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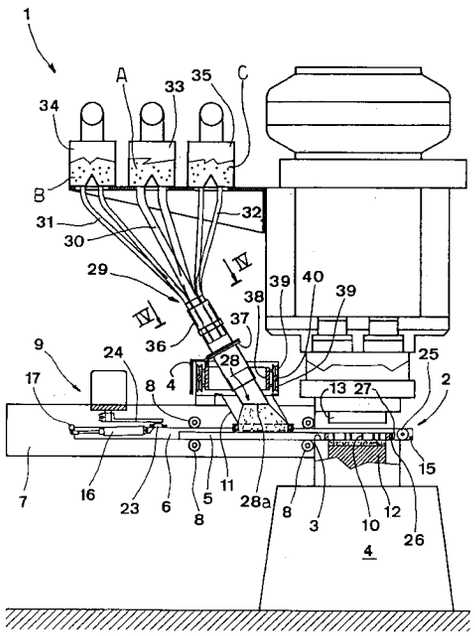
(54) Method for the manufacture of dry-moulded tiles, with relative moulding plant and tile.

(57) A method for the manufacture of dry-moulded ceramic tiles having effects of veining distributed in the ceramic body, comprises forming a mass of granules or powders with stream tubes flowing distinctly at least in the upper part of said mass, extracting by gravity from the bottom of the mass a layer of powder by means of separate, selected feed-apertures; the plant comprising a hopper (11) containing the powders fed by an alternative distributor (28) having at least two feeding ducts: a grid (10) being slidably mounted below the hopper for feeding the die-matrix (12, 13) by means of a plurality of baffles defining the feed-apertures for the powder.



EP 0 605 930 A1

The invention concerns a method for the manufacture of dry-moulded ceramic tiles, with relative moulding plant and tile, namely, a new process of preparing and treating clay-based powders, or ceramic granules, possibly mixed with powdered glazes, and of feeding them into the pressing device, the actual plant where the process is carried out and the ceramic tile obtained thereby also being the object of the present invention, said ceramic tiles being suitable for tiling the inside and outside floors and walls of residential and industrial buildings and of public and private premises in general.

The prior art involves moulding methods in which mixtures of granules or clay-based powders, are extracted from a hopper by means of a driven reciprocating grid for transfer to the matrix of the press.

Using these methods it is not possible to obtain tiles featuring permanent decorative effects of streaking, veining and the like, in imitation of natural stone; effects of this type can only be obtained by resorting to silk-screen printing or to the application of transfers.

Plant for the manufacture of ceramic tiles includes devices for the transfer of mixtures of ceramic granules , or clay-based powders, kaolin, ground glazes, and the like, to the matrix of a ceramic-tile press consisting of a trolley with a grid for the collection and transfer of said mixtures; the trolley being longitudinally mobile with a reciprocating motion along the feeder-board of the press, between a rear loading point corresponding to the outlet for the mixtures from a hopper and a front discharge point, corresponding to the matrix of the press.

However, these devices do not allow aesthetic effects such as veining, streaking and blotching, in imitation of natural stone, to be reproduced in dry-moulded tiles: such effects only being obtainable by resorting to silk-screen printing or the application of transfers.

Moreover, silk-screen printing is a costly and cumbersome process, particularly in the case of polychrome decoration, when a separate printing device is required for each colour. Also, the decoration obtained by silk screen printing or by application of transfers permeates only a thin surface-layer of the tile; if it is worn off by scuffing or damaged by a blow, the unsightly, undecorated body of the tile is revealed. Finally, silk-screen printing and decoration with transfers only allow for the reproduction of a repetitive motif.

From the foregoing, it emerges that a solution needs to be found to the technical problem of devising a method and a relative plant for the preparation of powders, and/or clays, and/or granules, be they monochrome or polychrome, that will make it possible to obtain effects of streaking veining, or blotching, on ceramic tiles: these effects not being strictly repetitive yet conforming to a certain decorative motif or theme so that tiles of a given series are compatible with one another; finally, the process should be cost- and space-effective.

The present invention resolves the above-mentioned technical problem by adopting a method for the manufacture of ceramic tiles that involves the following steps:

1) gravity-feed of at least two types of powder down adjacent, horizontally-stratified streams having a substantially-vertical axis with a straight, preferably rectangular, cross-section, said streams flowing into a hopper to form a compact, oblong mass presenting in plan-view a plurality of more or less broad bands of similar or contrasting colour, composition and texture: said mass assuming the shape of a prism, truncated cone or pyramid, the axis of which may be inclined to the vertical plane, with a base at least equal to the surface of the faces of the tiles to be moulded; the powders forming said mass mingling progressively as the mass subsides, the degree of mingling being controlled, as required, by the depth of the mass itself, namely, the greater the depth, the greater the degree of mingling;

2) extraction by gravity from the bottom of said mass of a layer of powders at least equal in volume to that of the unmoulded tile, followed by the transfer of said layer to the moulding press: extraction having to take place by means of separate, selected feed-apertures distributed in accordance with a design motif that substantially corresponds to the distribution of the veining in the moulded tile;

3) smoothing of the face of the fired tile, before or after laying.

The expression, "types of powder", is meant to indicate powders of different colours and/or different grain-size, singly or in combination.

The feed-apertures referred to at point 2) being defined by borders in any combination of straight and/or curved or mixed lines, which may also form regular geometrical shapes: it being envisaged, furthermore, that the said feed-apertures can be selectively blocked off so as to reduce their output to a greater or lesser extent, thus facilitating the spread of the powders in the die matrix.

In a first embodiment of this method, at least three types of powder are envisaged so as to have streams flowing down a substantially vertical plane divided into layers of powder of different types forming the aforesaid prism-like mass.

The formation of said layers being achieved by means of the continuous or alternate depositing of the powders from a plurality of cylindrical columns: the straight cross-section of said columns being of symmetrical configuration with axis of symmetry advantageously horizontal, as follows:

- at least one central column for feeding the powders that figure predominantly in the composition of the tile to be moulded and which are destined to form the tile matrix;
- at least a first and second pair of alternate opposed columns for feeding the powders destined to form veins, streaks, or blotches;

it being envisaged that the distribution of powders that go to form the prism-like mass occurs by means of reciprocating or synchronous traverse of said columns in a direction orthogonal or parallel to that of extraction of the bottom layer of powders; the powders in each column forming the layers of each said stream; the angle formed between the direction of motion of translation of the columns and the axis of symmetry of their plan configuration being between 0° and 180°.

The motion of translation of said columns possibly being complemented by rotation about the longitudinal axis, the degree of rotation being pre-established for each run and varying between fractions of a rotation and one or more full rotations.

In a second embodiment of the method, the feeding of the powders from at least one column being intermittent, in order to obtain, for example, sporadic, randomly-distributed blotches of colour in the tile being moulded.

The invention also includes a plant for the dry-moulding of ceramic tiles, consisting of a die fed by a slide, or trolley, that is cranked to and fro along the feeder-board of the die-matrix in order to transport to the matrix itself a predetermined quantity of powders extracted by gravity from the lower outlet of a hopper by means of a grid fixed to said slide; it being envisaged that a multiple powder distributor, having at least two feed-ducts and driven to travel with a horizontal, reciprocating motion, be mounted above the upper loading aperture of said hopper; said grid consisting of a plurality of vertical baffles forming separate, selected feed apertures for the powders and conforming to a motif prefiguring that formed by the distribution of veining in the tile; said baffles presenting in plan view straight lines or broken curves, or any combination of the two, and being oriented with respect to the direction of travel of the slide at an angle of between 0° and 90°: said angle being constant or variable between the baffles and between consecutive sections of each baffle, in order to form outlets for the powders to pass through, arranged according to a motif featuring stripes, and/or polygons with curved sides, and/or geometrical shapes.

The tile obtained by this method consisting of a ceramic body obtained by dry-moulding in which the decorative effects of veining, and/or streaking, and blotching, intermingle and penetrate the possibly homogeneous body of the tile to a substantial depth of at least 2mm and even to its very base.

The advantages offered by the invention are: the realisation of original, choice and durable aesthetic effects on the tiles,consisting of streaking and veining, and blotching, colour-coordinated with the tile body or in contrast with it; avoidance of repetitiveness in the chromatic effect while preserving the same pattern of veining in the tiles of a given series; moderate cost; modest overall dimensions.

Some ways of carrying out the invention are illustrated, by way of example, in the eleven tables of drawings attached, in which: Figure 1 is a partly-sectional side view of the plant for feeding the powders to the moulding press; Figure 2 is a partly-sectional left view of Fig. 1, showing the device for traversing the multiple distributor; Figure 3 is a plan view of the feeder board of the die, in the version for the moulding of one tile per cycle, for example in the format 40 cm x 40 cm; Figure 4 is the enlarged straight cross-section IV - IV of Figure 1 showing the configuration of the conduits in the five-channel embodyment of the multiple distributor, for example for three colours; Figure 5 is a schematic diagram of the distribution of powders in the hopper after a single traverse of the multiple distributor; Figure 6 is a schematic vertical section of the hopper provided with a first embodiment of the distributor having motion orthogonal to the direction of travel of the slide, the hopper showing the stratifying of the powders after to-and-fro traverse of the distributor in Fig. 4; Figure 7 is a cross-section like that of Figure 4 but in the eight-channel embodyment, for example for five colours; Figure 8 is a plan view, from below, of a first embodiment of the grid for extracting the powders from the hopper and transporting the same to the moulding press, with wavy baffles inclined obliquely to the direction of travel of the trolley; Figure 9 is a plan view, from below, of a second embodiment of the grid, with oblique wavy baffles interspersed with blocking elements; Figure 10 is a plan view, from below, of a third embodiment of the grid with the baffles arranged in a pattern of variously-shaped polygons and interspersed with blocking elements; Figures 11, 12, 13 are plan views from below of a fourth, fifth and sixth embodiment of the grid with their geometrical patterns defined, respectively, by parallel baffles, at right- angles to the direction of travel of the trolley, by straight baffles in a criss-cross configuration and by baffles that are circular in cross-section; Figure 14 is a schematic vertical section of the hopper provided with a second embodiment of the distributor having motion parallel to the direction of travel of the slide; Figure 15 is a plan view of the hopper of Figure 14; Figure 16 is a schematic plan view of a ceramic tile according to the invention; Figure 17 is section XVII-XVII of Figure 16, in which the various shadings correspond to various colours or powders.

