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(54) **Flooring element in plastic material having a net structure, process for the manufacturing of the same and use of the flooring element**

(57) A flooring element (1) comprises a net structure made of a plastic material (2) having a plurality of first elements 4) and a plurality of second elements (6). Anchoring portions extend from the prevalent development plane of the net structure, which anchoring portions, in use condition, are destined to face towards a terrain surface. The element comprise at least an anti-slip element (10) situated on an opposite side to the anchoring portion with respect to the development plane (3) of the net structure (2).

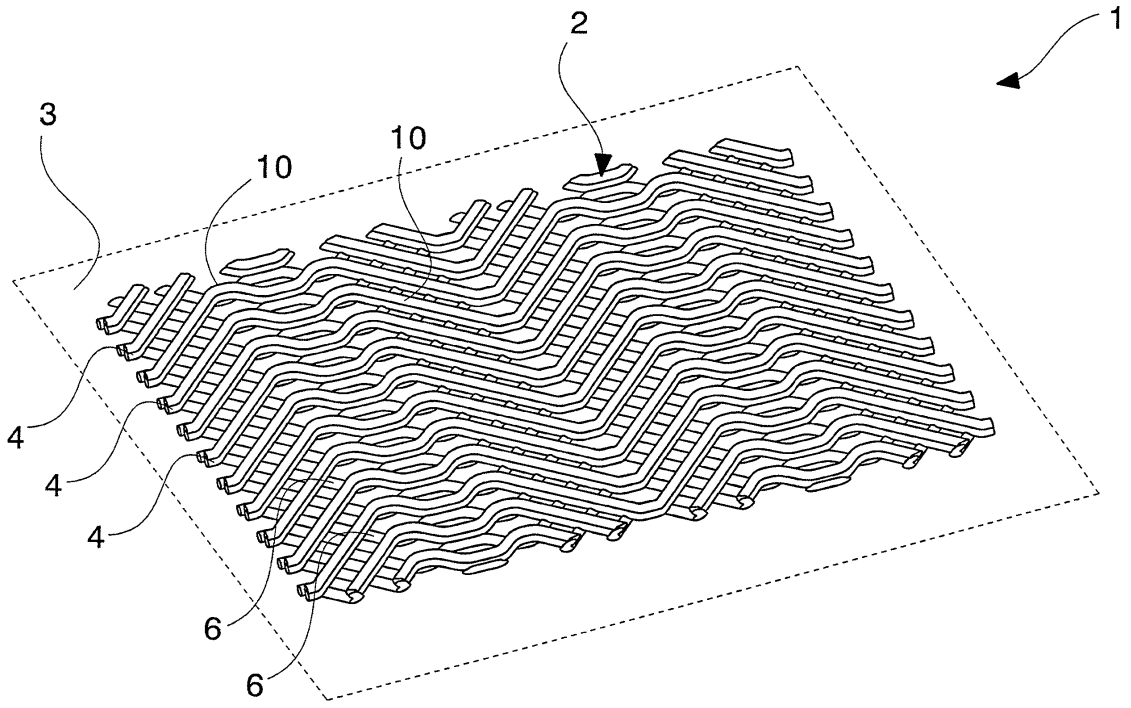

Fig.2

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a flooring comprising a net structure made of a plastic material. The flooring of the invention provides effective anchoring to the ground and guarantees good adherence and treadability. Beyond these main characteristics, the element provides the use surface with a good degree of compaction; merely by way of example, a typical application can be on areas that are frequently occupied and grassy areas which are frequently used for passage.

[0002] The invention also relates to a production process of flooring elements and a method of use therefor. In an aspect, the flooring elements can be made by extrusion.

BACKGROUND ART

[0003] As is known, the market offers structures made of plastic or metal material, or masonry, used for consolidating terrain surfaces.

[0004] A first example involves use of reinforcing honeycomb bricks, which once assembled form a net structure. This type of solution is used for consolidating a surface of the terrain, giving it the ability to resist loads determined by the transit of persons or means of transport. The described solution is not applicable to non-flat surfaces because of its intrinsic rigidity. Furthermore, installing the bricks, according to the above solution, comprises a laborious step of laying. Lastly, at the level of production, manufacturing the above bricks involves significantly high costs.

[0005] A second example relates to panels made of plastic material, also honeycomb-conformed, which can be assembled in such a way as to form structures of various shapes and dimensions on the basis of use requirements. This solution offers, like the previous one, the possibility of improving the surface compactness of the terrain. Further, using the panels reduces the laying time.

[0006] Also known is a third solution which comprises use of plastic net structures in a single piece, which thanks to their deformability can be stored in rolls, thus simplifying storage arrangements, as well as transport and laying. These plastic net structures are laid for consolidating the soil.

[0007] A further known solution relates to a net material made by coupling wire-shaped elements made of plastic. The net structure exhibits, on the side destined to rest on the ground to be consolidated, a polymer layer having a high coefficient of friction. The wire-shaped elements which form the net structure are able to work by traction and are ideal for applications on sloped walls or inclinations at risk of landslides where it is necessary to guarantee a containing action, but are totally unsuitable for use as flooring. Further, it is notable that the high-friction polymer layer is destined in use conditions to be facing towards the terrain in order to enable anchorage thereto.

