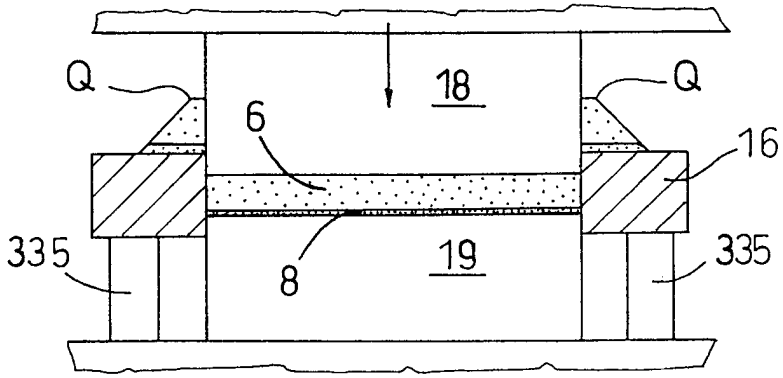


FIG.86

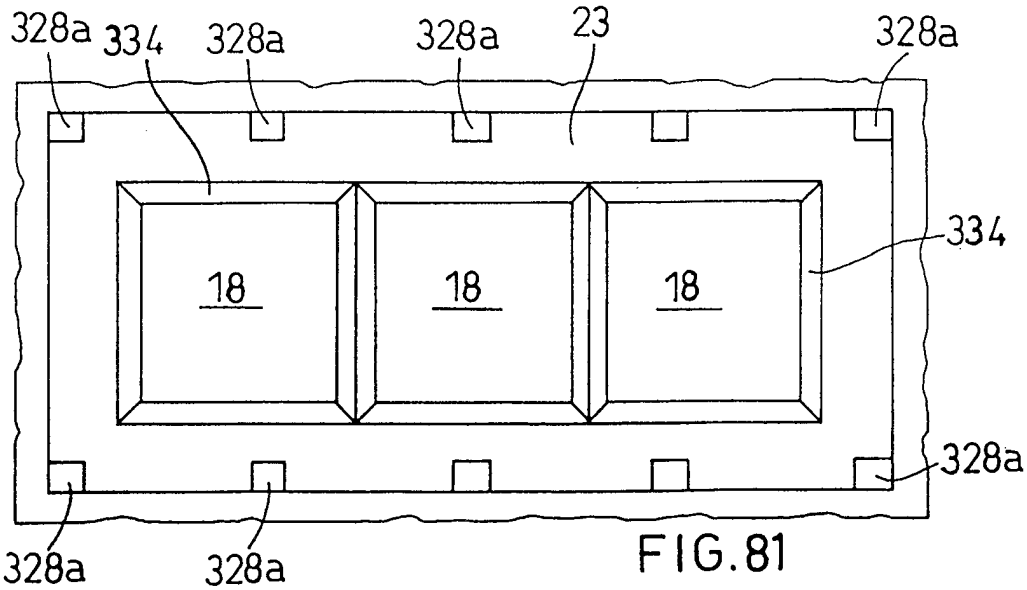


FIG.81

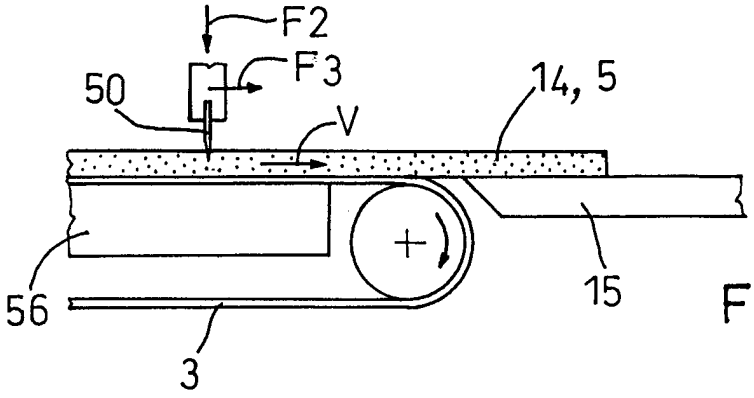