The figures show: the plant 1 for the preparation of the powders and their transfer to the moulding press 2; the feeder-board 3 of the die of the press 4 along which a slide 5 travels with a reciprocating motion, having a pair of sides 6 designed to slide between longitudinal guides 7 with the interposition of two pairs of opposed rolling elements 8; a device 9 featuring a crank and slotted link for driving the slide 5; a grid 10 for receiving the powders from the lower aperture of a hopper 11 and transporting them in a controlled manner to a die-matrix 12: said matrix advantageously having a base-plate capable of vertical movement between its top position, when it lines up with the feeder-board 3 of the press, and its bottom position, when the matrix is charged before a die-punch 13 descends; a removable frame 14,(Figure 3) of the grid 10, slotted into the front section of the slide 5; a cleaning device 15 for the feeder-board operating after each pressing, comprising a cylindrical rotating brush, pivotally-mounted at the front end of the pair of sides 6: said brush being capable of being raised clear of the feeder surface on the return run by means of a device featuring a pair of articulated parallelograms, not shown, operated by a pneumatic cylinder 16 having its shaft hinged to a crosspiece 17 linking the connecting rods of the said parallelograms; the motor 18 rotating said cleaning element 15 by means of two pairs of pulleys 19 connected by a pair of drive belts 20; a slot 21 in a rear cross-member 22 linking the sides 6 of said slide, said slot acting as a guide for a cursor 23 mounted on a roller at the end of the crank 24; a bar 25 for expelling the moulded tiles fixed to the leading edge of the slide 5; a scraper-blade 26 oscillating in a vertical slot of a front cross-member 27 of the slide 5.

Inserted in the upper section of the hopper 11 is a dispenser 28 of a multiple distributor 29 for the powders, said distributor being gravity-fed by means of a plurality of pairs of conduits 30, 31, 32, the upper sections of which are flexible and lead from the containers 33, 34, 35, respectively, of the powders A, B, C: it being envisaged that the quantity of powder in said containers 33, 34, 35, respectively, be kept constant by means of a level-compensating device, comprising, for example, interception valves triggered by level-sensors, not shown, mounted on the feed-ducts of the containers themselves: the pair of central conduits 30 being advantageously connected to a single central conduit 30a in the lower section of the sleeve 36 of the multiple distributor 29.

The pairs of conduits 30, 31, 32, converging in the sleeve 36 of the multiple distributor 29, are located centrally, in the case of the pair of conduits 30 destined to carry the powder for the matrix of the tile, and in diametrically-opposite positions, in the case of the pairs of conduits carrying the powder for veining: it being possible for said powders to be of very different, or for example homogeneous, grain-size, or to consist of mixtures of granules and powder, of the same or different colour, or in polychromatic combinations.

The dispenser 28, formed by the extension downwards of the sleeve 36 enveloping the bottom sections of the pairs of conduits 30, 31, 32, has its mouth 28a parallel to the feeder board 3 of the moulding press to ensure that the hopper 11 is uniformly charged.

The pairs of conduits 30, 31, 32 together defining a plurality of columns destined to form the layers of each stream as described in step 1) of the method according to the invention.

In particular, powders A, B, C flow down a plurality of adjacent streams 33b corresponding to said columns, said streams being separated by ideal sustantially vertical planes 33a: each stream, having a straight rectangular cross-section equal in length to the hopper 11, consisting of superimposed sections of a plurality of layers 33c of powders A, B, C.

Layers 33c being defined by ideal planes 50 inclined down in the direction Y of extraction of the slide 5 at an angle that increases as the distance of the generic layer 50 from the lower layer decreases and as the rate of extraction by the slide drops.

The figures also show: the depth S of the powders in the hopper 11, advantageously ranging between about 10cm and about 25cm and adjustable by varying the axial position of the dispenser 28 by means of an actuator, not shown: increased depth corresponding to greater degree of mingling between the streams 33b relative to each column; a bracket 37 clamping the ring-shaped projection of the sleeve 36 to a trolley 38 sliding bilaterally, by means of two pairs of opposed wheels 39, on a pair of transverse guiderails 40 fixed to the framework; an enclosed block-chain 41 on a pair of crownwheels 42, one of which driven, having the upper section fixed to said trolley so as to move it: the length of travel L of the trolley being equal to the transverse dimension L1 of the hopper 11 less the transverse dimension L2 of the dispenser 28 of the distributor 29; a plurality of columns D, E, F, G, H of powders, or granules, of different types, singly or in combination, monochrome or polychrome, inserted in respective couples 51, 52, 53 of conduits analogous to those relative to the powders B, C,in the case of the columns of powders D, E, F: the central conduits 54, 55 being fed with columns of powders G, H, of different types, for example in order to obtain a streaky effect with a greater number of colours; a base frame 43 of the hopper 11 featuring a peripheral lip 44 to act as a dry seal against the upper surface of the slide 5 and so prevent powder spillage, when said slide is at the front-stop charging the die matrix 12; a plurality of baffles 45,(Figure 8), dividing the grid 10 into zones for the containment of the powders and for their controlled release into the die matrix: said

baffles having contours in plan view of any combination of wavy curves, either continuous or interrupted, the ends being fixed to the frame 14. The plan configuration of the baffles 45 prefigures the distribution of the veining in the tile in that it defines the separate feed apertures selected, as described in step 2) of the method according to the invention; the axis Z1 of one of the said baffles forming an angle B1 to the direction Z2 of travel of the grid 10, the term axis being used to indicate the straight line representing the mean inclination of the contour of a baffle or also of only a section of it: the angle B1 being variable between 0° and 180° and capable of remaining constant for the baffles of a given grid or of varying, in a random or repetitive manner, over single or successive sections of any one baffle, so as to create random or geometrical shapes, for instance touching circles 46, (Figure 13), consecutive squares or parallelograms 47, (Figure 12), parallel lines 48 (Figure 11), or whatever is appropriate; blocking elements 49 interposed between adjacent baffles forming zones where the downward flow of powders during the charging of the grid is blocked and such as to cause the powders to spread out when the base of the matrix is lowered: the thickness of said baffles, varying, from baffle to baffle or from section to section of one and the same baffle, as required, between a few millimetres to several centimetres, for example even ten or more, in the latter case functioning as a substitute for or a complement to the blocking elements 49.

The axis of symmetry Z3, (Figure 4) of the straight cross-section of the multiple distributor 29 forms an angle B2 with the direction of travel of the trolley 38: the size of the angle B2 ranging between 0° and 180°.

The depth of the baffles 45, determining the load capacity of the grid, is such as to allow a quantity of powder to be collected that is anyway greater than the volume of the layer of powder to be moulded that can be contained in the die-matrix 12 and may even amount to twice that volume, for example.

The distribution of the baffles 45 determines the nature of the veining of the tile, for example a diagonal configuration seen in Figures 8, 9 determines a correspondingly-diagonal pattern of veining, while the distribution of the baffles in asymmetrical polygons with varying contours as seen in Figure 10 produces a blotched effect.

Veining can be extended to the whole thickness of the tile if the die matrix is charged in a single layer, or be limited to just a part of the thickness of the tile, as when charging with several layers, the minimum thickness being about 2mm.

Examples.

Realisation of a tile using a grid as in the first embodiment (Figure 8).

Composition (by volume):	
powder A (red)	46%
powder B (black)	27%
powder C (yellow)	27%
grain-size	from 0.01 to 1.8mm
mean humidity	from 5 to 6.5%
format	40cm x 40cm

The parameters of the forming process being the following:

equivalent diameter of central column 30a	71mm
diameter of each column 31	38mm
diameter of each column 32	38mm
depths of powders in hopper 11	from 15 to 20cm
size of angle B2	15°

Extraction parameters:	
travel of slide 5	720mm
mean rate of extraction of slide 5	102m/min
period	1.18s

The charging of the die matrix 12 is accomplished by the lowering of the base-plate of the matrix when the slide is at the front-stop.

The moulding process is as follows: when, by rotation of the crank 24, the slide 5 is recalled from the front-stop position, where charging of the die-matrix 12 takes place, and the back edge of the frame 14 slides under the front edge of the hopper 11, the powder contained in the hopper itself falls by gravity into the separate selected feed outlets 45a formed by the baffles 45 and onto any residue of surplus powder remaining after the charging of said die-matrix: the rate of travel of the slide being coordinated with the rate of fall of the powders so as to effect the gradual replenishing of the grid 10 on its return run; a subsequent rotation of the crank then advances the slide towards the die-matrix and the charging process is repeated.

The moulded tiles are then conveyed to the kiln for firing and subsequent grinding, which may take place after laying.