AIM OF THE INVENTION

[0008] A first aim of the present invention is to solve one or more of the limitations and drawbacks of the preceding solutions.

[0009] A further aim of the invention is to make available a flooring element having an effective and improved grip on the ground.

[0010] An additional aim is to provide a flooring element that is capable of guaranteeing optimal adherence and treadability.

[0011] A further aim of the invention is to make available a flooring element having increased properties of resistance to mechanical traction, shear and flexion, without however excessively compromising deformability thereof in at least a plane.

[0012] Lastly, a further aim is to provide a solution having a broad field of application, ease of laying and simplified storage.

SUMMARY

[0013] At least one of the above-described aims is substantially attained by a flooring element, or by a manufacturing process thereof, in accordance with one or more of the accompanying claims.

[0014] Aspects of the invention are described herein below.

[0015] A 1st aspect comprises a net structure made of a plastic material extending along a prevalent development plane, wherein the net structure in turn comprises: a plurality of first elements that are reciprocally distanced; a plurality of second elements, distanced from one another and intersecting the first elements to form a plurality of meshes; and at least an anti-slip element, in cohesion with at least a portion of surface of the first elements and/or the second elements, the anti-slip element being situated on an opposite side to the anchoring portion with respect to the prevalent development plane.

[0016] In a 2nd aspect, in accordance with the first aspect, a predetermined number of the plurality of the first elements and/or the plurality of second elements exhibit an anchoring portion which extends transversally to the prevalent development plane of the net structure for enabling, in use conditions, an anchoring thereof to a terrain.

[0017] In a 3rd aspect, according to any one of the preceding aspects, the anti-slip element comprises a first material being less hard than a second material used for forming the net structure.

[0018] In a 4th aspect, according to any one of the preceding aspects, the anti-slip element exhibits an irregular free surface which is not smooth.

[0019] In a 5th aspect, according to any one of the preceding aspects, the flooring element comprises a plu-

rality of anti-slip elements applied in cohesion with a plurality of the first elements.

[0020] In a 6th aspect, according to any one of the preceding aspects, the flooring element comprises a plurality of anti-slip elements applied in cohesion with a plurality of the second elements.

[0021] In a 7th aspect, according to any one of the preceding aspects, each anti-slip element is applied by hot-joining to the net structure, such as to form a single body there-with.

[0022] In an 8th aspect, according to any one of the preceding aspects, the first elements and the second elements are joined to one another in a single piece, by contemporary extrusion.

[0023] In a 9th aspect, according to the preceding aspect, each anti-slip element is made by extrusion.

[0024] In a 10th aspect, according to the preceding aspect, each anti-slip element is made by extrusion contemporaneously with the extrusion of the first elements and the second elements.

[0025] In an 11th aspect, according to any one of the preceding aspects, the anti-slip elements in cohesion with first elements and/or the second elements are arranged according to a plurality of lie lines which are superposed on the first elements and/or on the second elements.

[0026] In a 12th aspect, according to any one of the preceding aspects, the first elements exhibit an undulating or straight progression along the prevalent development plane.

[0027] In a 13th aspect, according to any one of the preceding aspects, the second elements exhibit an undulating or straight progression along the prevalent development plane.

[0028] In a 14th aspect, according to any one of aspects 12 or 13, the lie lines of the anti-slip elements substantially exhibit an undulated or straight configuration, complementarily shaped to the conformation of the respective first and/or second elements to which the anti-slip elements cohere.

[0029] In a 15th aspect, according to any one of the preceding aspects, the anti-slip element is applied on a totality of the surface of the net structure.

[0030] In a 16th aspect, according to any one of the preceding aspects, the anti-slip element exhibits a thickness which is comprised between 1 and 7 mm.

[0031] In a 17th aspect, according to any one of the preceding aspects, the anti-slip element exhibits a thickness which is comprised between 3 and 6 mm.

[0032] In an 18th aspect, according to any one of the preceding aspects, the net structure exhibits a size in a perpendicular direction to the prevalent development plane which size is greater than 8mm.

[0033] In a 19th aspect, according to any one of the preceding aspects, the net structure exhibits a size in a perpendicular direction to the prevalent development plane which size is greater than 10mm In a 20th aspect, according to any one of the preceding aspects, the second elements intersect the first elements, forming intersection angles that are right-angles or acute angles and are comprised between 20° and 90°.

[0034] In a 21st aspect, according to any one of the preceding aspects, the first elements are arranged substantially parallel to one another.

[0035] In a 22nd aspect, according to any one of the preceding aspects, the distance between two first adjacent elements, measured perpendicular to the first elements, is greater than the width of the first elements.

[0036] In a 23rd aspect, according to any one of the preceding aspects, the second elements are arranged substantially parallel to one another.

[0037] In a 24th aspect, according to the preceding aspect, the distance between two second adjacent elements, measured perpendicular to the second elements, is greater than the width of the second elements.

[0038] In a 25th aspect, according to any one of the preceding aspects, the first elements and the second elements intersect at nodes and form a plurality of meshes, each of the first elements and/or the second elements exhibiting intermediate portions which extend between consecutive nodes.

[0039] In a 26th aspect, according to the preceding aspect, the intermediate portions have a transversal section of a progressively decreasing area starting from a node in a direction of a median line of the intermediate portions, and increasing in a distancing direction from the median line towards the successive node.