FIG.97

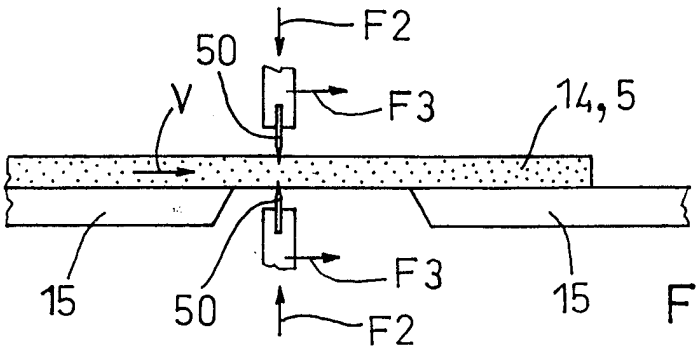


FIG.98

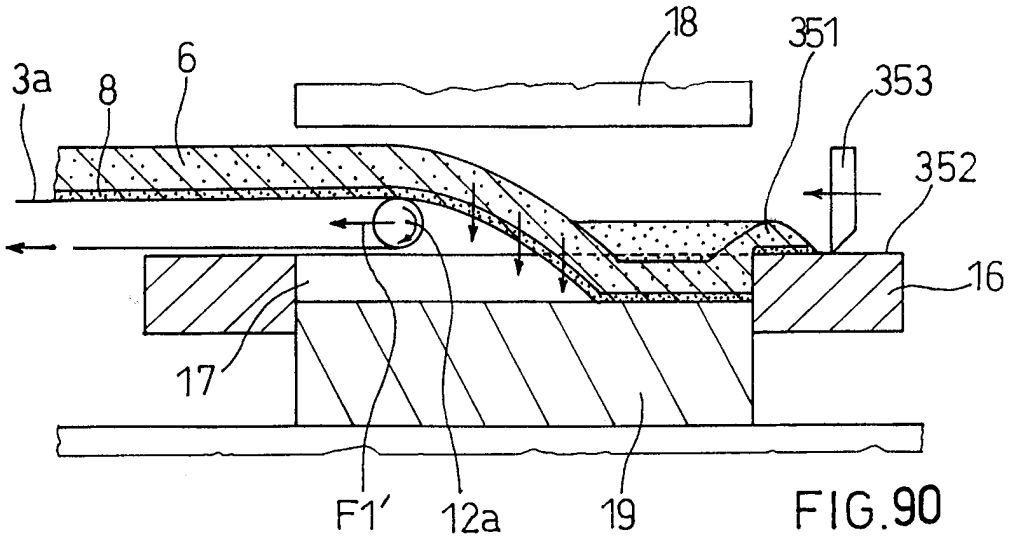


FIG.90

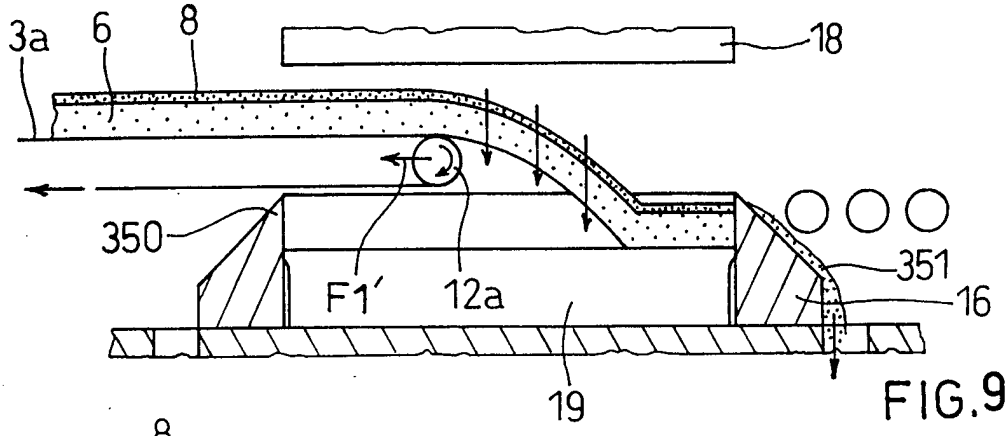