The powders are gradually consumed along ideal planes 50, (Figure 6) inclined forwards and down towards the feeder-board 3 of the press; the reserve of powders being replenished at every cycle by a traverse of the multiple distributor 29, clamped to the trolley 38, over the whole length of the hopper 11; the quantity of powders deposited on each run of the trolley being such as to restore the depth S of powders in the hopper 11. The powders are thus distributed in the hopper 11 in streams 33b built up in layers 33c: the central stream consisting substantially of any powder being introduced in greater proportion, the lateral streams consisting of alternate layers 33c of powders in lesser proportions: the degree of mingling between layers and/or adjacent streams depending on the ratio between the volume of powder consumed at each cycle and the depth S.

It being noted that, with the same grid, if the rate of travel of the slide 5 is increased as it passes under the hopper 11, veining is thinner and longer and the colour contrast lessens: if the rate of travel is decreased, blotchy veining is achieved. Furthermore, if powders of different grain-size are used, the larger particles tend to flow, with the result that greater colour contrasts can be obtained.

It being possible to feed the powder through the conduits, or columns, 30, 31, 32, 51, 52, 53, 54, 55 intermittently, thus allowing the number of colours and/or grain-sizes in the powder in a given series of tiles being formed to be varied in a controlled fashion.

In another embodiment of the invention, the multiple distributor 29 may, in addition to running back and forth to restore the depth S of powders in the hopper, be enabled to rotate, continuously or intermittently, around its own longitudinal axis: this makes it possible to achieve aesthetic effects which are further enhanced by the greater degree of mixing between the powders.

In this case, the dispenser 28 clamped to the trolley 38 must be pivotally coupled to the sleeve 36 on a plane X orthogonal to the axis of the sleeve itself, so as to allow the rotation of the sleeve through a predetermined angle, equal to one rotation or to a fraction of a rotation: it being possible to achieve the rotary action of the distributor by means of a pneumatic cylinder, reduction unit, cam device, or other appropriate means.

In a further embodiment of the invention shown in Figures 14, 15, a second embodiment of the multiple distributor 129 comprises a casing 129a extending substantially the whole width of the hopper 11, said casing enclosing a plurality of substantially vertical conduits 130, 131, 132 alligned along its length.

The distributor 129, coupled with driving means 153 has a bottom exit which co-operates with a flow control member comprising a shelf 151, adjacent to the top of the hopper 11, which closes the bottom exit of said distributor when not in operation (operative position in dotted line).

The conduits have extendable outlets 130a, 131a, whose position with respect to the bottom exit of said distributor 129 determines the quantity of powders introduced in the casing 129a: by adjusting the position of the extendable outlets it is possible to slightly change the pattern of the tile in a very easy way.

The hopper 11 may be provided with a plurality of parallel vanes 152, said vanes are pivotable in order to deflect the flow of powder in substantially separated streams.

In practice, the dimensions and details of execution may be different from but technically equivalent to those described without departing from the scope of the present invention.

Claims

1. Method for the manufacture of dry-moulded ceramic tiles, comprising the preparation of the powders, flowing the powders into a hopper, transfer of the powders to a pressing device, pressing the powders and kiln-firing,
characterised in that
   - the powders are charged to the hopper and form a mass of material in granules or powder comprising streams (33b) which, at least in the upper part of said mass, are distinct from one another;
   - granules or powder are extracted by gravity from the bottom of said mass of material by means of separate, selected feed apertures (45a).

2. Method as claimed in claim 1, characterized in that said streams (33b) are adjacent and flow down a substantially-vertical axis.

3. Method as claimed in claim 1 or 2, characterized in that said streams (33b) are formed by superimposed layers of at least two types of said powders.

4. Method as claimed in claim 1, 2 or 3, characterized in that said mass is in the shape of a prism or truncated pyramid, the axis of which may be inclined to the vertical plane, said streams mingling in said mass.

5. Method as claimed in claim 4, characterized in that the depth (S) of said mass is determined by the degree of merging envisaged between said streams (33b).

6. Method as claimed in claim 1 or 4, characterised by the fact that said streams (33b) have a substantially rectangular cross-section.

7. Method as claimed in claims 1 or 4, characterized in that said feed apertures (45a) are distributed according to a motif substantially corresponding to the distribution of veining, streaking and blotching in the moulded tile.

8. Method as claimed in claim 1 or 4, characterized in that said powders differ from each other in colour. possibly, in grain size.

9. Method as claimed in claim 1 or 4, characterized in that said powders differ from each other in grain size.

10. Method as claimed in one or more of the foregoing claims, characterized in that said lower layer of powders is at least equal in volume to that of the unmoulded tile.

11. Method as claimed in one or more of the foregoing claims, characterized in that said feed apertures (45a) are defined by any combination of straight contours.

12. Method as claimed in one or more of claims 1 to 10, characterized in that said feed apertures (45a) are defined by any combination of curved contours connected, or not, by straight sections.

13. Method as claimed in one or more of the foregoing claims, characterized in that said feed apertures (45a) are blocked off so as to reduce their output to a greater or lesser extent, thus facilitating the spread of the powder in the pressing device.

14. Method as claimed in claim 3, characterized in that said streams (33b) stratified in layers (6) are formed by the alternate deposition of powders from columns having substantially-vertical axes.

15. Method as claimed in claim 14, characterized in that said alternate deposition of the powders is achieved by alternating and, possibly, synchronous traverse of said columns in a direction orthogonal to the direction (Y) of extraction of the lower layer of powders.

16. Method as claimed in claim 14, characterized in that said alternate deposition of the powders is achieved by alternating and, possibly, synchronous traverse of said columns in a direction parallel to the direction (Y) of extraction of the lower layer of powders.

17. Method as claimed in claim 15, or 16, characterized in that said alternating traverse is complemented by a rotation of the columns about an axis parallel to the axes of the columns themselves; the degree of said rotation being predetermined up to a maximum value of at least one full turn.

18. Method according to one or more of the preceeding claims, characterized in that at least one of said columns is fed intermittently.

19. Plant for the moulding of ceramic tiles, including a die (12, 13) fed by means of a slide (5) or trolley, cranked to and fro along the feeder-board (3) or the die-matrix (12) in order to transport to the matrix itself a predetermined quantity of powders extracted by gravity from the lower outlet of a hopper (11) by means of a grid fixed to said slide, characterized in that a multiple powder distributor (29; 129), having at least two ducts for feeding the columns of powders to the hopper, is mounted above the upper loading aperture of said hopper (11) and is driven to travel with a horizontal reciprocating motion.

20. Plant as claimed in claim 19, characterized in that the grid (10) is formed of a plurality of vertical baffles (45, 46, 47, 48) defining separated, selected feed apertures (45a) for the powders and conforming to a motif prefiguring that formed by the distribution of veining, streaking and blotching in the tile.

21. Plant as claimed in claim 19 or 20, characterized in that said multiple distributor consists of a sleeve (36) in which at least two conduits defining said at least two ducts for feeding the columns of powders to the hopper (11) converge.

22. Plant as claimed in claim 21, characterized in that the straight cross-section of said multiple distributor (29) is symmetrical with respect to a horizontal axis (Z3) forming an angle (B2) with the direction of travel of the distributor: said angle being variable between 0° and 180°.

23. Plant as claimed in claim 21 or 22 characterized in that said multiple distributor (29) has five conduits inside said sleeve (36) comprising a central conduit (30a) and two opposed alternate pairs of peripheral conduits (31).

24. Plant as claimed in claim 21 or 22, characterized in that said multiple distributor (29) has eight conduits inside said sleeve comprising three opposed alternate pairs of peripheral conduits (51, 52, 53) and two central conduits (54, 55).

25. Plant, as claimed in claim 19, or 20, characterized in that the multiple distributor (129) comprises a casing (129a) extending substantially the whole width of the hopper (11), said casing enclosing a plurality of conduits (130, 131, 132) along its length.

26. Plant, as claimed in claim 25, characterized in that, the distributor (129) has a bottom exit which co-operates with a flow control member.

27. Plant, as claimed in claim 26, characterized in that, the flow control member comprises a shelf (151), adjacent to the top of the hopper (11), which closes the bottom exit of said distributor.

28. Plant, as claimed in claim 25, characterized in that the conduits have extendable outlets (130a, 131a).

29. Plant as claimed in any of claims 25 to 28, characterized in that said hopper (11) is provided with a plurality of parallel vanes (152).

30. Plant, according to claim 29, characterized in that, the vains are pivotable.

31. Plant according to any of claims 19 to 30, characterized in that the distributor (29; 129) is driven to travel with a horizontal reciprocating motion.

32. Plant, according to claim 31, characetized in that the direction in which the distributor is driven is parallel to the direction (Y) of travel of the grid.

33. Plant, according to claim 31, characterized in that, the direction in which the distributor is driven is orthogonal to the direction (Y) of travel of the grid.

34. Plant as claimed in one or more of claims 19 to 33, characterized in that said grid (10) has baffles (45) presenting in plan view any combination of wavy curved lines; the axis (Z1) of each baffle forming an angle (B1) with respect to the direction (Z2, Y) of travel of the grid between 0° and 180°: said angle not necessarily being constant between the baffles.

35. Plant as claimed in claim 34, characterized in that said angle may vary from section to section of one and the same baffle.

36. Plant as claimed in claim 34, characterized in that said grid (10) has baffles (47, 48) presenting in plan view any combination of straight lines.

37. Plant as claimed in claim 34, characterized in that said grid (10) has baffles presenting in plan view curved lines such as to define a pattern of touching circumferences.

38. Plant as claimed in any one of claims 34 to 37, characterized in that said grid (10) has blocking elements (49) interposed between adjacent baffles to block the downflow of powders from the hopper (11).

39. Plant as claimed in any of claims 34 to 38, characterized in that the depth of the baffles of said grid is such as to allow a volume of powders to be extracted from the lower section of the hopper (11) that is greater than the volume of the tile to be moulded.