[0040] In a 27th aspect, according to the preceding aspect, the intermediate portions exhibit a central zone having a substantially constant width.

[0041] In a 28th aspect, according to any one of the preceding aspects, the first elements are not tubular and exhibit a full transversal section.

[0042] In a 29th aspect, according to any one of the preceding aspects, the second elements are not tubular and exhibit a full transversal section.

[0043] In a 30th aspect, according to any one of the preceding aspects, the transversal section of the first elements and/or the second elements has a substantially circular, or polygonal, or substantially elliptical conformation. In a 31st aspect, according to any one of the preceding aspects, the first elements exhibit a transversal section having an area of greater than 10 mm^2.

[0044] In a 32nd aspect, according to any one of the preceding aspects, the first elements exhibit a transversal section having an area of greater than 20 mm^2.

[0045] In a 33rd aspect, according to any one of the preceding aspects, the second elements exhibit a transversal section having an area of greater than 10 mm^2.

[0046] In a 34th aspect, according to any one of the preceding aspects, the second elements exhibit a transversal section having an area of greater than 10 mm^2.

[0047] In a 35th aspect, according to any one of the preceding aspects, the material of which the first elements are made comprises HDPE or Polypropylene or polyester resins.

[0048] In a 36th aspect, according to any one of the preceding aspects, the material of which the second elements are made comprises HDPE or Polypropylene or polyester resins.

[0049] In a 37th aspect, according to any one of the preceding aspects, the first and second elements are made of a same material.

[0050] In a 38th aspect, according to any one of the preceding aspects, the material of which the anti-slip element or elements are made comprises: LDPE, elastomer materials such as for example EVA.

[0051] In a 39th aspect, according to any one of the preceding aspects, the flooring element exhibits a plurality of anchoring portions that are distanced and separated from one another.

[0052] In a 40th aspect, according to any one of the preceding aspects, the anchoring portion exhibits a height in at least a transversal direction to the prevalent development plane of the net structure which is at least 4mm.

[0053] In a 41st aspect, according to any one of the preceding aspects, the anchoring portions exhibits a polygonal transversal section.

[0054] In a 42nd aspect, according to any one of the preceding aspects, the anchoring elements are configured according to a plurality of development lines extending, in use conditions, inferiorly of the first elements and/or the second elements, and wherein the development lines substantially follow the development direction of the first elements or the second elements.

[0055] In a 43rd aspect, according to any the preceding aspect, the development lines are substantially parallel to one another, for example straight or undulated.

[0056] In a 44th aspect, according to any one of the preceding aspects, the flooring element exhibits a specific weight per surface unit that is greater than $900g/m^2$.

[0057] In a 45th aspect, according to any one of the preceding aspects, the flooring element exhibits a specific resistance to traction in at least a direction that is greater than 6.5 kN/m, the specific resistance to traction being measured using the method set out in the description.

[0058] In a 46th aspect, according to any one of the preceding aspects, the flooring element exhibits a percentage elongation in at least a parallel direction to the main development plane that is greater than 20%.

[0059] In a 47th aspect, according to any one of the preceding aspects, the resistance to delamination between the anti-slip element and the net structure is such that by applying, on a flooring element located horizontally, a tangential force directed parallel to the prevalent development plane of at least 1 Kg, optionally of at least 2Kg, and distributed on a surface of $1cm^2$, no separation phenomena of the anti-slip element from the net structure must occur.

[0060] A 48th aspect concerns a process for realising the flooring element having a structure according to any one of the preceding aspects, the procedure comprising:

a step of predisposing the net structure, and

a step of hot depositing of at least an anti-slip element.

[0061] In a 49th aspect, according to the 48th aspect, the step of predisposing comprises a step of contemporaneous extrusion of the first elements and the second elements in order to form the net structure.

[0062] In a 50th aspect, according to aspects 48 or 49, the step of hot-depositing comprises a co-extrusion of the anti-slip element on the net structure during the step of contemporaneous extrusion of the first elements and the second elements.

[0063] In a 51st aspect, according to any one of aspects from 48 to 50, the process comprises a step of stretching the first elements and/or the second elements in at least one of the prevalent development directions.

[0064] A 52nd aspect concerns a use of the flooring element according to any one of aspects from 1 to 47, comprising positioning of flooring elements on a ground by means of flanking a plurality of the flooring elements of discrete dimensions.

[0065] In a 53rd aspect according to the 52nd aspect, the flooring element is deposited on the ground with the anchoring portions facing towards the terrain and immersed at least partially therein.

[0066] A 54th aspect concerns a flooring element according to any one of aspects from 1 to 47, wherein the flooring element is wound upon itself to form a rolled structure.

[0067] In a 55th aspect according to the preceding aspect, the flooring element is obtained by co-extrusion according to the process of any one of aspects from 49 to 51, and is therefore rolled in a roll according to a rolling axis which is transversal of the extrusion direction.

