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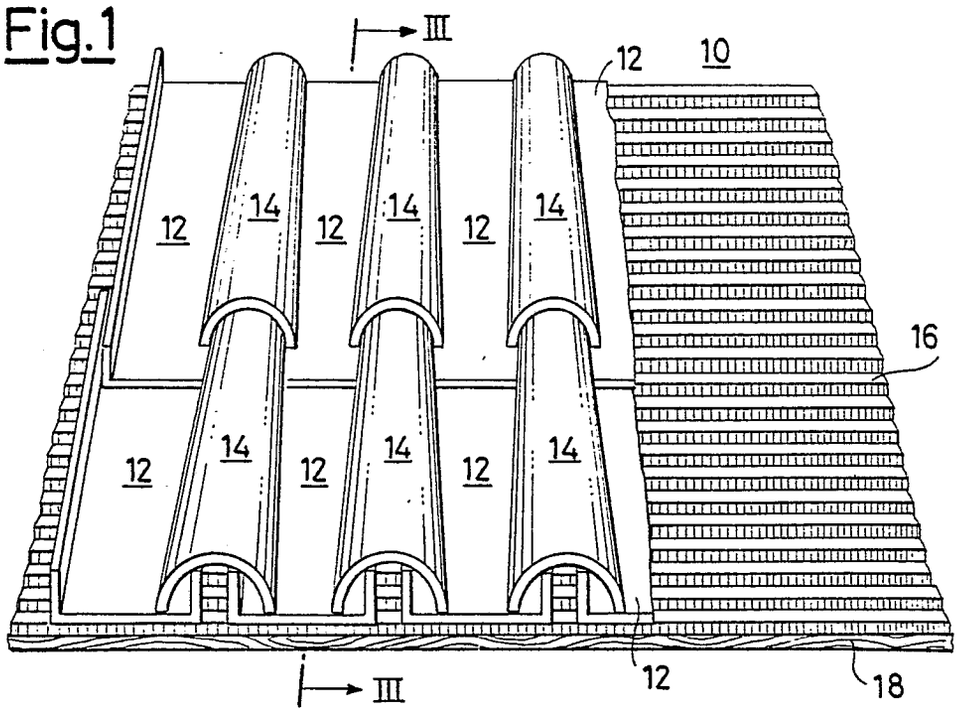
(54) **Undertile waterproof plates, particularly suitable to prevent the tiles from sliding.**

(57) Undertile waterproof plates (16), of the planar or corrugated type and scored, essentially perpendicularly positioned with respect to the rows of tiles (12, 14) to be supported, having whatever clean edge profile, and adapted to increase the friction between the said tiles (12, 14) and the plates (16) themselves, in order to prevent the tile (12, 14) sliding.

Fig.1



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"Undertile waterproof plates, particularly suitable to prevent the tiles from sliding.

The present invention relates to waterproof plates to be inserted between the tiles and the supporting girders of a roof, to avoid that possible water seepages around or through the tiles cause the girders to be damaged, are shaped so as to avoid or minimize the probability of sliding of said tiles onto said plants even in the case of highly inclined roofs. It is known since long time that the roofs covered by baked clay tiles, especially the curved tiles, show extraordinary properties of mechanical strength to loading and impact as well as resistance to corrosive environmental and chemical agents.

However, in order to avoid an immediate risk of water seepage owing to exceptional rain or th tile breakage, and also to achieve a saving of thermal energy, it is coming customary, both in novel high class building and in the restoring of ancient or anyhow degraded buildings, to use plates of waterproof materials, such as plates of resin materials of the type as polyvinylchloride (PVC), acrilic-butadiene-styrene copolymers (ABS), etc., or plates of fiber materials, such as paper board, impregnated with bitumen, (the typical plates of bitumized paper board) to be interposed between the covering tiles and the roof supporting structures, said plates acting as an waterproof auxiliary roofling, adapted to prevent possible seepages of water around the integer tiles or through perforated, cracked or anhyhow damaged tiles from reaching structural parts of the roof, such as girders, which can be possibly damaged by said seepages, and acting as well as a supplementary support for said tiles, the supporting capacity of the girders being thus distributed to the whole part of the tiles which in direct contact with said interposed plates, and lastly acting as a supplementary thermal isolation.

As a matter of practice, for this purpose, both resin plates and bituminized paper board plates have been provided, which gave excellent results as regards the supplementary waterproofing given therefrom, the resin plates being preferred where a particularly certain additional waterproofing is sought for and the cost control is not the main problem, those of bituminized paper board being preferred in the case in which said expenses are to be controlled.

Obviously, depending on the fact that the tiles positioned onto the roof are of planar type or of the curved type, planar or corrugated plates shall be used, the corrugated plates being selected with a pitch and a wave height such as to conform to the said tiles.

One of the more serious drawbacks occurring with the use of the said undertile waterproof plates is the risk of the sliding of the tiles onto the plates themselves, which may occur especially in locations undergoing heavy snow falls and wherein particularly inclined roofs are adopted , when the snow, tending to slide down from the said roofs, does apply a tangential force downwardly directed on to the tiles.

In order to avoid such a tile sliding, systems are adopted to increase the friction coefficient between said tiles and said undertile plates. A first system consists in roughing by abrasion, sanding or blasting the surfaces facing towards the tiles of the plates of resin materials.

This system does not always lead to satisfactory results since generally such a roughing is not very deep and the irregularities as produced thereby by means of mechanical means, especially rotating means, tend to have rounded edges by which the friction coefficient is not increased. Moreover whatever subsequent mechancial working of finished plates increases their cost, making them less attractive for the customers. A simpler system consists in incorporating granulated material, such as sand, within a surface at the time of the forming thereof, but the results, being dependent on the adhesion of said granulated material to the said surface, are not always certain and moreover the further processing for the embedding of said granulated materials does add to the plate costs.

As regards the bituminized paper board plates, the roughing by abrasion is not effective since the paper board fibres tend to form lints under abrasion and the sand addition is of questionable effectiveness since said sand tends to be readily detached from the bituminized paper board, the bitumen in the winter time becoming fragile owing to the low temperatures and in the summer time becoming soft owing to the high temperatures, whereby in any case the detachment of the sand granules is promoted.

In the prior art a solution has been proposed in order to increase the friction coefficient of bituminized paper board plates by using plates manufactured by the so-called "planar table", namely a system in which the paper board is manufactured by filtering paper pulp through a net leaving an impression thereof onto the paper board plate having a moderate anti-sliding effect in the downwardly direction.

Another solution according to the prior art consists in passing the paper board plates, still in the moistened condition, before their entry in the drying section, through a roller pair, one of which has a knurled surface leaving onto one surface of said

paper board plate an impression similar to that of the net in the planar table.

The more serious drawback shown by the aforesaid solutions according to the prior art consists in that the net or the knurling generates impressions which are not perpendicular but inclined according to an angle different from 90^0 with reference to the laying of the tiles to be laid down, onto the plate and moreover with rather rounded corners whereby the antisliding effect of said impressions is rather moderate.