40. Plant, according to claim 39, characterized in that, the volume of the powders to be extracted is twice the volume of the tile to be moulded.

41. Plant as claimed in claim 25, characterized in that the sleeve (36) of said multiple distributor (29) extends downwards to form a dispenser (28) with a mouth (28a) parallel to the feeder-board (3) of the die.

42. Plant as claimed in claim 41, characterized in that the distance between said mouth and said feeder-board, determining the depth (S) of the powders in the hopper (11) is between about 10 cm and about 25 cm.

43. Plant as claimed in claim 34, characterized in that the sleeve (36) of said multiple distributor (29) has a ring-shaped projection for coupling to a bracket (37) mounted on a trolley (38) sliding bilaterally on a pair of transverse guiderails (40).

44. Plant as claimed in claim 33, characterized in that said conduits (30, 31, 32) are flexible in their upper sections to enable them to be inserted into relative powder containers (34, 35, 36) fed by means of a level-compensator device.

45. Plant as claimed in claim 33, characterized in that a slide (5), on which is mounted the grid (10) for the extraction and transfer of the powders, is driven by means of a crank and slotted link (9) to run to and fro beneath the lower section of said hopper (11).

46. Plant as claimed in claim 41, characterized in that said sleeve (36) is pivotally mounted on the dispenser (28) along a transverse plane (X) orthogonal to the longitudinal axis of said sleeve to allow it to rotate through a predetermined angle in its traverse of the hopper (11) by means of an actuator.

47. Plant as claimed in claim 43, characterized in that said conduits (30, 31, 32, 50, 51, 52, 53, 54, 55) are fixed inside said sleeve (36); said dispenser (28) being integral with said trolley (38).

48. Plant as claimed in claim 20, characterized in that the thickness of said baffles may vary from section to section of one and the same baffle between a few millimetres to several or more centimetres.

49. Plant as claimed in claim 48, characterized in that said baffles vary in thickness from one another.

50. Plant as claimed in claim 41, characterized in that the traverse (L) of said dispenser (28) is equal to the transverse dimension (L1) of the hopper (11) less the transverse dimension (L2) of the dispenser itself.

51. Plant as claimed in claim 19, characterized in that a cylindrical rotating brush (15) is mounted on the front part of said slide (5) by means of a pair of articulated parallelograms interconnected by means of a cross-member (17) and driven by a pneumatic cylinder (16).

52. Plant as claimed in any of the preceding claims characterized in that said columns are arranged in a symmetrical configuration having a straight cross-section with at least one axis of symmetry (Z3) advantageously horizontal, said configuration comprising:

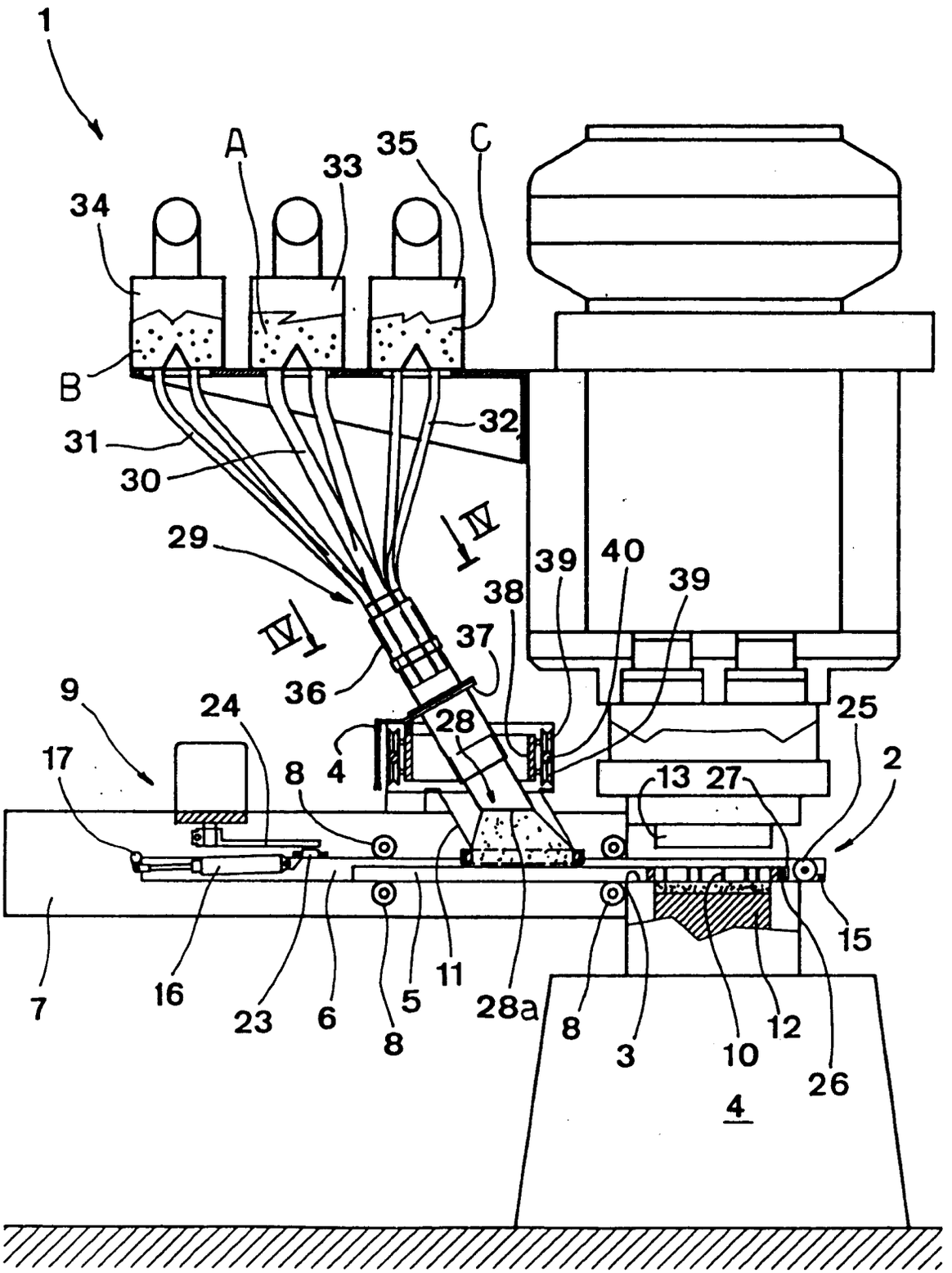
- at least one central column (30, 30a, 55) for the ducting of powders destined to form the matrix of the tile;
- at least one first (31, 51) and one second (32, 52) pair of alternate opposed columns for ducting the powders destined to form the veining or blotching of the tile.

53. Plant as claimed in claim 52, characterized in that said symmetrical configuration of the columns comprises at least one central column (30a, 54, 55) and at least one alternate opposed pair of peripheral columns (31, 32, 51, 52, 53).

54. Plant as claimed in claim 52 or 53, characterized in that the axis of symmetry (Z3) of said straight cross-section forms an angle (B2) of between 0° and 180° with the direction (Z4) of the traverse of the columns.

55. Tile, such as that obtained by the method as claimed in claims 1 to 18, having a surface provided with veining, streaking, and/or blotching and consisting of a dry-moulded ceramic body, characterized in that the veining, streaking and/or blotching, intermingle and penetrate the tile matrix to at least a substantial depth of the whole thickness.

56. Tile as claimed in claim 55, characterized in that said substantial depth is equal to at least 2 mm.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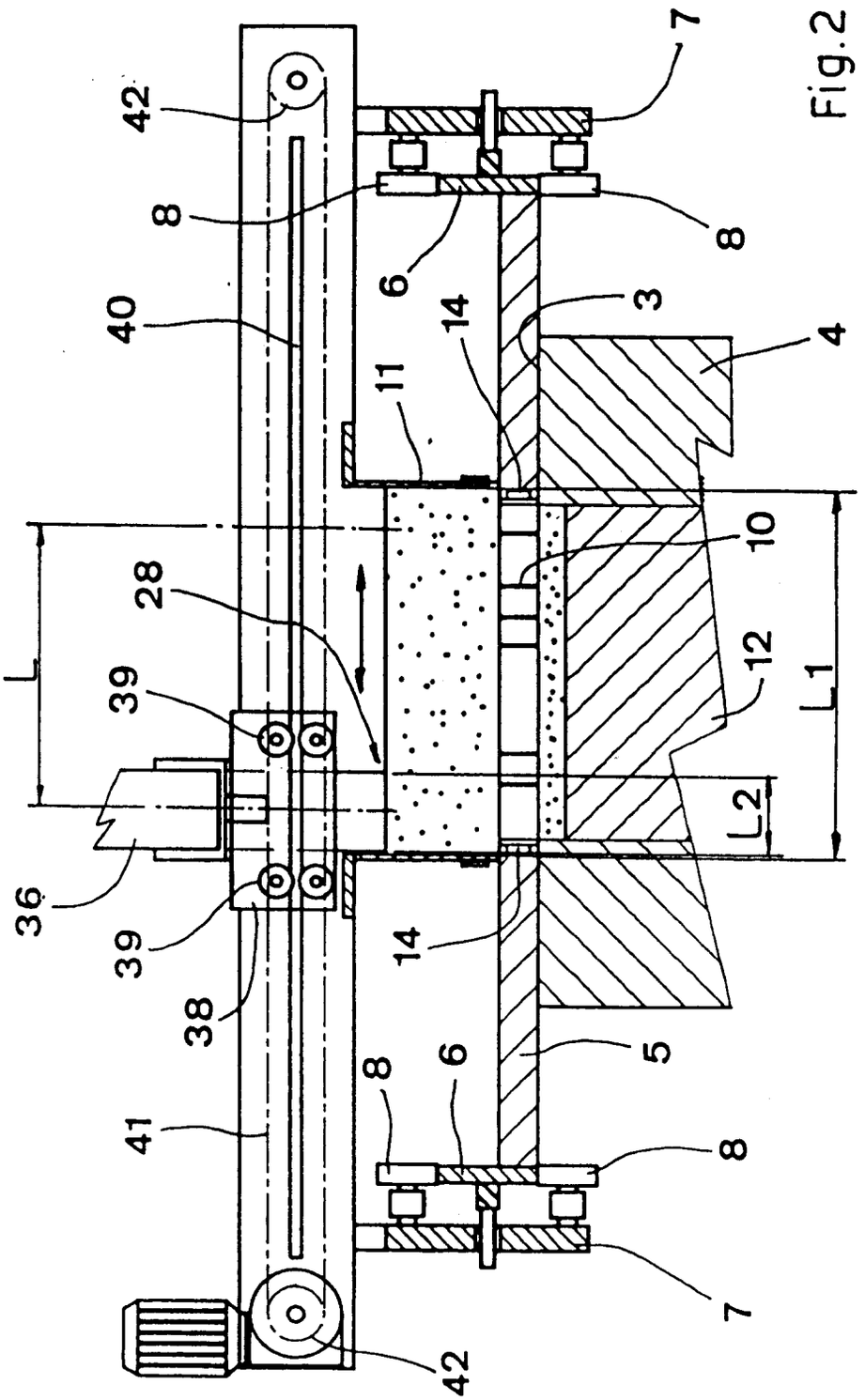