[0068] A 56th aspect, includes a flooring element, comprising

a net structure made of a plastic material extending along a prevalent development plane, wherein the net structure in turn comprises:

a plurality of first elements that are reciprocally distanced;

a plurality of second elements, distanced from one another and intersecting the first elements to form a plurality of meshes;

an anchoring portion which is joined to a side of the net structure and extends transversally to the prevalent development plane of the net structure for enabling, in use conditions, an anchoring thereof to a terrain, and a plurality of anti-slip elements, in cohesion with at least a portion of surface of the net structure on a side opposite to the anchoring portion with respect to the prevalent development plane, wherein each anti-slip element comprises a first material less hard than a second material used for form-

ing the net structure, and wherein each of said plurality of anti-slip elements has elongated conformation developing substantially parallel to a corresponding one of said first and second elements, and having a side defining a continuous elongated join to one corresponding of said first and second elements.

[0069] In a 57th aspect according to the 56th aspect each of said anti-slip elements is joined to the net structure by hot bonding, the material of the anti-slip element in correspondence of the continuous elongated joint being brought to a temperature of softening to thereby at least partially intermingling with the material of the net structure all along the continuous elongated join.

[0070] A 58th aspect concerns a flooring element, comprising

a net structure made of a plastic material extending along a prevalent development plane, wherein the net structure in turn comprises:
a plurality of first elements that are reciprocally distanced;
a plurality of second elements, distanced from one another and intersecting the first elements to form a plurality of meshes;
an anchoring portion formed in the net structure which extends transversally to the prevalent development plane of the net structure for enabling, in use conditions, an anchoring thereof to a terrain, and a plurality of elongated anti-slip elements, in cohesion with at least a portion of surface of the net structure,

wherein each anti-slip element is situated on a side of the net structure opposite to the anchoring portion and joins the net structure along the entire length of the anti-slip element.

[0071] In a 59th aspect according to any one of aspects from the 56th to the 58th, each anti-slip element exhibits an irregular free surface which is not smooth.

[0072] In a 60th aspect according to any one of aspects from the 56th to the 59th, the flooring element comprises a plurality of anti-slip elements applied in cohesion with one selected in the group comprising:

the first elements,
the second elements, and
the first and the second elements,
each of said plurality of anti-slip elements having elongated conformation developing substantially parallel to a corresponding one of said first and second element, and having a side defining a continuous elongated join to the corresponding first or second element.

[0073] In a 61st aspect according to any one of aspects from the 56th to the 60th each anti-slip element is applied by hot-bonding to the net structure, such as to form a single body there-with and wherein the first elements and the second elements are joined to one another in a single piece, by means of contemporaneous extrusion.

[0074] In a 62nd aspect according to any one of aspects from the 56th to the 61st each anti-slip element extruded and continuously joined along its longitudinal development to the respective first or second element, substantially contemporaneously with the extrusion of the first elements and the second elements.

[0075] In a 63rd aspect according to any one of aspects from the 56th to the 62nd each of the anti-slip elements in cohesion with the respective of the first elements and/or the second elements is arranged according to a respective lie line superposed on the corresponding of the first and/or second elements and wherein said continuous join extends through the entire length of the anti-slip element along said lie line.

[0076] In a 64th aspect according to any one of aspects from the 56th to the 63rd the first elements and the second elements exhibit an undulating or straight configuration along the prevalent development plane,
and wherein the lie lines of the anti-slip elements substantially exhibit an undulated or straight configuration, complementarily shaped to the conformation of the respective first and/or second elements to which the anti-slip elements cohere.

[0077] In a 65th aspect according to any one of aspects from the 56th to the 64th each anti-slip element exhibits a thickness which is comprised between 1 and 7 mm.

[0078] In a 66th aspect according to any one of aspects from the 56th to the 65th the net structure exhibits a size in a perpendicular direction to the prevalent development plane which size is greater than 8mm.

[0079] In a 67th aspect according to any one of aspects from the 56th to the 66th the net structure exhibits a size in a perpendicular direction to the prevalent development plane which size is greater than 10mm.

[0080] In a 68th aspect according to any one of aspects from the 56th to the 67th the second elements intersect the first elements , forming intersection angles that are right-angles or acute angles and are comprised between 20° and 90°.

[0081] In a 69th aspect according to any one of aspects from the 56th to the 68th the first elements are arranged substantially parallel to one another and the second elements are arranged substantially parallel to one another, and wherein a distance between two adjacent first elements and a distance between two adjacent second elements is respectively greater than a width of the first elements and a width of the second elements. In a 70th aspect according to any one of aspects from the 56th to the 69th the first elements and the second elements intersect at nodes and form a plurality of meshes, each of the first elements and the second elements exhibiting intermediate portions which extend between consecutive nodes, a plurality of the intermediate portions having a transversal section of a progressively decreasing area starting from a node in a direction of a median line of the

intermediate portions, and increasing in a distancing direction from the median line towards the successive node, and wherein the intermediate portions exhibit a central zone having a substantially constant width.

[0082] In a 71st aspect according to any one of aspects from the 56th to the 70th the first elements and the second elements exhibit a full, non tubular, cross section, said cross section having an area that is greater than $10mm^2$.

[0083] In a 72nd aspect according to any one of aspects from the 56th to the 71st the flooring element exhibits a plurality of anchoring portions distanced and separated from one another, wherein each anchoring portion exhibits a height in at least a transversal direction to the prevalent development plane of the net structure which is at least 4mm.