FIG.91

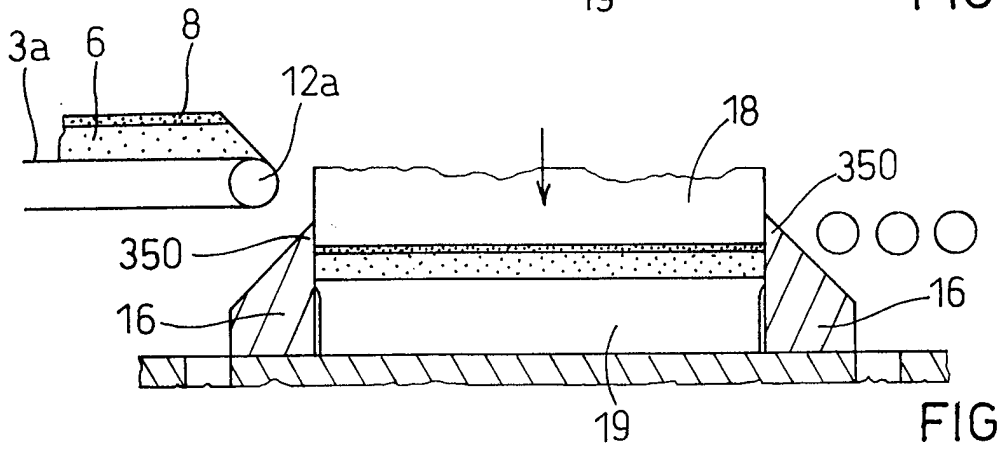


FIG.92

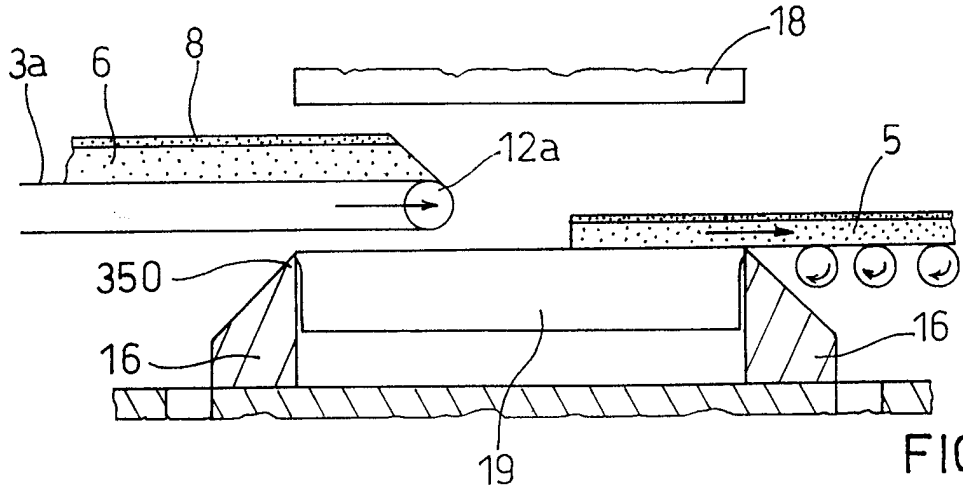


FIG.93