Fig.2

Fig.3

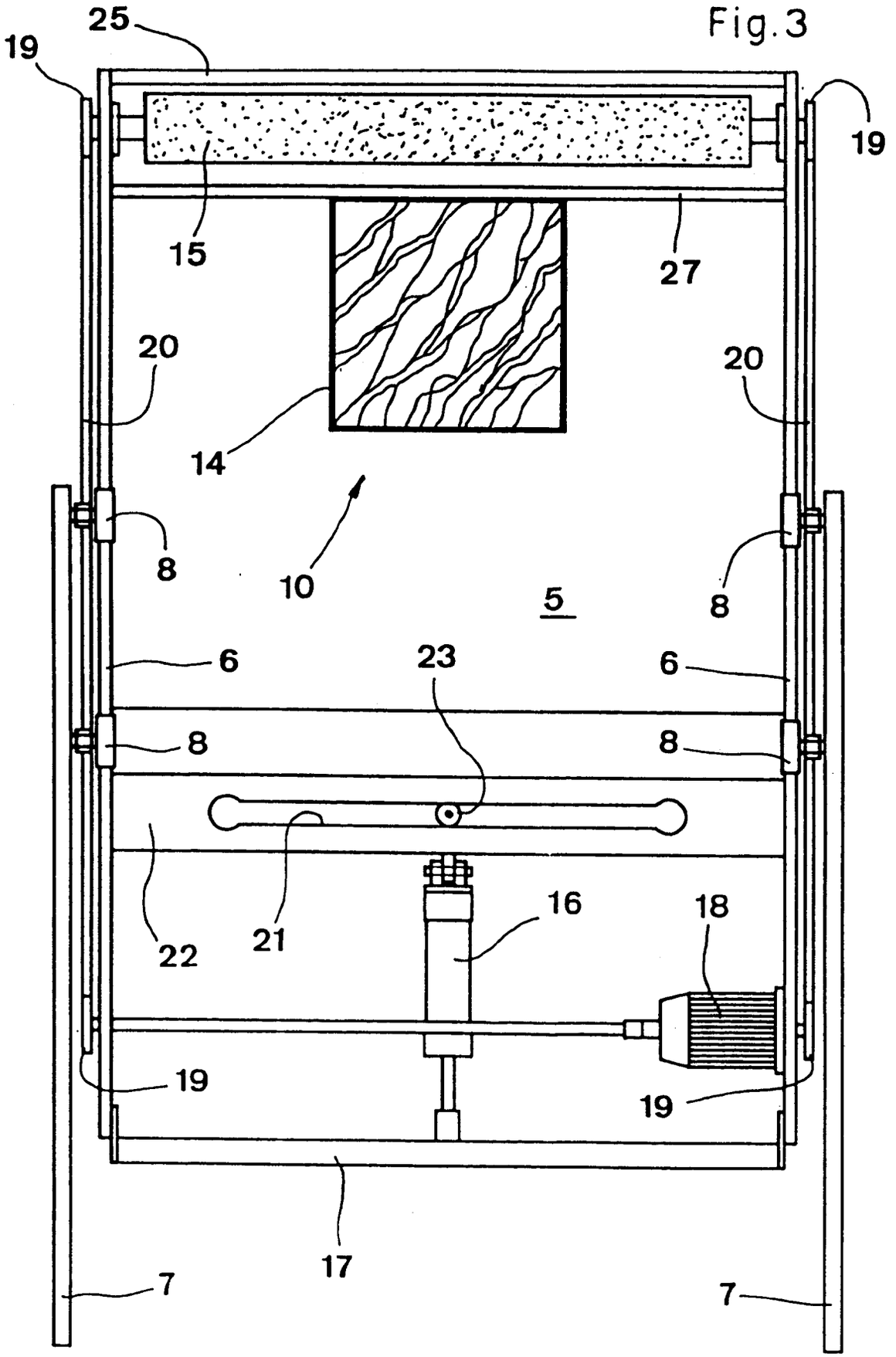


Fig.5

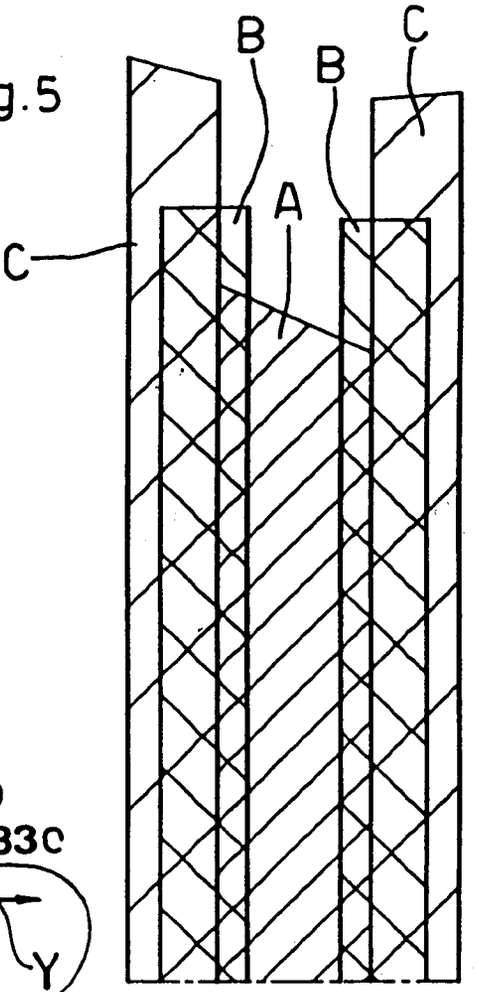


Fig.6

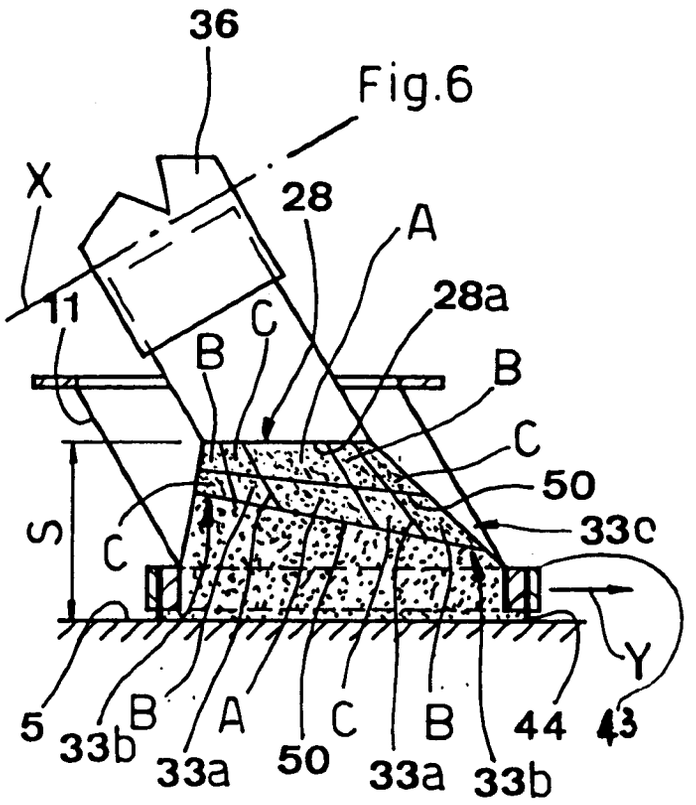


Fig.7

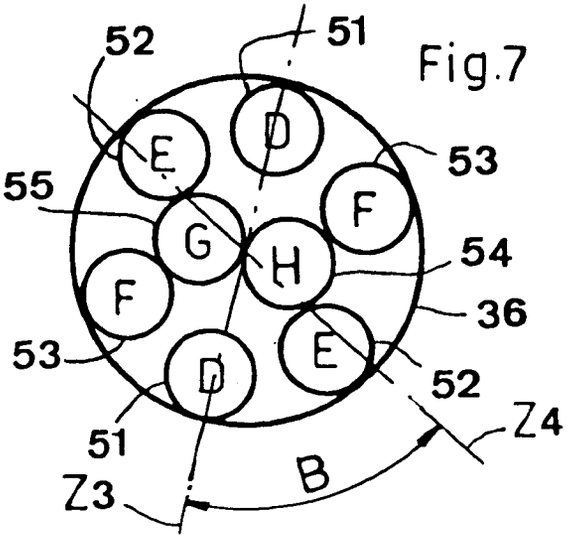