[0084] In a 73rd aspect according to any one of aspects from the 56th to the 72nd the anchoring portions are configured in a plurality of development lines extending, in use conditions, inferiorly of at least one of the first elements and second elements and wherein the development lines substantially follow the development direction of one of the first elements and second elements.

[0085] In a 74th aspect according to any one of aspects from the 56th to the 73rd the flooring element exhibits:

a specific weight per surface unit which is greater than 900g/m2;
a specific resistance to traction in at least a direction that is greater than 6.5 kN/m, the specific resistance to traction being measured using the method set out in the description;
a percentage elongation in the prevalent development direction of the first elements and/or the second elements of greater than 20%, the maximum percentage elongation being measured according to the method set out in the description.

[0086] In a 75th aspect according to any one of aspects from the 56th to the 74th a resistance to delamination between the anti-slip element and the net structure is such that by applying, on a horizontally positioned flooring element, a tangential force directed parallel to the prevalent development plane of at least 1 Kg and distributed on a surface of 1cm2, no separation phenomena of the anti-slip element from the net structure must occur.

[0087] In a 76th aspect according to any one of aspects from the 56th to the 75th the flooring element is obtained with a process comprising a stage of contemporary extrusion of the first elements and the second elements in order to form the net structure and a stage of hot-deposition, by co-extrusion, of the anti-slip element on the net structure during the contemporary extrusion stage of the first elements and the second elements.

[0088] In a 77th aspect according to any one of aspects from the 56th to the 76th one selected in the group comprising:

the first elements,
the second elements,
the first and second elements,
is stretched in at least a prevalent development direction to define a molecular orientation in the material forming the stretched element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0089] Some embodiments and some aspects of the invention will be described herein below with reference to the accompanying drawings, purely by way of non-limiting example, in which:

Figure 1 is a perspective view from above of a portion of the flooring element according to a first embodiment.
Figure 1A is a profile view of the flooring element of figure 1.
Figure 1B is a detail of a portion of the flooring element of figure 1 in a view from above.
Figure 1C is a perspective view from below of the flooring element of figure 1.
Figure 2 is a perspective view from above of a portion of the flooring element according to a second embodiment.
Figure 3 is a partial perspective view from below of the flooring element paving of figure 2.
Figure 4 is a view from above of the portion of flooring element of figure 2.
Figure 5 is a section view along line V-V of figure 4.
Figure 6 is a section view along line VI-VI of figure 4.
Figures 7A - 7B - 7C show the possible profiles, seen in cross section, of the first or transversal elements.
Figure 8A- 8B - 8C - 8D show some of the possible profiles, seen in cross section, of the anchoring portions.

DETAILED DESCRIPTION

[0090] With reference to the figures of the drawings, 1 denotes in its entirety a flooring element. A first example of a flooring element 1 is illustrated in figures 1, 1A, 1B, 1C and a second example is shown in figures 2-6: in these examples the same components are denoted by the same numbers.

[0091] The flooring element 1 comprises a net structure 2 exhibiting first and second elements 4 elements 6, both made of plastic material; in particular, the elements 4 and 6 might for example be made of HDPE or other polymers such as polypropylene or polyester resins.

[0092] Observing the accompanying figures of the drawings, it can be seen that the first elements 4 are spaced from one another, which is also true for the second elements 6. In particular, the first elements 4 intersect with the second elements 6 at respective nodes 8a such as to form a plurality of meshes 8 or through holes. In particular, the first elements 4 extend, in an undulating

(figure 2) or straight progression (figure 1); in turn, the second elements 6, also with undulating or straight, extend transversally with respect to the first elements 4. In the illustrated examples, the minimum distance 8b between the first adjacent elements 4 is greater than 1 cm, and the minimum distance between the second adjacent elements 6 is greater than 1 cm.

[0093] In a further example, the maximum distance between adjacent first elements 4 is less than 5 cm, for example, less than 3cm; similarly, the maximum distance between adjacent second elements 6 is less than 5 cm, for example, less than 3cm. Note that the passage areas of the meshes can be uniform over the entire flooring element (figure 1) or can exhibit differentiated areas depending on zones of the structure (figures 2-5 show a plurality of zones: in each of these zones the meshes have a uniform passage area that is however different from the passage area of the meshes of the other zones). The structural features described ensure, firstly, that each mesh 8 has a sufficiently large size to facilitate anchoring to the ground and growth of any grassy substrate, and, secondly, that the net structure has sufficient structural strength. In particular, each mesh 8 exhibits, parallel to the plane 3, a mean open area (i.e. passing through the thickness of the net structure) that is comprised between 1 cm^2 and 10cm^2, optionally between 1.5 cm^2 and 8 cm^2.

[0094] In the example of figures 1, 1A, 1B, 1C, the second elements 6 are placed perpendicularly to the first elements 4 forming the rectangular or square mesh 8, possibly joined together at the intersections of these elements 4 and 6. Optionally (see for example figure 1 B), the width 4a of the first element 4 and the width 6a of the second elements 6, viewed from above, varies internally of the meshes 8 between a node and a consecutive node. In particular, in proximity of the centre line between two nodes, the width assumes a minimum value, for example at least 30% less than the width in the vicinity of the nodes. Still with reference to figure 6, it can be noted that between two nodes there is a central zone 14 in which the width remains constant over a tract that is at least 30% of the distance between two consecutive nodes.