The purpose of the present invention is that of providing undertile waterproof plates, both of planar and of corrugated type, shaped so as to avoid the sliding of the tiles especially in roofs with highly inclined sides.

Another purpose of the present invention is that of providing undertile waterproof plates of thermoplastic resin materials.

A third purpose is that of providing said waterproof plates of bituminized paper board.

The aforesaid and other purposes of the present invention are achieved by forming undertile waterproof plates having essentially rectilinear scoring or depression, with clean edges and oriented perpendicularly to rows of tiles to be laid down onto the plates themselves.

According to a particular embodiment, said scorings have rectangular profile.

According to another particular embodiment, said scorings have triangular profile.

According to a further embodiment said scorings have serrated profile.

According to a particular embodiment, said plates are formed by thermoplastic material.

According to a more particular embodiment, said thermoplastic material is polyvinyl chloride (PVC).

According to another more particular embodiment, said thermoplastic material consists of acrilic-butadiene-styrene copolymers (ABS).

According to a preferred embodiment, said plate of thermoplastic material, if of the planar type, is manufactured by means of an extruder having an extruding die shaped as a slot with a rectilinear major side and the opposite major said of tortuous shape.

According to another preferred embodiment, said plate of thermoplastic material, if of corrugated type, is manufactured by corrugating a planar plate with a second face as above defined.

According a further embodiment, said plates of bitumen impregnated paper board of planar type are provided with scorings perpendicular to the rows of tiles to be laid down onto the plates themselves, while still in the moistened state and before being impregnated with bitumen, by means of a roll scored parallely to the generating line thereof pressing the paper board plates against another smooth roll.

According to an alternative embodiment, said plates of bitumen impregnated paper board, of corrugated type, are provided with scorings perpendicular to the generating lines of these corrugations, by impressing said scoring onto a face of said paper board plates of planar type, while still in the moistened condition and before being bituminized, by means or a roller scored parallely to its generating lines, as above described, and subsequently carrying out the corrugation of the paper board, still moistened, between other roller pairs.

According to a preferred embodiment, said plates of bitumen impregnated paper board, of planer type, are scored by manufacturing said paper board from a moistened paper pulp laid down onto a roller scored along its generating lines, in order to obtain scorings perpendicular to the direction of the paper fibers and so that the paper fibers nearest to the roller are positioned according to the scorings of said roller and subsequently are positioned in a manner less and less tortuous until they take a smooth pattern, whereby the surface of the paper board facing the scored roller is scored, whereas the opposite surface is smooth.

According to an alternative embodiment, said plates of bitumen impregnated paper board, of corrugated type , are firstly scored at one surface by manufacturing said paper board from a moistened paper pulp, according to the above described method, leading to scorings perpendicular to the plate forming direction and to the direction of the paper fibers, and then by corrugating said just formed paper board, still moistened, according to corrugations having generating lines perpendicular to said scorings onto one surface.

The aforesaid features and advantages of the present invention, together with other advantages and features, shall be better understood from the detailed description of the preferred embodiments thereof referred to in the accompanying drawings wherein:

- figure 1 is a perspective view of a portion of Roman roof with roof tiles laid down onto scored undertile plates of planar type according to the invention;

figure 2 is a perspective view of a portion of roof with curved tiles laid down onto scored undertile plates of corrugated type still according to the invention;

figure 3A is a cross-section, seen sidewise, of the roof of figure 1, taken along the line III-III, particularly representing a planar undertile plate, having cross scorings with rectangular profile, and the anchoring action thereof with respect of the abutting tiles;

figure 3B is a cross-section view, as seen sidewise, of the roof of figure 1 , taken along the line III-III, particularly representing a planar undertile plate, having cross scorinsg with serrated profile, and the anchoring action thereof with respect to the abutting tiles;

figure 4A is a cross-section, as seen sidewise, of the roof of figure 1, taken along the line IV-IV, particularly representing a corrugated undertile plate, having cross scorings with rectangular profile, and the anchoring action thereof with respect to the abutting tiles;

figure 4B is a cross-section view , as seen sidewise, of the roof of figure 2, taken along the line IV-IV, particularly representing a corrugated undertile plate, having cross scorings with serrated profile, and the anchoring action thereof with respect to the abutting tiles;

figure 5 schematically illustrated a method and apparatus for the manufacturing of scored planar plates of thermoplastic material;

figure 6 schematically illustrates a detail of an apparatus for the manufacturing of paper board planar plates with scorings having rectangular profile;

figure 7 is an enlarged cross-section view of a portion of a paper board planer plate, with rectangular profile scorings adapted to illustrate the disposition of the fibers in the plate itself;

figure 8 schematically illustrates a detail of an apparatus for the manufacturing of paper board planar plates with scorings having triangular or serrated profile;

figure 9 is an enlarged cross-section view of a portion of a planer paper board plate, with triangular or serrated profile scorings, adapted to illustrate the disposition of the fibers in the plate itself.

Referring to figures 1, 3A and 3b, a Roman roof 10 is seen as formed by roof tiles 12, the junctios of which are covered by curved tiles 14, the roof tiles 12 abutting onto scored undertile plates of planar type 16. The scoring of said undertile plates may have whatever profile useful to prevent the tiles from sliding, such as rectangular, trapezoidal, triangular, serrated or like profiles, the profile illustrated in figure 3A being rectangular and that shown in figure 3A being the particular type of triangular profile known as serrated profile.

As shown in figures 3A and 3B, the undertile plates, which are therein respectively indicated as 16a and 16b , are abutting onto a girder or slab 18 by which they are supported, the plate 16a having rectangular ribs 17 alternating with the depressions 19, the plate 16b having serrated ribs 17b.

Referring to the figures 2, 4A and 4B, it is seen that a roof with tiles 20 comprises, as it is known since very long time, curved tiles 22, the channel is which of upwardly facing, and curved tiles 24 having the channel facing downwardly, the curved tiles 22 with the channel facing upwardly being abutted against scored undertile plates of corrugated type 26. The scoring of said undertile plates may have whatever profile useful to prevent the tiles from sliding, such as rectangular, trapezoidal, triangular, serrated or like profile, the profile illustrated in the figure 4A being rectangular and that shown in the figure 4B being the particular type of triangular profile known as serrated profile.

As shown in the figures 4A and 4B the undertile plates which are therein respectively indicated by 26a and 26b are supported onto a slab or girder 28 by which they are supported, the plate 26a showing rectangular ribs 27a alternating with depressions 29 and the plate 26b having serrated ribs 27b.

The action of the planar undertile plates 16a and 16b, figures 3A and 3B is illustrated hereinafter.

The roof tiles 12 abut against said undertile that 16a of figure 3A with the upper edge restrained in a depression 19 between two ribs 17a.