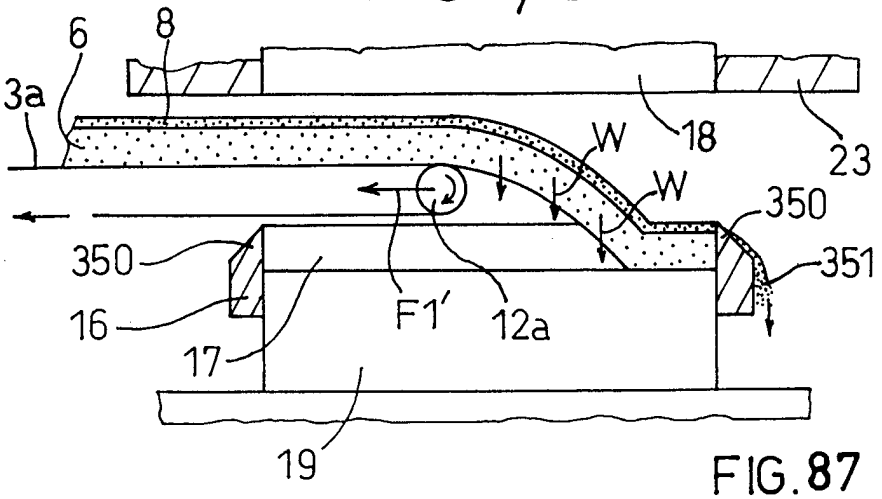


FIG.87

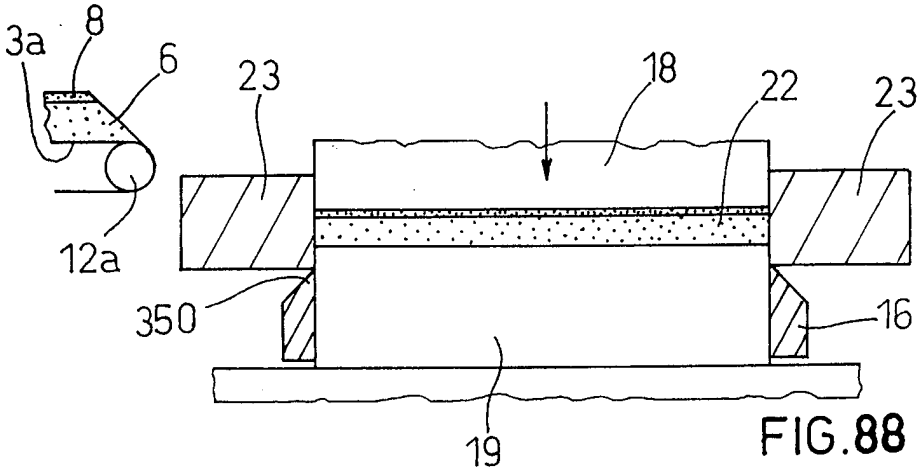


FIG.88

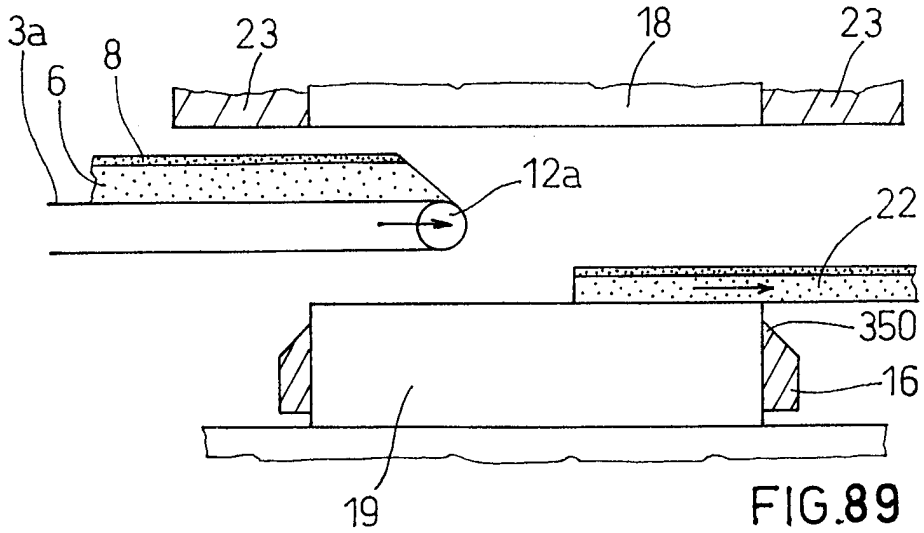


FIG.89