[0095] In the alternative configuration illustrated in figures 2-6 the second elements 6 are arranged, with respect to the first items 4, at an acute angle of between 0° and 90°, such as to create meshes 8 having diamond or parallelogram shapes. Once more, in plan view the first and second elements may exhibit a substantially constant width, or may taper slightly at the central tracts comprised between a node and a consecutive node. In terms of geometry, the cross section of the first elements 4 and the second elements 6 can take on different shapes depending on operational needs: in addition, in a further variant applicable to both the example of figure 1 and that of figure 2, the profiles of the transversal sections may vary along the prevalent development direction of the elements. In any case, the first and the second elements exhibit a substantially full transversal section, which is determined by the type of production process used, which will be more fully described herein below. The example of figures 7A - 7B - 7C shows some of the possible profiles of the transversal sections of the elements 4 and 6. In particular, these shapes can be: polygonal (figure 7A), elliptical (figure 7B), circular (figure 7C).

[0096] The first elements 4 and the second elements 6 exhibit a transversal section that has an area of more than 10 mm^2. For example, the first and/or second elements may exhibit a transversal section area of greater than 20 mm^2.

[0097] The dimensions that are transversal of the prevalent development plane as well as the arrangement of the first elements 4 and the second elements 6 characterise the thickness of the flooring element, i.e. the overall dimensions 2a of the net structure 2 perpendicularly to the prevalent development plane 3. This thickness or overall dimensions 2a can be greater than 8mm, optionally greater than 10mm.

[0098] In accordance with a further aspect, the flooring element has a rigidity that is sufficient for the designated use thereof but not excessive, such that the flooring element can adapt to uneven ground while still being portable in roll form. For example, the flexional rigidity of the flooring element in a direction belonging to the plane 3 is not greater than 30 kg • cm. In the example in figure 1, the flexional stiffness is less than 22 kg • cm along the direction 17 and is less than 5 kg • cm in a direction lying on the plane 3 and perpendicular to the direction 17. With reference to figures 2-5, and for convenience making particular reference to the view of figure 4, the flexional rigidity is less than 22 kg • cm along a direction that is perpendicular to plane V-V and extending along the prevalent development plane 3 (this direction is in fact the outlet direction of the product from the production machine when the flooring element is made by co-extrusion according to one of the production processes which will be described in the following) and is less than 4.7 kg • cm in a direction lying on the plane 3 that is parallel to the plane V-V. The above-described flexional rigidities are determined according to the ASTM D 1388 standard.

[0099] The flooring element 1 also exhibits a plurality of anchoring portions 9, which allows a stable engagement to the ground and which extend perpendicular to the prevalent development plane 3 of the net structure 2.

[0100] According to the example embodiments, the anchoring portions 9 are arranged in different configurations. Independently of the configuration, the anchoring portions are in a single body with the net structure 2 and can be protuberances emerging from the first or second elements or, alternatively, may be constituted by a part of the actual first or second elements. For example, in the case of figures 1, 1A, 1B, 1C, the portions 9 are distinct from the first and second elements and are reciprocally distanced, and emerge transversally to the prevalent development plane of the net structure. In the case of figures 2-6, the anchoring portions are lower parts of

the second elements 6.

[0101] In terms of lie position, the portions 9 can be arranged in a plurality of development lines 17 which essentially follow the development directions of the first elements and/or the transversal elements. In the latter case, the portions 9 can include segments that are continuous and parallel to one another as shown in figure 1C. In the example of figures 1, 1A, 1B, 1C, the flooring element 1 exhibits an anchoring portion 9 comprising a plurality of main elements 15 and a plurality of auxiliary elements 16. In terms of geometry, the main elements 15 exhibit a shape in cross section that is polygonal and in particular rectangular (figure 8A), triangular (figure 8B), square (figure 8C) or semicircular (figure 8D). The main elements 15 are longitudinally arranged in continuous lines (figure 1 C), coinciding with the development direction of the first 4 elements. It should be noted that a variant the transversal section of the main elements 15 does not remain constant but varies continuously along the development of the elements. The height 15a of the main elements 15, perpendicular to the plane 3, is greater than 4 mm, while the area in transversal section is, for example, greater than 5 mm^2. The geometric aspect and dimensions of the main element 15 lend rigidity to the net structure 2 and guarantee the anchoring thereof to the ground. The auxiliary elements 16 comprise discrete portions of longitudinal and transversal extension that are significantly smaller than the longitudinal extension of the main elements 15; the auxiliary elements 16 are arranged in an alignment direction 18, in particular coinciding with the development direction of the second elements 6. In terms of geometry, they exhibit a profile such as a spherical cap (figure 1C). The auxiliary elements 16 contribute to the anchoring to the terrain because of the thickness 16b thereof, for example comprised between 1 mm and 3 mm, without excessively stiffening the structure further.

[0102] In the example illustrated in figures 2-6, the first elements are located above the second elements and the main development plane can be defined as the lie plane of the nodes between the first and the second elements, defined at the anchoring portions 9 which are in reality defined by the lower parts of the second elements that extend in a distancing direction with respect to the plane 3.

[0103] On an opposite side to the anchoring portions 9 with respect to the prevalent development plane 3, the flooring element 1 exhibits at least an anti-slip element 10.