An accidential displacement of one of said tiles to the position 12′, shown by dash and dot and lines in figure 3A, causes the upper edge of said tile to be more deeply fixed within a depression 19′ which is adjacent or anyhow close to the depression 19 it which is was originally fixed, it moreover pressing with a greater force and further pushing against the rib 17a which is immediately adjacent, with attendant great increase of the friction coefficient between the tile and the undertile plate preventing any further sliding of the tile itself.

In a fully similar manner the planar tiles 12 abut against said undertile plate 16b of figure 3B with the upper edge fixed between two serrated adjacent ribs 17b and more particularly with the edge abutted against the less inclined profile of one of said ribs and the immediately adjacent edge area abutted against the upper edge of the immediately next rib. An accidental displacement of one of said tiles to the position 12′, shown by dot and dash lines in the said figure 3B, causes the upper edge of said tile to more deeply fix within the less inclined profile of a close rib 17b′ and immediately adjacent edge area to press with a greater force and to further push onto the upper edge of the immediately next rib 17b″, with the attendant great increase of the friction coefficient between tile and undertile plate preventing any futher sliding of the tile itself.

The action of the corrugated undertile plates 26a and 26b of figures 4A and 4B is illustrated hereinafter.

The curved tiles 22 abut onto said undertile plate 26a of figure 4A with the upper edge re-

strained in a depression 29 between two ribs 27a. An accidental displacement of one of said tiles to the position 22′, illustrated by dash and dotted lines in figure 4A causes the upper edge of said tile to be more deeply restrained in the depression 29′ adjacent or anyhow close to the depression 29 in which it was originally restrained, pressing moreover with a greater force and pushing against the rib 27a which is immediately adjacent, with the attendant great increase of the friction coefficient between the tile and the undertile plate, by which any further sliding of the tile itself is prevented.

In a fully similar manner, the curved tiles 22 abut onto said undertile plate 26b of figure 4B with the upper edge restrained between two adjacent serrated ribs 27b and more particularly with the corner abutting onto the less inclined profile of one of said ribs and the edge area which is immediately adjacent abutted onto the upper edge of the immediately next rib.

An accidential displacement of one of said tiles to the position 22′, illustrated by dash and dot and lines in figure 4B, causes the upper edge of said tile to be more deeply fixed within the less inclined profile of a near rib 27b′ and the immediately adjacent edge area to press with a greater force a two further push against the upper edge of the immediately adjacent rib 27b″, with the attendant great increase of the friction coefficient between the tile and under tile plate preventing the tile itself from any further sliding.

Turning now to consider figure 5, detail of an extrusion apparatus is illustrated suitable for the manufacturing of planar plates of thermoplastic material such as PVC, ABS and the like. Said extruder 100 comprises a die or extrusion mold 110 having a tortous upper edge, which in the shown example is shown as rectangular profile but may have any other profile useful in the production of cross scorings, and with a straight lower edge. From said die 100 a scored plate 116 is extruded which is pushed onto a conveying table comprising two supporting posts 112 which support idle rollers 114 permitting the forwarding of said plate 116.

As it can be seen in said figure 5, the plate 116 is provided with scorings oriented in the extrusion direction indicated by the arrow 115, comprising protruding ribs 117 and depressions 119, all of retangular profile.

Obviously, as above stated, the profile of said scorings may be different and, particularly, may be the serrated profile shown in figure 3B It is also obvious for the skilled person how from said planar plate 116 a corrugated plate can be obtained by using a corrugating machine.

The scored plates of bituminized paper board, both planar and corrugated, even if they do not show properties of strenght of moisture resistance comparable with those of the plates of thermoplastic materials, are however very interesting owing to their very reduced costs, owing to their very low fragility and to the optimum friction coefficient which can be obtained with said scoring.

Said scoring may be provided in several manners among which the preferred ones are the use of a scoring machine formed by two rollers one of which has a planar cylindrical surface to rearwardly support a wetted paper board and the other has a scored surface in the direction of the generating lines with scorings of square, rectangular, triangular of serrated section to press and impress and scoring of the plate.

The two cylinders may be spaced in adjustable manner from each other, whereby an impression more or less deep can be impressed.

This method of scoring by impression onto wet paper board has however the drawback that, owing to the subsequent drying of the paper board the impressions tend to level owing to the fact that, as it is believed, the fibers of wet paper board, bend for the impression and to straighten owing to the drying and consequently to provide a scoring having a given dry deepness, a much more deep scoring must be impressed in the wet state, sometimes in the proximity of the brecking limit of the paper board itself.

In order to avoid this drawback of the poor deepness of the scoring or of possible bracking of the paper board, the systems, respectively illustrated in figures 6 and 8 have been proposed, giving as results sheets or plates of paper board of the type illustrated in the figures 7 and 9 respectively.

By considering figure 6, it is seen that in order to form a sheet of scored paper board a felt belt 130 is passed, moving according to a direction 132 and carrying a layer of paper pulp 134, under a roller 136 with rectangular scoring by which the pulp of the layer 134 is detached from the felt 130 and accumulated onto said roller 136 to form a layer in form of a cylindrical endless sheet 138.

The fibres of paper pulp, having a length much less than the spacing between the scorings of the roller 136 at the and beginning are positioned so as to follow said scoring namely following their contour. As the thickness of the cylindrical endless sheet 138 increases , the fibers are positioned according to a more and more regular and smooth pattern until said scorings are no longer followed.

The roller 136 during the rotation does continuously accumulate paper pulp until a required thickness is achieved, and at that time a blade 140, housed within a cavity 142, comes out cutting the cylindrical endless sheet 138 which is thus opened and detached from the roller 136 it being removed by means of a sliding table (not shown) for the

conveying to a further drying.

As it can be more particularly seen in figure 7, the sheet of fresh paper board 116a, which on one side has a scoring form by protruding ribs 117a and depressions 119 is formed by a plurality of layers 120-128 in which the fibers of the upper layers 120-123 follow in a progressively less marked manner the said scoring and those of the layers 124-128 are essentially smooth as the lower surface of said sheet.

By considering figure 8, it is seen that in order to form another type of scored paperboard sheet a felt belt 150, moving alone a direction 152 and conveying a layer of paper pulp 154, is passed under a roller 156 having a scoring of the so-called serrated shape, by which the pulp of the layer 154 is detached from the felt 150, it being accumulated onto said roller 156 to form a cylindrical endless sheet 158. The fibers of paper pulp, having length much less than the space between scorings of the roller 156, are initially positioned according to said scorings namely following their contour. As the thickness of the cylindrical endless sheet 158 increases, the fibers are positioned according to a more and more regular and smooth pattern until said scorings are no longer followed.

The roller 156 during the rotation continuates to accumulate paper pulp until a required thickness is achieved , and at that time a blade 160 housed in a cavity 162 comes out cutting the cylindrical endless sheet 158 which is opened and detached from the roller 156, it being removed by means of a sliding table for the forwarding to the further drying.