Fig.4

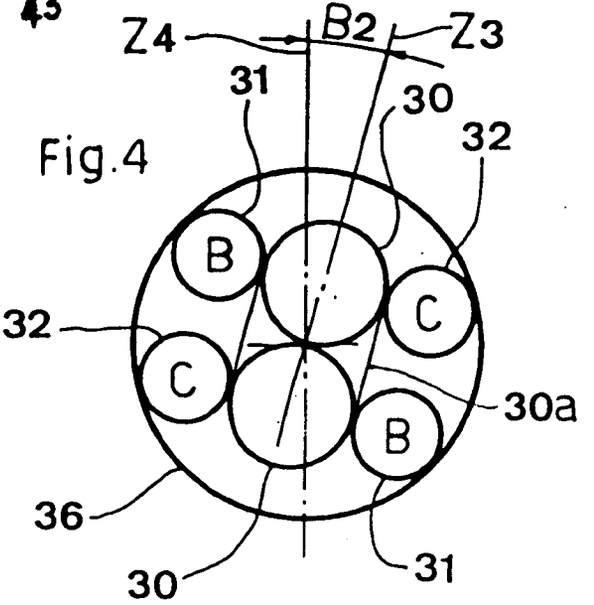


Fig.8

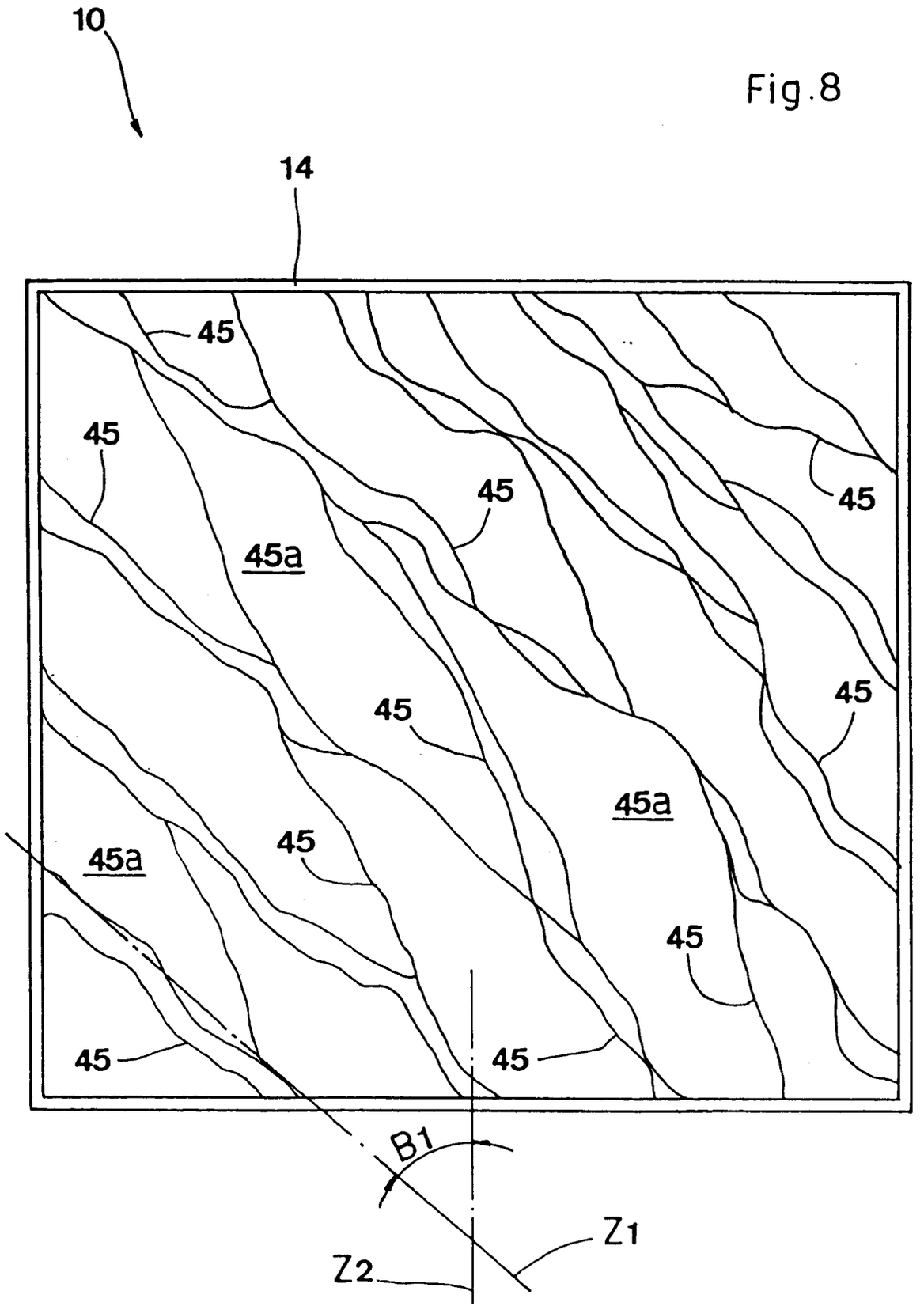


Fig.9

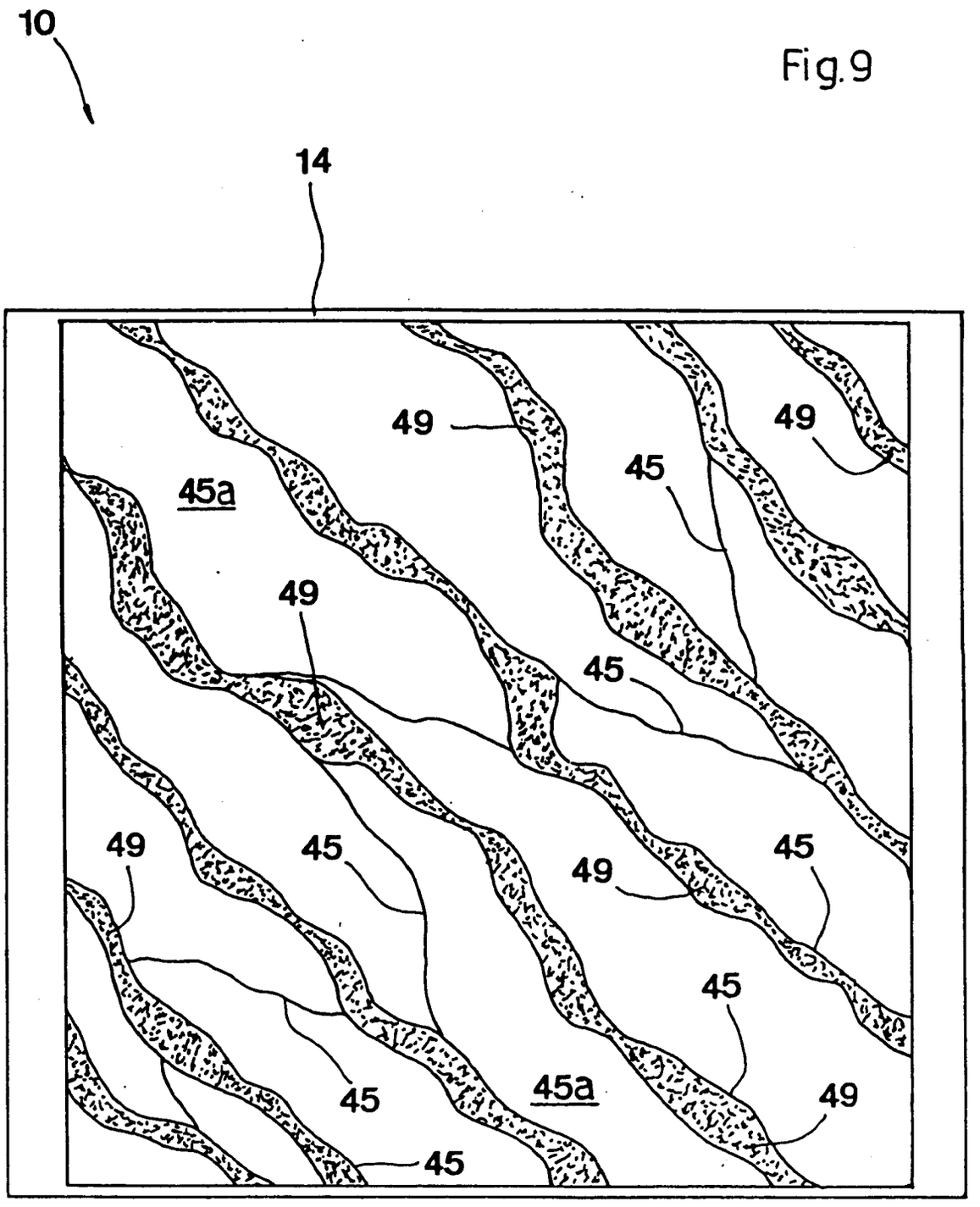
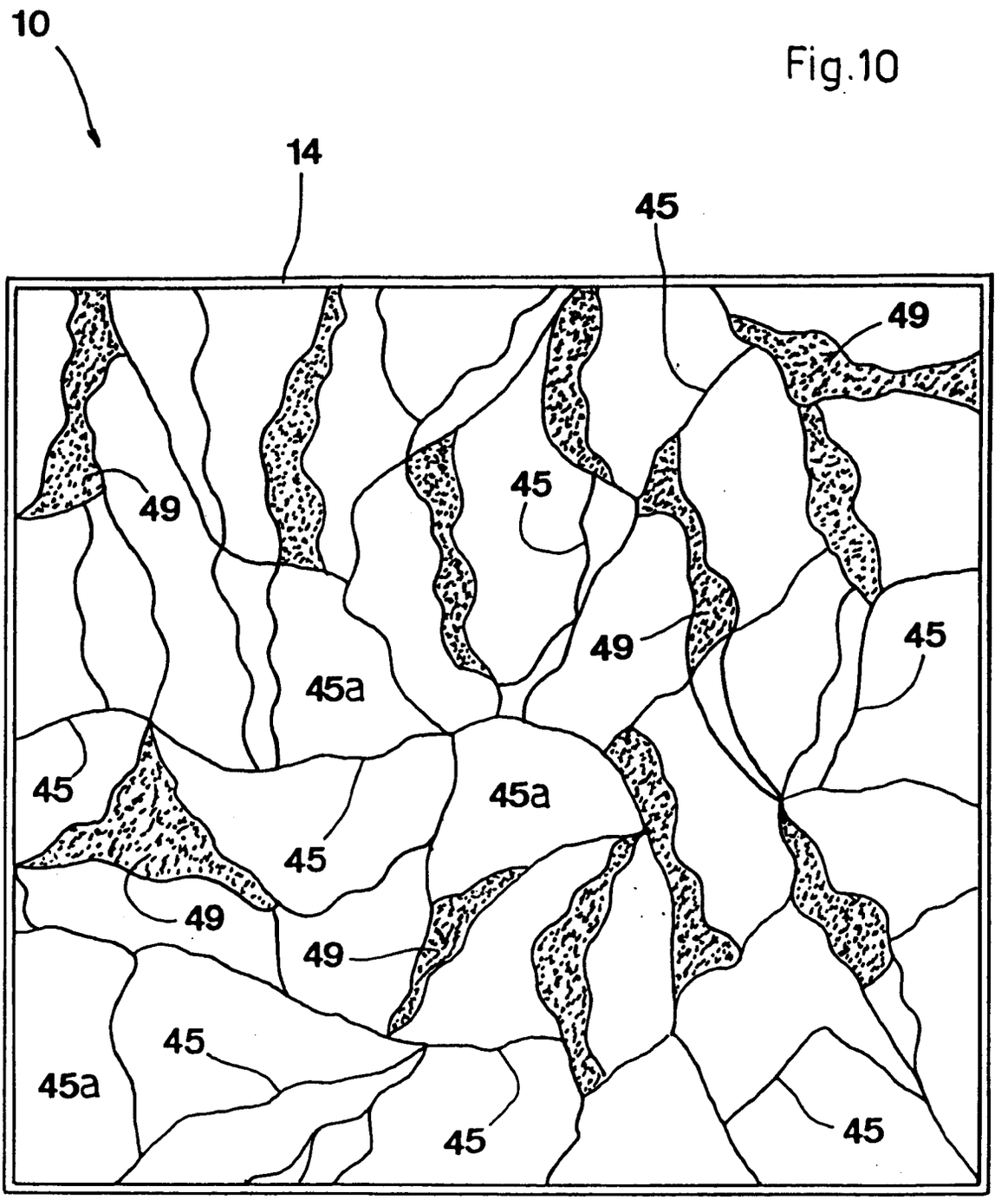