[0104] In a first alternative, each anti-slip element 10 is made of a first material having a lower degree of hardness in relation to the materials constituting of the first elements and second elements. In particular, the first material is softer to penetration than the material of the elements 4 and 6. Thanks to the first material, the surface of the anti-slip element 10 exhibits a coefficient of static friction that is greater than the coefficient of static friction of a surface having a same geometry and made with the material or materials used for the first elements 4 and the second elements 6 would have. This property provides the characteristics of grip and treadability, for example for the passage of vehicles or persons.

[0105] Alternatively, each anti-slip element can comprise a free surface 11 obtained by working or processing, which can alter the surface finish thereof, and the free surface 11 has an irregular geometry, i.e. is undulated or exhibits other irregularities on the surface (figure 4) which afford the flooring optimum gripping ability. In this case an identical material to that used for the first elements 4 and/or the transversal elements 6 may be used for forming the anti-slip element 10.

[0106] In a third alternative, each anti-slip element 10 can be made with a first material having a lower degree of hardness than that of the materials constituting the first elements 4 and the second elements 6 (similarly to the first alternative), and may also comprise, in combination, an irregular, e.g. undulated, free surface as described herein above with reference to the second alternative.

[0107] As shown in figure 1, the anti-slip element or elements 10 can be applied to cover the whole of a surfaces (e.g. the top) of the net structure 2. This condition can be obtained for example by painting, or by partial immersion of the net structure in baths suitable for the application of the material defining the anti-slip element 10, or coextrusion processes, or even using other methodologies. The application of the anti-slip element or elements 10 can be done along continuous lines of material (see figure 1 and figure 2) arranged along the first elements 4 and distinct from one another, such that each line-shaped anti slip element is not connected to other anti-slip elements by the first material (i.e. the material forming the anti-slip elements) but only by the material of the net structure 2. More generally, the various anti-slip elements can be isolated from one another and connected only by the net structure 2. In the above-cited examples, various anti-slip elements are defined, arranged in adjacent lines 10; the various anti-slip elements are connected to the respective element of the first (or second) elements along respective continuous join lines extending along the entire longitudinal development of the anti-slip elements themselves.

[0108] The anti-slip element or elements 10, or the portions that form the elements, are superposed on the net structure 2 and exhibit a minimum thickness of greater than 1mm, such as to ensure sufficient elastic deformability of the anti-slip element in a perpendicular direction to the plane 3. In general the thickness of the anti-slip elements is comprised between 1 and 7 mm, optionally between 3 and 6 mm, for example in the vicinity of 5mm.

[0109] As the anti-slip element or elements give the flooring element a considerable adherence capacity, the anti-slip element or elements must be well anchored to the net structure and the net structure, thanks to the anchoring portion, must be capable of being stably blocked to the terrain. In particular, the coupling between the anti-slip element and the net structure is such as to ensure a

high degree of resistance to delamination, obtained thanks to the extended connection along the whole longitudinal development of each anti-skid element and thanks to the hot-coupling process between each anti-slip element and the net structure, which guarantees a partial co-penetration and mixing of the first material forming the anti-slip elements with the second material forming the net structure.

[0110] In accordance with an optional aspect of the invention, the resistance to delamination is such that, by applying to a horizontally-placed flooring element a tangential force of at least 1 kg (optionally at least 2 kg) directed parallel to the plane 3 and distributed on a surface of 1 cm^2, no separation phenomena will occur between the anti-skid element and the underlying net structure 2.

[0111] Finally, from a structural point of view, in accordance with further optional aspects of the invention, the flooring element has the following characteristics:

specific weight per surface unit area (again measured parallel to the plane 3) of greater than 900 g / m^2;
specific resistance to traction of at least 6.5 KN/m;
although the element 1 does not manifest isotropic behaviour, the specific resistance to traction must be at least as above-specified in any application direction belonging to the plane 3;
high friction level at the surfaces where the anti-slip element is present, such that the flooring element can be classified as "low potential for slip" according to the BS 7976-2 standard;
percentage elongation in at least a direction parallel to the prevalent development plane of more than 20%.

Production of the flooring element

[0112] In a possible production process, with which the products of figure 1 and 2 can be made, the flooring element 1 is constituted by a plastic material (e.g. HDPE) in which the first elements and the second elements are made by means of an extrusion process simultaneously. Subsequently or contemporaneously, the first elements 4 and second elements 6 are hot-coupled to form the net structure 2, which is therefore a monolithic plastic body. The anti-slip element or elements are then applied to the net structure 2 by a hot-depositing, painting or dipping process; for example the anti-slip element or elements are extruded onto the top of the net structure 2 during, or immediately after, the formation thereof. In other words, the first and second elements can be formed by contemporaneous extrusion such as to create a monolithic net structure: for example the first and the second elements can form a tubular net structure which, then cut along a longitudinal development direction, goes to form a flat net structure. During the coextrusion of the first and the second elements, extrusion of the anti-slip element or elements may be performed. The extrusion of the anti-skid element or elements may be made substantially contemporaneously to the formation of the net structure, such that the anti-slip element or elements are thus joined in a single piece by hot-joining to the net structure exactly at the desired points or lines. During this step a further passage many be required in which the anti-slip element or elements are subjected to a processing or treatment able to modify the surface finishing of the element 10.