As it is more particularly seen in figure 9, the sheet of fresh paper board 116b which on one side has a scoring formed by serrated ribs 117b, is formed by a number of layers 163-170 in which the fibers of the layers 163 and 166 follow in a lesser and lesser marked manner said scorings and those of the layers 167-170 are essentially smooth as the lower surface of said sheet.

Of course, both the sheet of paper board 116a and the sheet 116b can be dried in a planar form or, before the final drying, may be passed through a corrugating machine by which a corrugation perpendicular to the direction of their scorings is given.

The above described and illustrated embodiments of the present invention are preferred ones, given merely for exemplifying and non limiting purpose, and the skilled in the art shall realize totally or partially equivalent solutions with respect to those above mentioned which are obviously herein covered.

Claims

1. Waterproof plates, to be interposed between the tiles and the girders of a roof in order to protect said girders from possible water seepage, particularly to minimize the possibility of sliding of said tiles onto said plates, by increasing as much as possible the friction coefficient between said tiles and said plates, characterized in that in order to increase said friction coefficient said plates are provided with scorings or depressions, which are essentially rectilinear and with clean edges and are positioned perpendicularly with respect to rows of tiles to be placed onto the plates themselves.

2. Waterproof plates according to claim 1, characterized in that said scorings have rectangular profile.

3. Waterproof plates according to claim 1, characterized in that said scorings have trapezoidal profile.

4. Waterproof plates according to claim 1, characterized in that said scorings have triangular profile.

5. Waterproof plates according to claim 1, characterized in that said scorings have serrated profile.

6. Waterproof plates according to claims 1-5, characterized by being formed of thermoplastic material .

7. Waterproof plates according to claim 6, characterized in that said thermoplastic material is polyvinyl chloride (PVC).

8. Waterproof plates according to claim 6, characterized in that said thermoplastic material is an acrylic-styrene-butadiene copolymer (ABS).

9. Waterproof plates, according to claims 6-8, characterized in that, if of planar type, their manufacturing takes places by means of an extruder having an extrusion die in form of a slot having a rectilinear major side and the opposite major side of tortuous shape.

10. Waterproof plates, according to claim 9, characterized in that said plates of thermoplastic materials, if of corrugated type, are manufactured by corrugating planar plates having a scored surface.

11. Waterproof plates according to claims 1-5, characterized by being formed by fiber materials, such as paper boards, impregnated with bitumen.

12 Waterproof plates, according to claim 11, characterized in that said bitumen impregnated paper board plates of planar type are provided with scoring perpendicular to the rows of tiles to be laid down onto the plates themselves by impressing said scorings onto a surface of the plate themselves still in the moistened state and before being

bituminized , by means of a roller which is scored parallely to its generating lines pressing the paper board plates against another smooth roller.

13. Waterproof plates of bitumen impregnated paper boards of corrugated type, provided with scorings perpendicular to the generating lines of said corrugations, obtained by impressing said scoring in surface of a planar type paper board plate, when the paper board is still in the moistened condition and before being bituminized, by means of a roller scored parallely to its generating lines, as described in claim 12, characterized in that the paper is subsequently corrugated, it being still in the moistened stated, between other pairs of rollers.

14. Waterproof plates, according to claim 11, characterized in that said bitumen impregnated paper board plates, of planar type, are scored by manufacturing said paper board from a wet paper pulp which is laid down onto a roller scored along its generating lines, to obtain scorings perpendicular to the direction of the paper fibers and so that the paper fibers closests to the roller are laid according to the scorings of said roller and subsequently are positioned in a less and less tortuous manner until a smooth pattern, is taken , whereby the surface of the paper board facing towards the scored roller is scored whereas the opposite surface is smooth.

15. Waterproof plates of bitumen impregnated paper boards of corrugated type, which are firstly scored onto a surface by manufacturing said paperboard from a wet paper pulp according to the method of claim 14, thus obtaining scorings perpendicular to the direction of forming of the plates and to the direction of the paper fibers, characterized in that said paper board, once formed and still moistened, is thereafter cor rugated with corrugations having generating lines perpendicular to said scorings onto one surface.