Fig.10



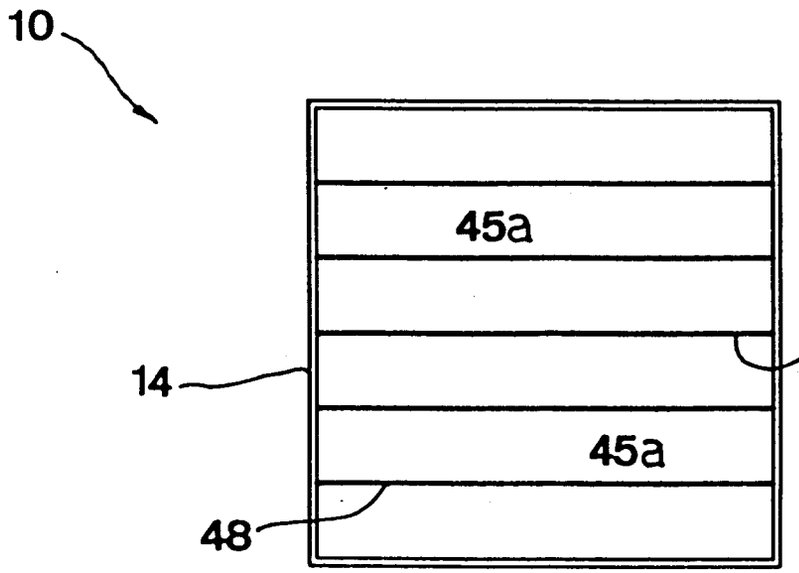


Fig.11

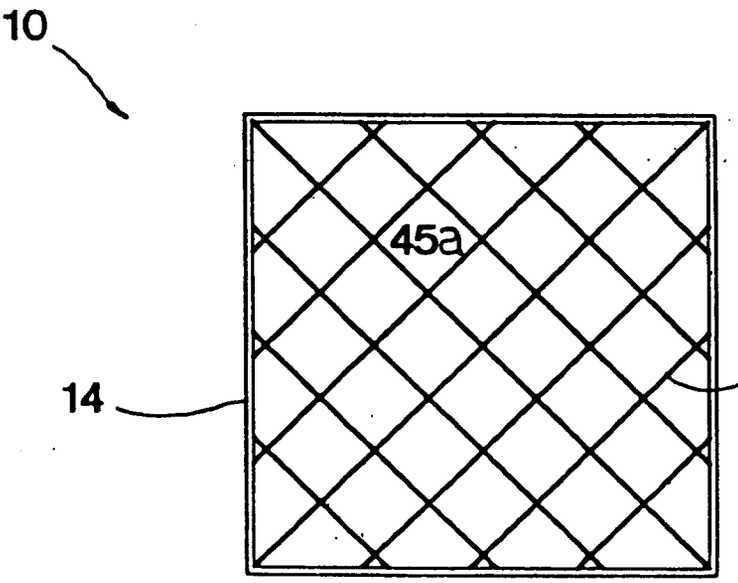


Fig.12

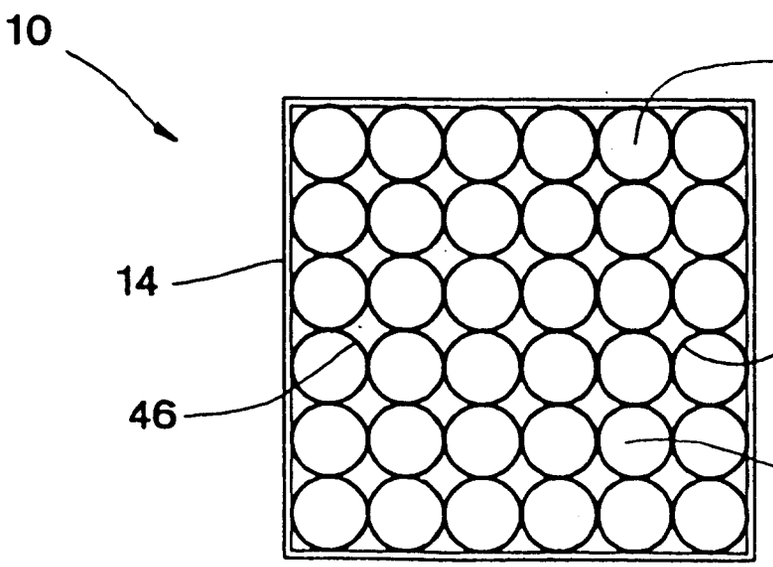


Fig.13

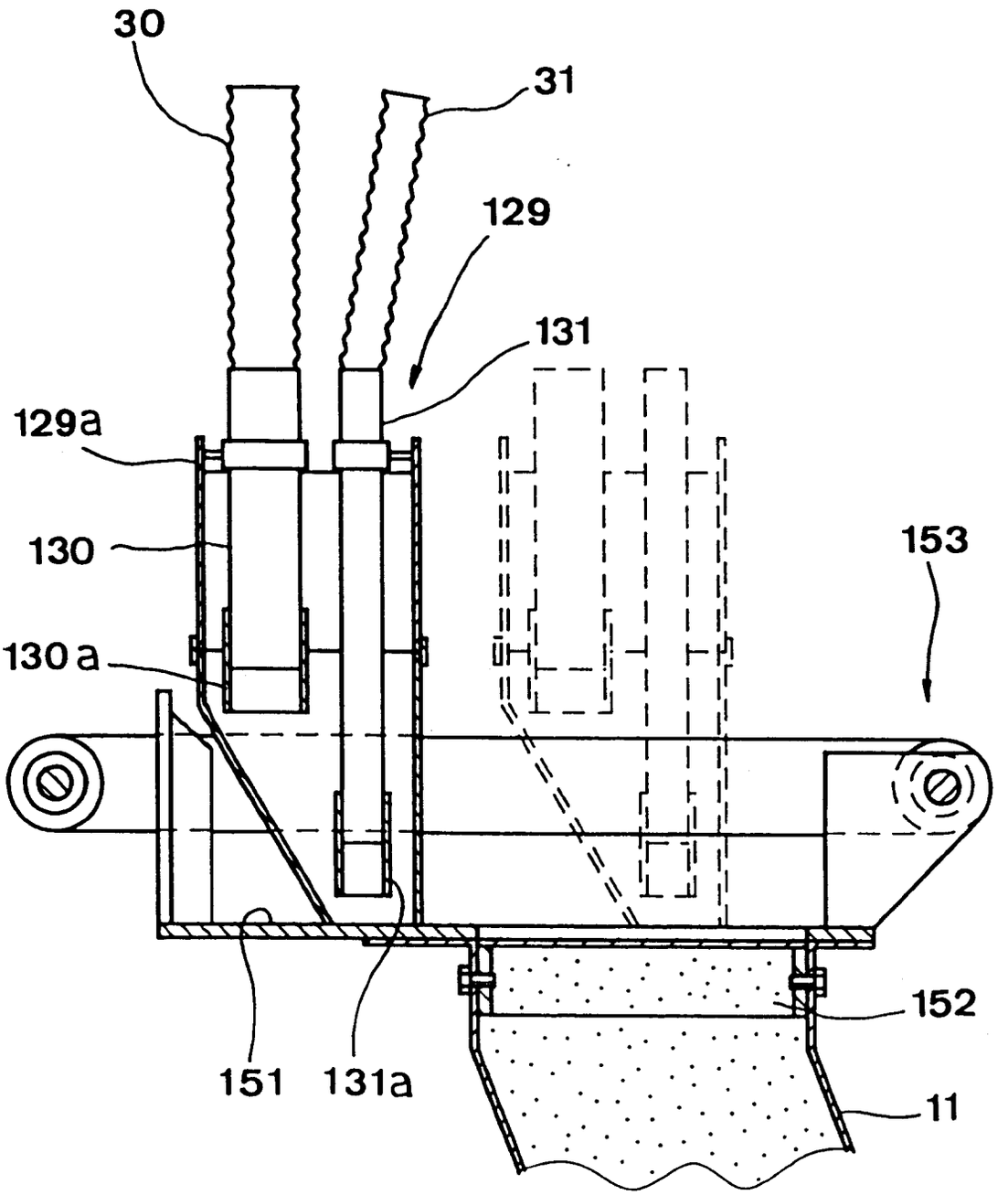


Fig. 14

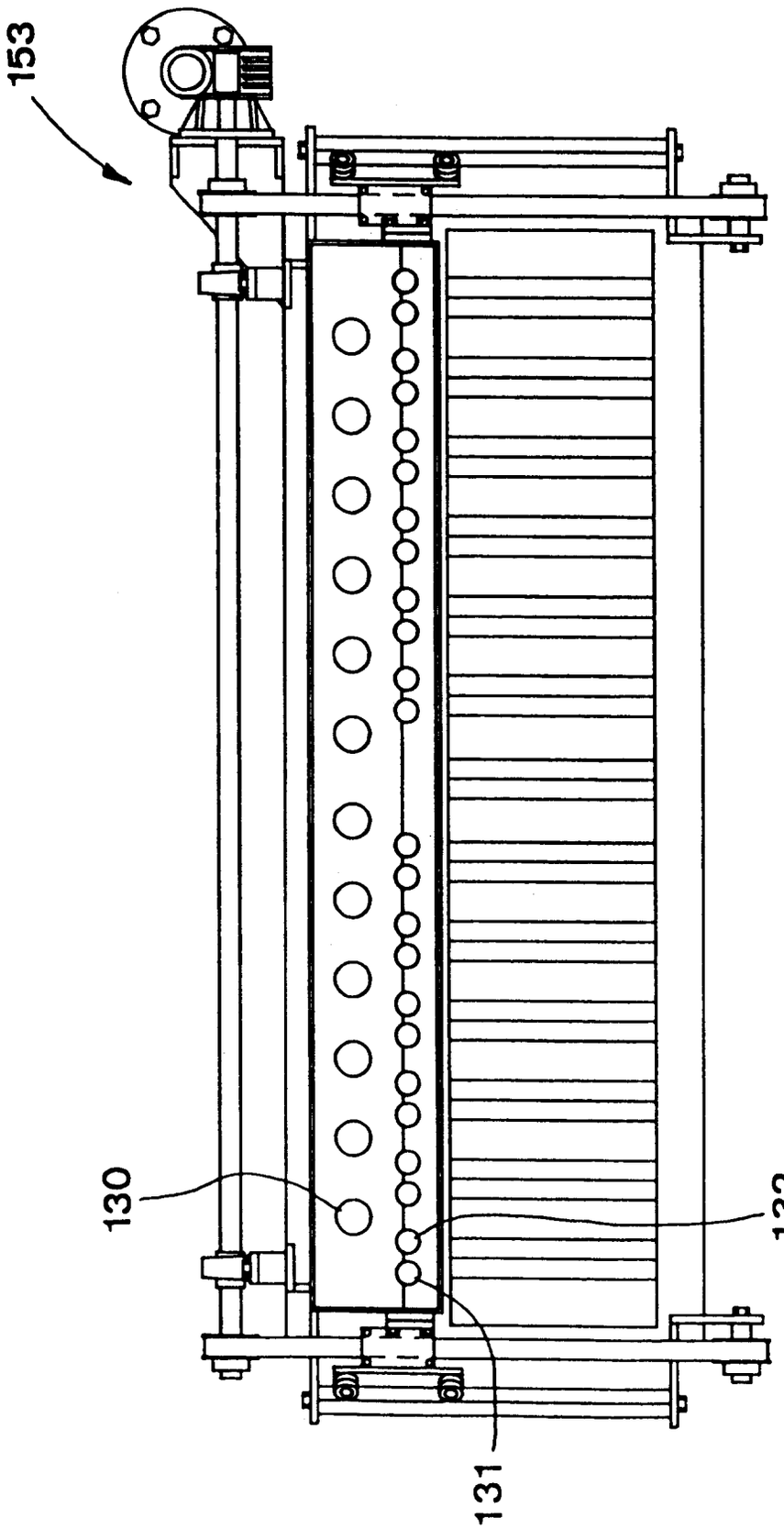


Fig.15

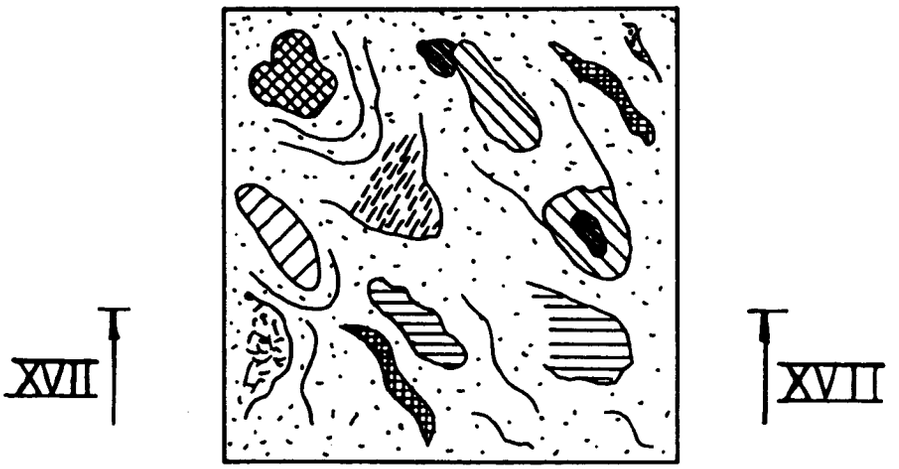


Fig.16

Fig.17

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Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	SOVIET PATENTS ABSTRACTS Week 8940, 15 November 1989 Derwent Publications Ltd., London, GB; AN 89-291610/40 & SU-A-1 447 681 (LVOV POLY) 30 December 1988 * abstract * ---	1-3,6,8, 10,14, 19,21, 39,40, 55,56	B28B13/02 B28B1/00
A	EP-A-0 300 532 (KONINKLIJKE MOSA B.V.) * column 2, line 40 - column 2, line 54 * * column 3, line 1 - column 3, line 21 * * column 4, line 41 - column 4, line 58 * * column 5, line 1 - column 5, line 58 * * column 6, line 1 - column 6, line 38 * * figure 1 * ---	1-3,8, 10,19, 21,55,56	
A	EP-A-0 492 733 (KONINKLIJKE MOSA B.V.) * the whole document * ---	1-3,8, 10,15, 19,55,56	TECHNICAL FIELDS SEARCHED (Int.Cl.5) B28B B30B