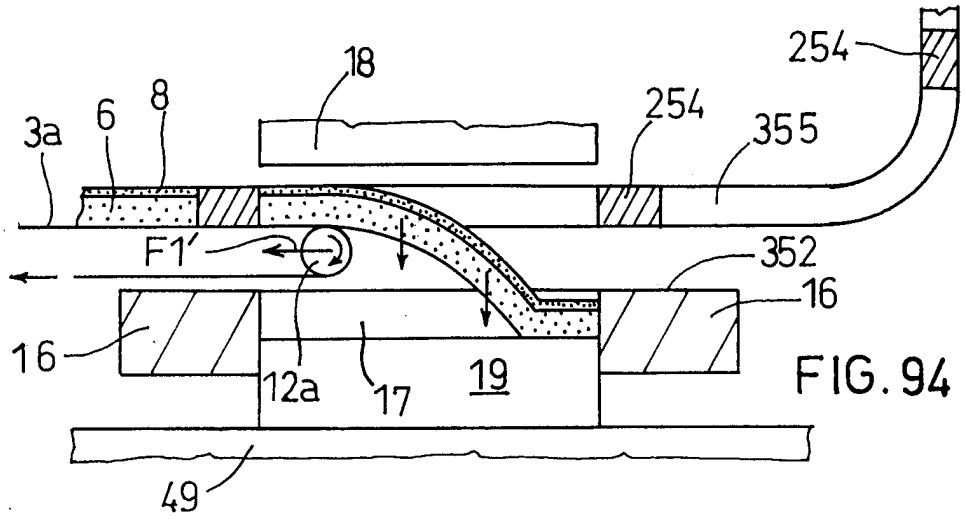


FIG. 94

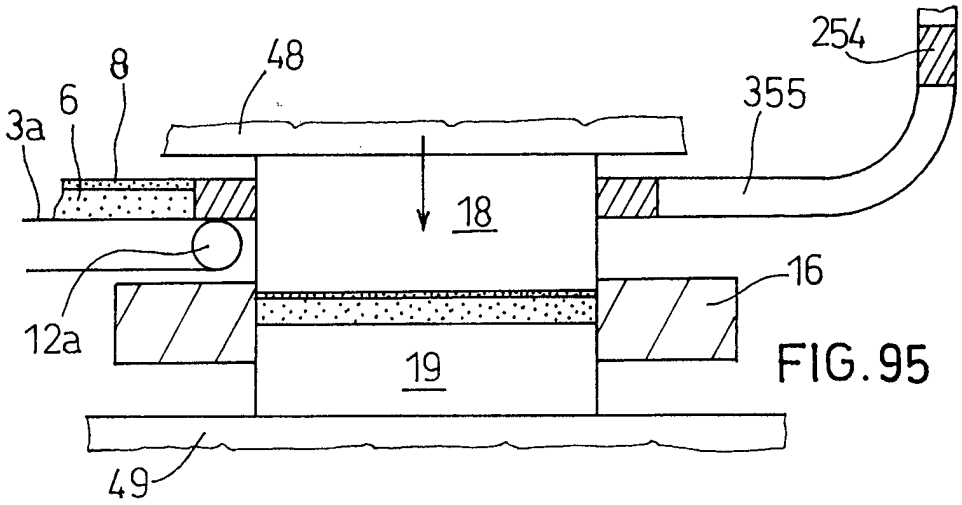


FIG. 95

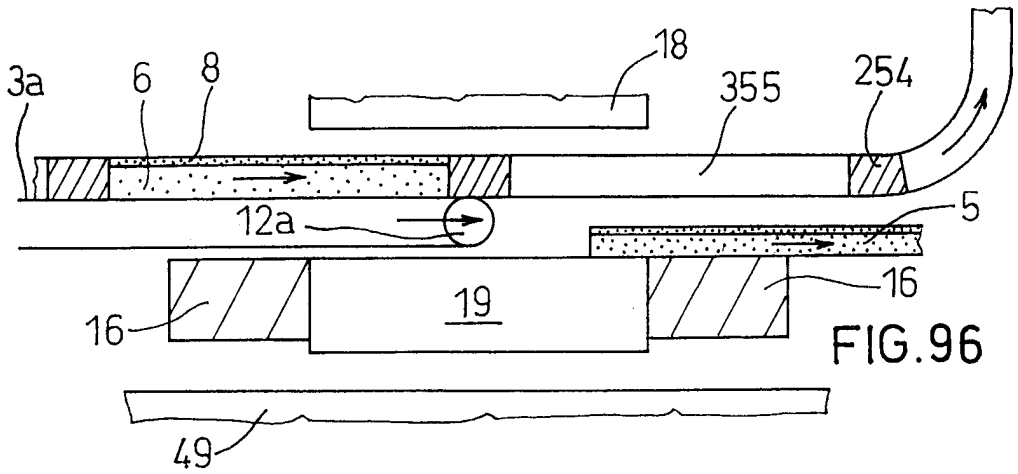


FIG. 96