Fig.1

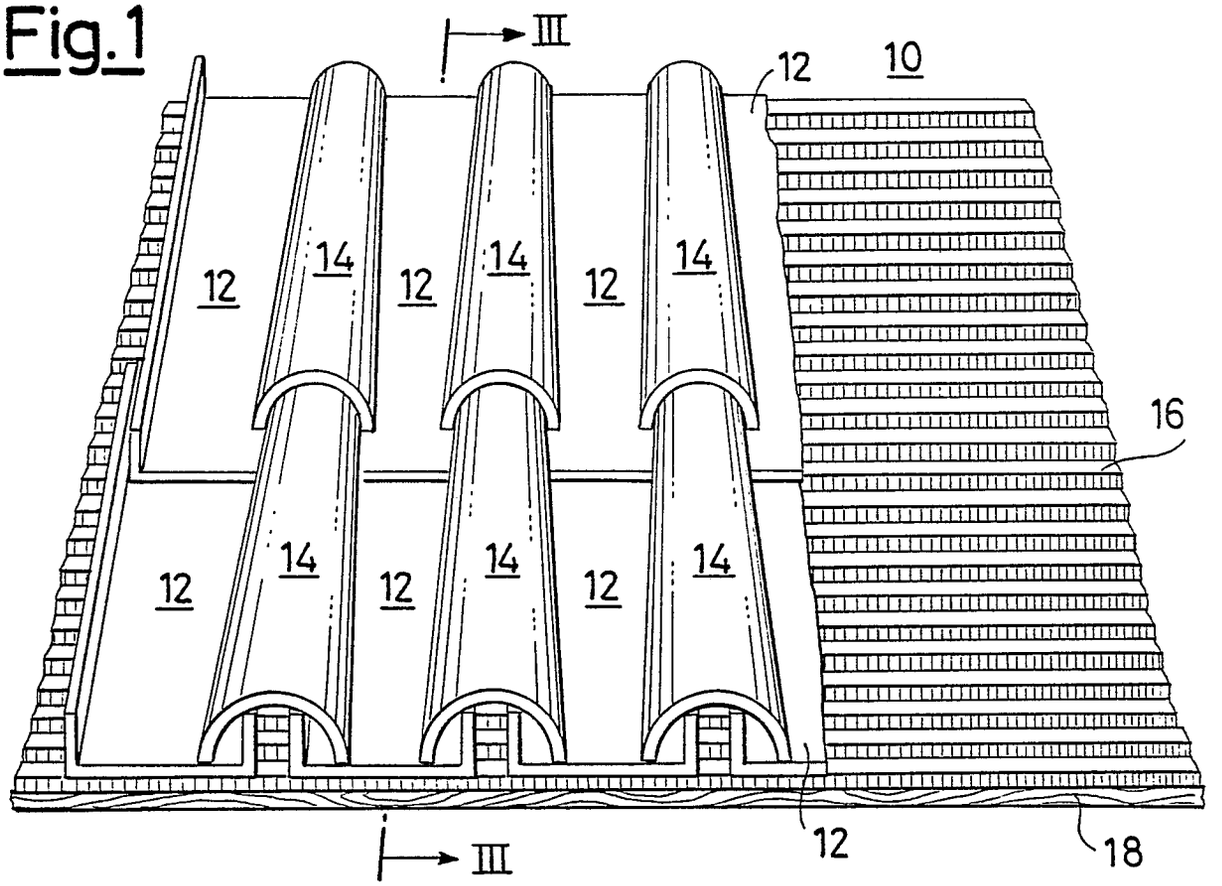
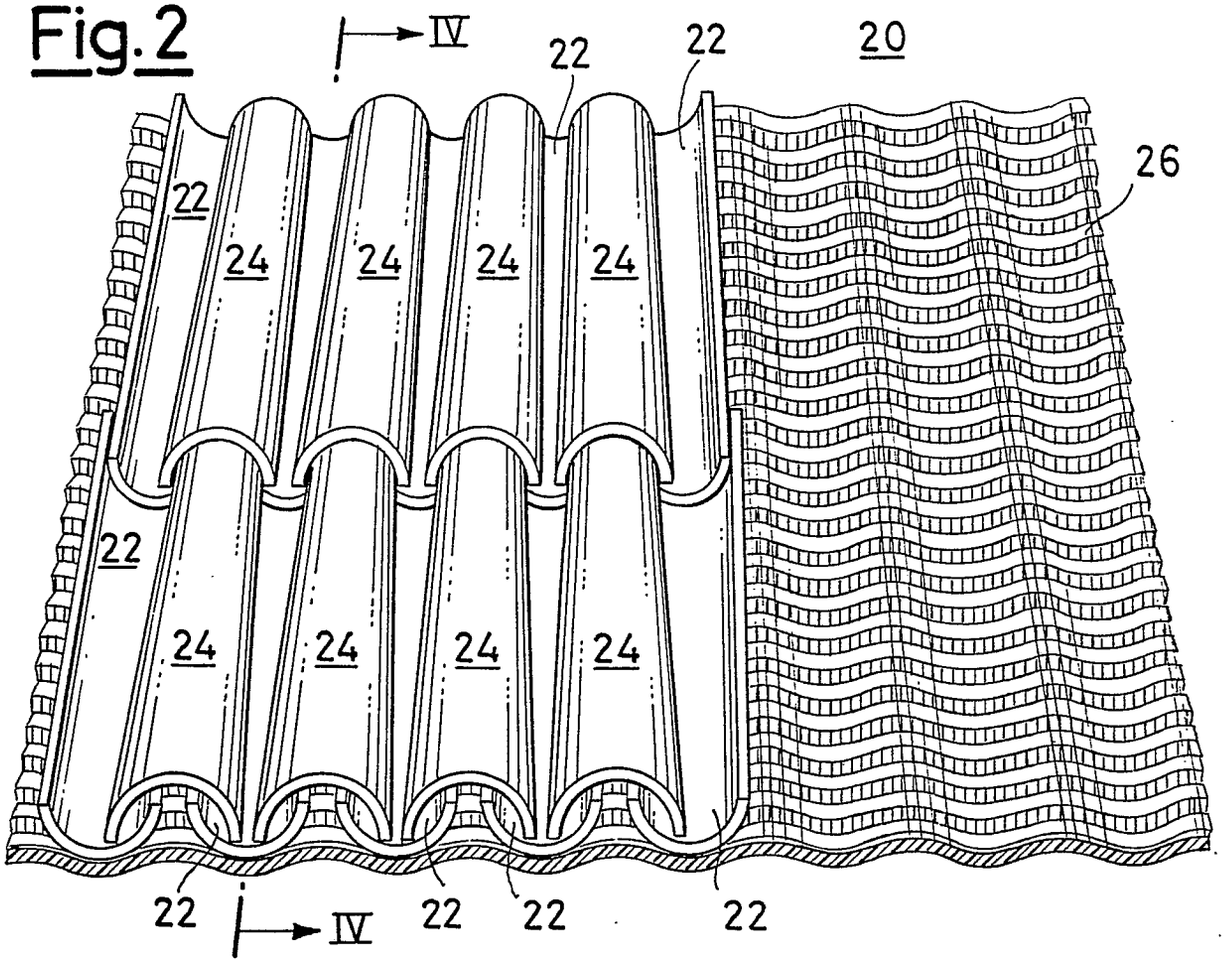