A	DE-B-10 70 983 (A. CHATELAIN) * the whole document * ---	1,2,15, 16, 19-21,55	
A	BE-A-759 787 (J. G. M. J. SWENDEN) * figures 1-7 * --- -/--	1,10-13, 19,20, 34-36, 48,49, 55,56	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 April 1994	Gourier, P

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EUROPEAN SEARCH REPORT

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A	NL-C-74 (SOCIETE ANONYME DES ANCIENS ETABLISSEMENTS G. FIEVE) * figures 1-6 * ---	1,10-13, 19,20, 34-40, 48,49, 55,56	
A	DE-A-37 14 420 (LAEIS GMBH) * the whole document * ---	1,4,5, 14,15, 19,31, 33, 41-44, 46,47, 50,55	
A	DE-A-23 16 481 (E. CHIESA) * the whole document * ---	1,2,8, 19,21, 44,55,56	
A	US-A-1 586 805 (A. J. HESKETT) * the whole document * ---	1,19,45	TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A	FR-A-1 469 223 (L. A. BOISSONNET) * page 3, line 1 - page 3, line 3 * * page 4, line 21 - page 4, line 25 * * figures 1-4 * -----	1,19,51	

The present search report has been drawn up for all claims

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THE HAGUE	8 April 1994	Gourier, P

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