Fig.2



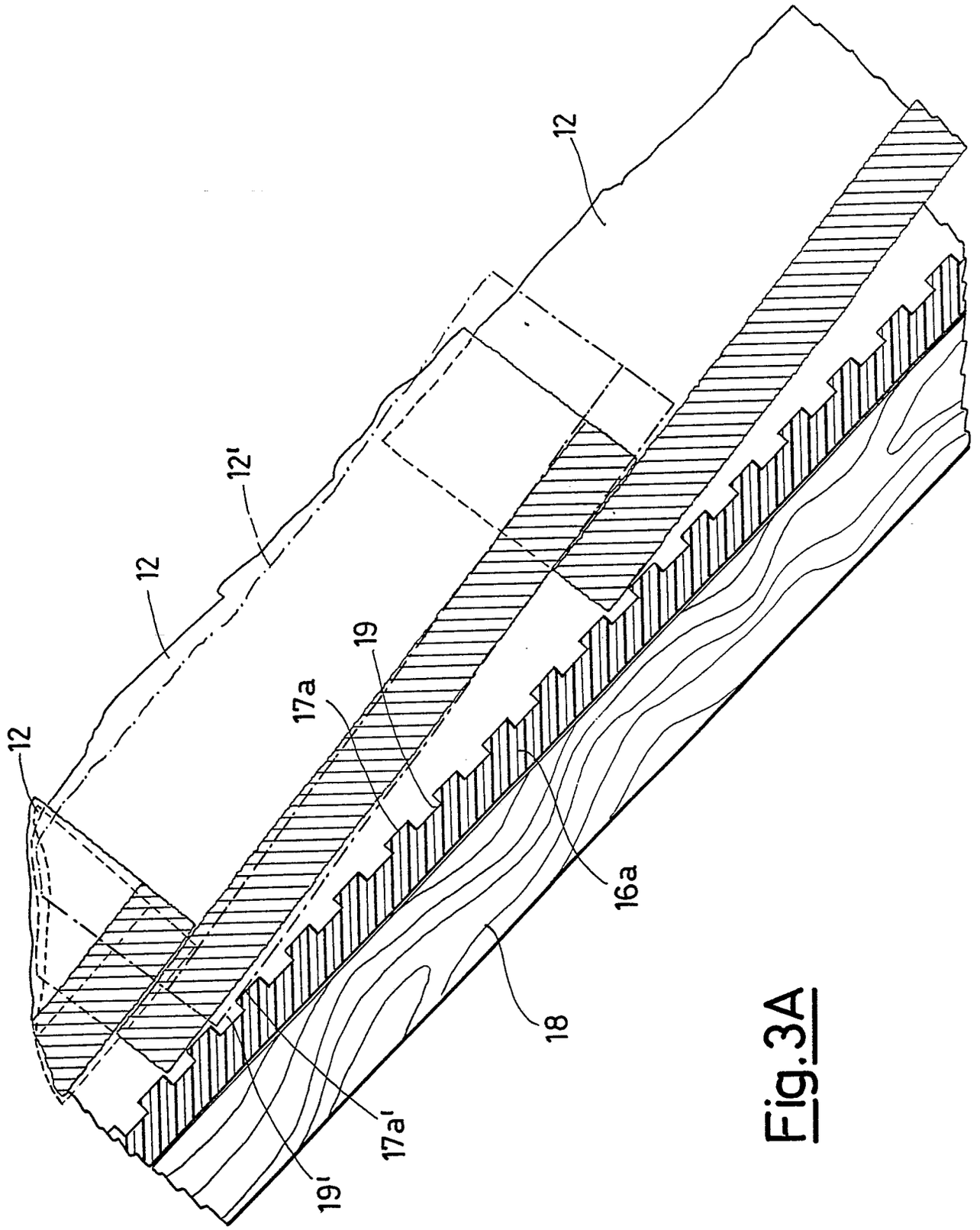


Fig.3A

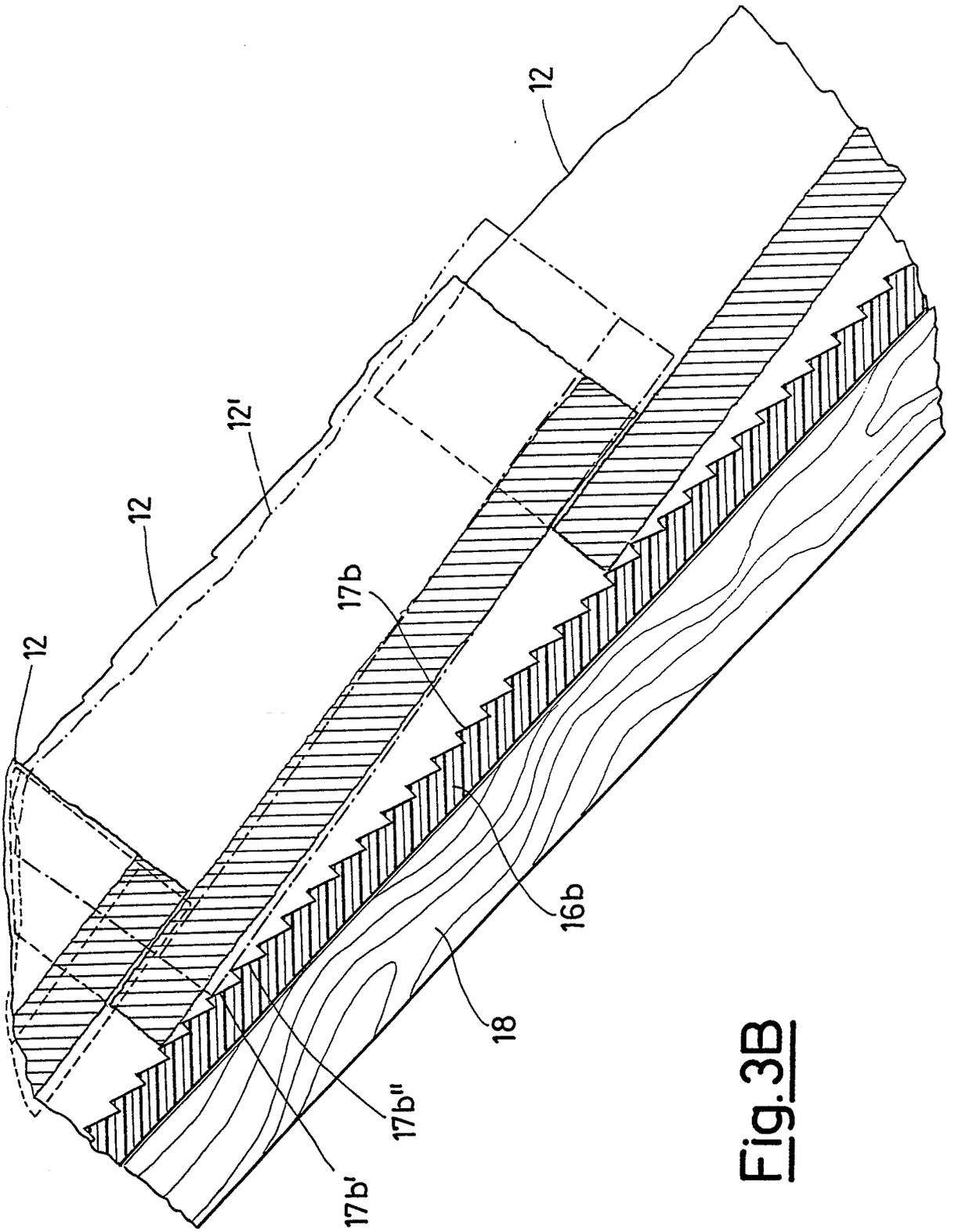


Fig.3B

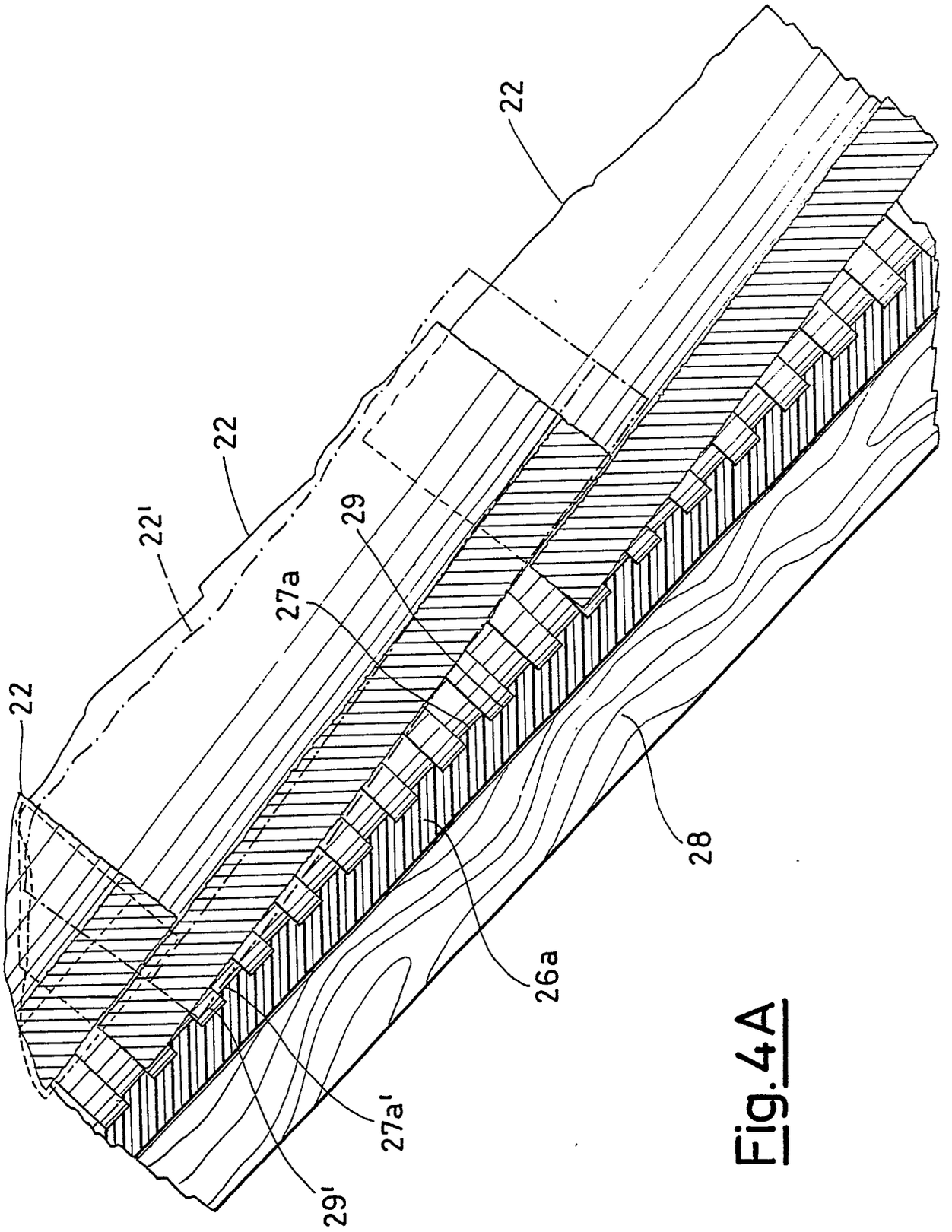


Fig.4A

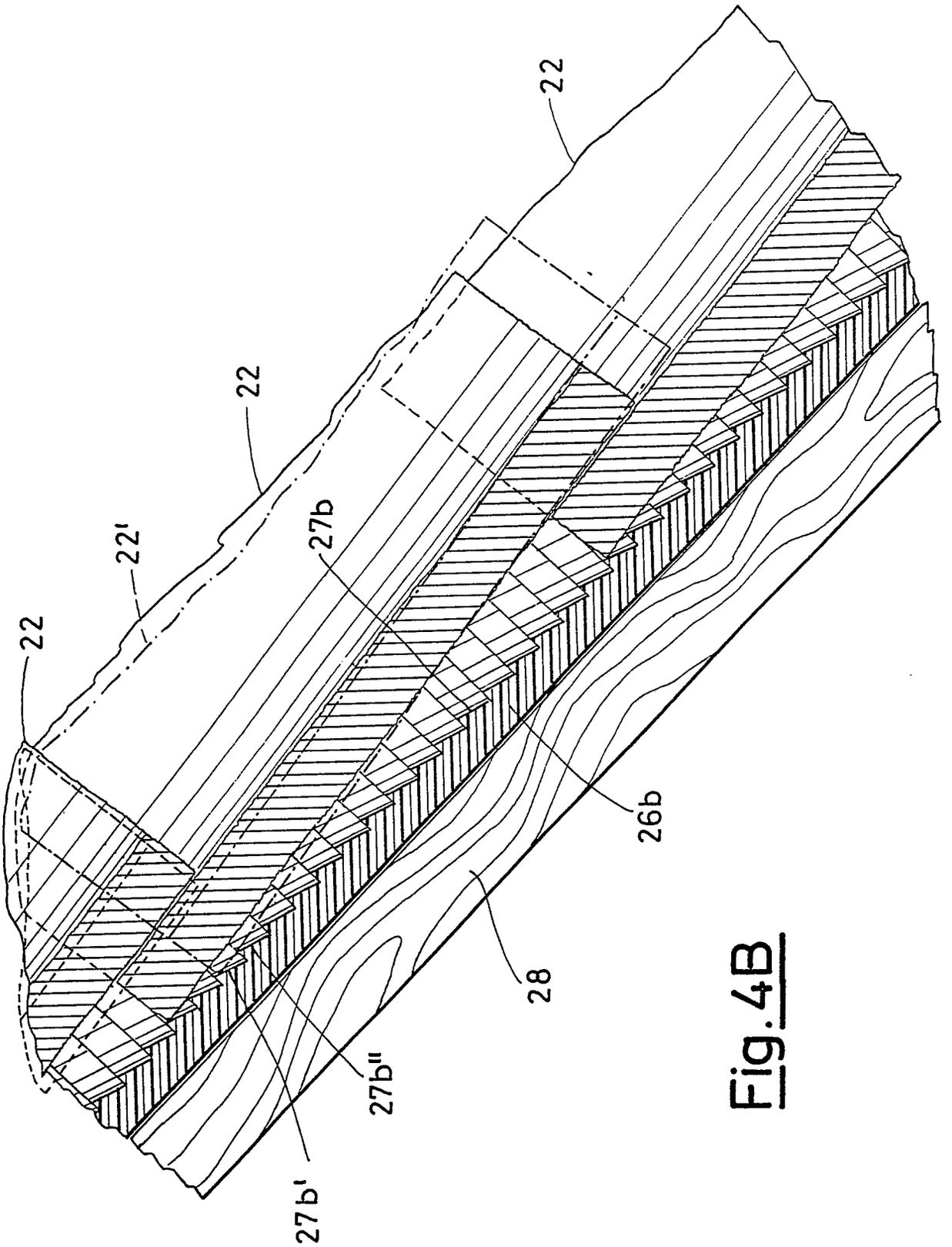


Fig.4B

Fig.5

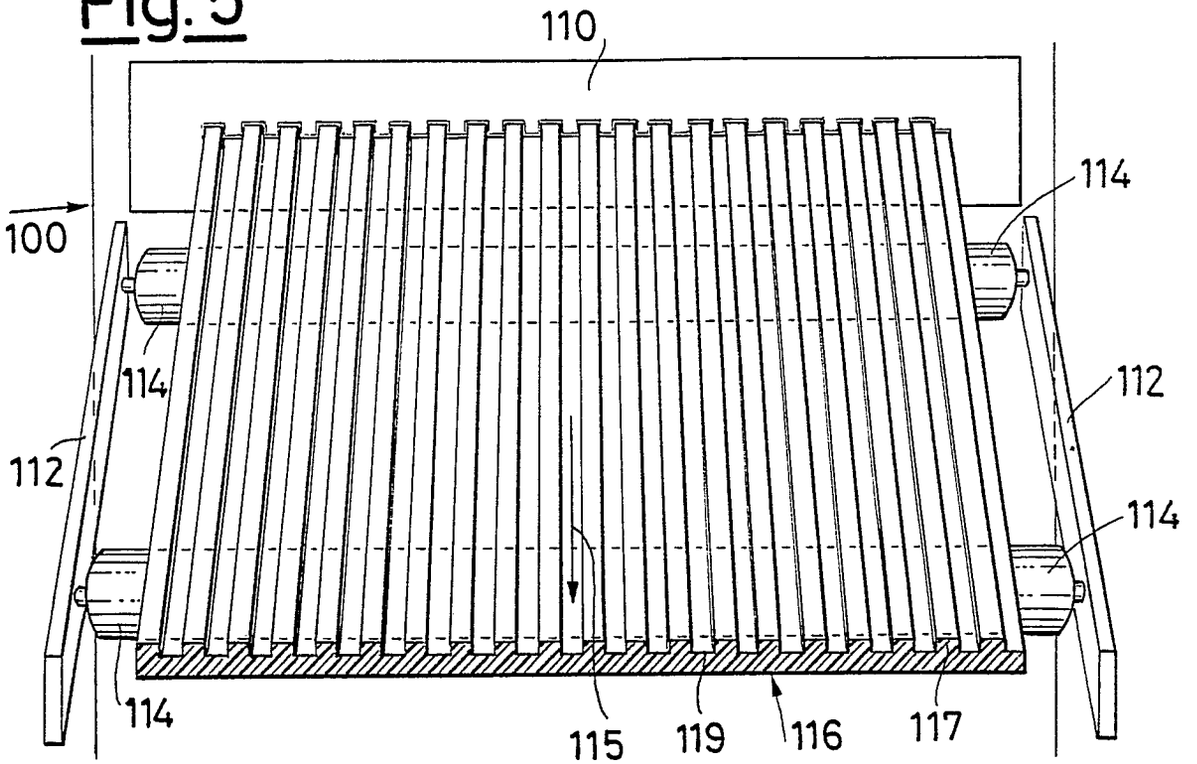


Fig.6

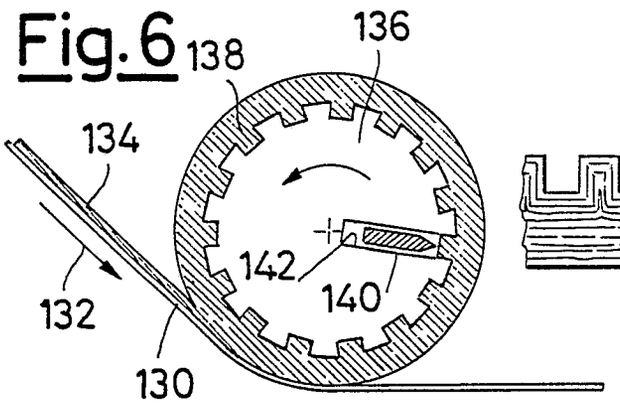


Fig.7

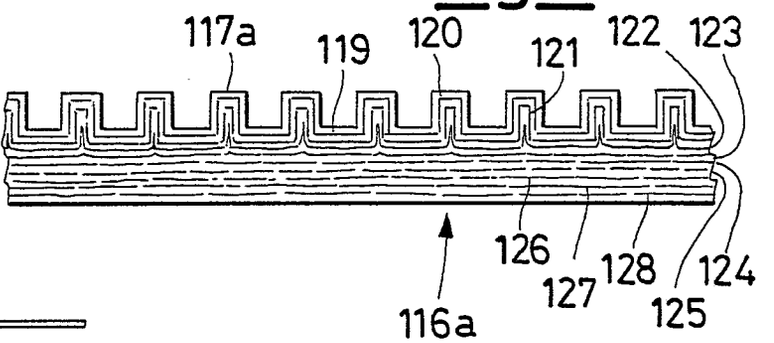


Fig.8

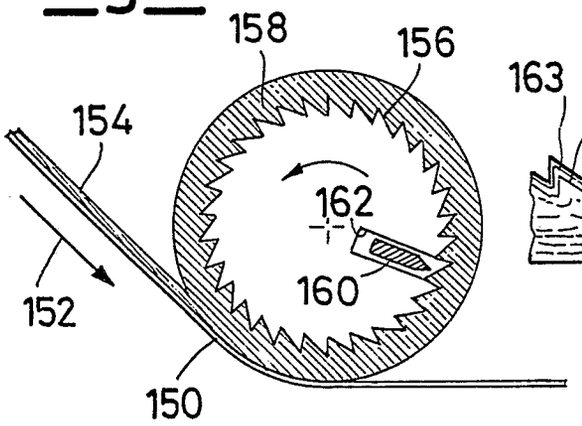
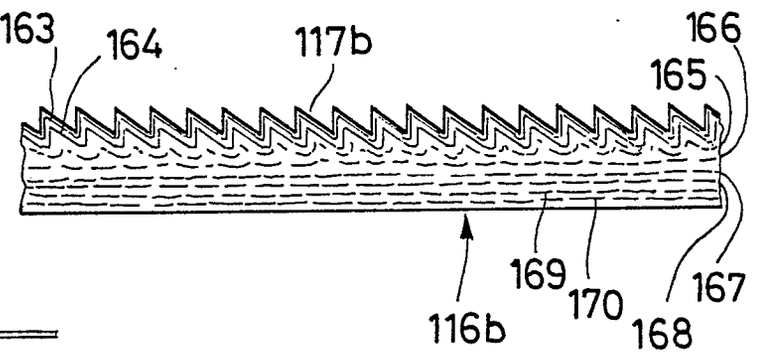


Fig.9



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 11 5794

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.4)
X	EP-A-0 063 550 (PIRCHER) * Figures 1-5 *	1,2	E 04 D 12/00
X	FR-A-2 183 430 (SOCIETE ANONYME DE PANNEAUX BETON INDUSTRIES CHIMIQUES) * Claim 4; figures 4,5 *	1,3	
X	FR-A-2 478 706 (LESAGE) * Figures 1-4 *	1,3,5	
X	FR-A-2 422 003 (HUE) * Page 1, lines 14-36; page 2, lines 1-3; figures 1,3 *	1,3,5	
A		6,7,8	
A	DE-A-2 050 552 (OBERSCHWÄBISCHE METALLWARENFABRIK GmbH & CO.) * Page 2, paragraph 2; figures *	9	
A	DE-A-1 609 986 (HEBGEN) * Figures 3,4 *	1,10,15	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	GB-A-2 041 782 (THE PRE-SEAL CO.) * Page 1, lines 91-99; figures *	1,11	E 04 D
A	FR-A- 989 373 (LACROUX) * Abstract; figures *	1,2,11	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19-12-1988	CHESNEAUX J.C.

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