[0113] In a second manufacturing process, the net structure 2 of the element 1 may be made by a process of injection moulding. Subsequently the anti-slip element (or elements) can be applied, for example by painting, dipping or extrusion of a suitable material at least on the side of the net structure 2 destined in use to be trod upon.

[0114] Furthermore, in accordance with an additional aspect which may be included in any one of the preceding manufacturing processes, the flooring element can be subjected to a further stretching step in at least a direction coinciding with the prevalent development direction of the first elements 4 and/or the second elements 6. This step enables the flooring to increase the resistance to traction thereof with respect to a flooring lacking the stretching treatment, thanks to a pronounced molecular orientation which improves the mechanical characteristics with respect to a non-stretched condition.

[0115] The manufacturing processes and flooring elements described above will comprise use of the following materials:

First elements: HDPE or polypropylene or polyester resins.
Main elements: HDPE or polypropylene or polyester resins.
Anti-slip elements: LDPE, elastomer materials such as EVA, for example.

[0116] Finally it should be noted that the floor element may, for example, for storage or transportation purposes, be wound on itself such as to form a rolled structure. Should the flooring element be obtained by coextrusion of the first and second elements according to the above-described procedure, the co-extruded product in output from the extruder in a machine-advancing direction is wound in a roll according to a winding axis that is transversal to the advancement direction in output from the extruder.

Claims

1. A flooring element (1), comprising

a net structure (2) made of a plastic material extending along a prevalent development plane (3), wherein the net structure in turn comprises:
a plurality of first elements (4) that are reciprocally distanced;
a plurality of second elements (6), distanced

from one another and intersecting the first elements (4) to form a plurality of meshes (8);
a predetermined number of the plurality of the first elements (4) and/or the plurality of second elements (6) exhibiting an anchoring portion (9) which extends transversally to the prevalent development plane (3) of the net structure (2) for enabling, in use conditions, an anchoring thereof to a terrain, and
at least an anti-slip element (10), in cohesion with at least a portion of surface of the first elements (4) and/or the second elements (6), the anti-slip element being situated on an opposite side to the anchoring portion (9) with respect to the prevalent development plane (3).

2. The flooring element of any one of the preceding claims, wherein the anti-slip element (10) comprises a first material less hard than a second material used for forming the net structure (2); optionally wherein the anti-slip element (10) exhibits an irregular free surface (11) which is not smooth.

3. The flooring element of any one of the preceding claims, comprising a plurality of anti-slip elements (10) applied in cohesion with first elements (4) and/or in cohesion with second elements (6), each of said plurality of anti-slip elements having elongated conformation developing substantially parallel to a corresponding first or second element, and having a side defining a continuous elongated join to the corresponding first or second element.

4. The flooring element of any one of the preceding claims, wherein each anti-slip element (10) is applied by hot-bonding to the net structure, such as to form a single body there-with and wherein the first elements (4) and the second elements (6) are joined to one another in a single piece, by means of contemporaneous extrusion.

5. The flooring element of the preceding claim, wherein each anti-slip element (10) extruded and continuously joined along its longitudinal development to the respective first or second element, optionally contemporaneously with the extrusion of the first elements (4) and the second elements (6).

6. The flooring element of any one of the preceding claims from 3 to 5, wherein each of the anti-slip elements (10) in cohesion with the respective of the first elements (4) and/or the second elements (6) is arranged according to a respective lie line superposed on the corresponding of the first and/or second elements (4,6) and wherein said continuous join extends through the entire length of the anti-slip element along said lie line.

7. The flooring element of any one of the preceding claims, wherein the first elements and/or the second elements (4, 6) exhibit an undulating or straight configuration along the prevalent development plane (3), and wherein the lie lines of the anti-slip elements (10) substantially exhibit an undulated or straight configuration, complementarily shaped to the conformation of the respective first and/or second elements to which the anti-slip elements (10) cohere.

8. The flooring element of any one of the preceding claims, wherein the anti-slip element (10) is applied on a totality of the surface of the net structure (2).

9. The flooring element of any one of the preceding claims, wherein:

the anti-slip element (10) exhibits a thickness which is comprised between 1 and 7 mm, optionally between 3 and 6 mm;
the net structure (2) exhibits a size (2a) in a perpendicular direction to the prevalent development plane (3) which size (2a) is greater than 8mm, optionally greater than 10mm, and
the second elements (6) intersect the first elements (4), forming intersection angles that are right-angles or acute angles and are comprised between 20° and 90°.

10. The flooring element of any one of the preceding claims, wherein the first elements (4) are arranged substantially parallel to one another and the second elements (6) are arranged substantially parallel to one another, and wherein a distance (8b) between two adjacent first elements (4) and/or a distance (8c) between two adjacent second elements (6) is respectively greater than a width of the first elements (4) and a width of the second elements (6).

11. The flooring element of any one of the preceding claims, wherein the first elements (4) and the second elements (6) intersect at nodes (8a) and form a plurality of meshes (8), each of the first elements (4) and/or the second elements (6) exhibiting intermediate portions (13) which extend between consecutive nodes, the intermediate portions (13) having a transversal section of a progressively decreasing area starting from a node in a direction of a median line of the intermediate portions (13), and increasing in a distancing direction from the median line towards the successive node, optionally wherein the intermediate portions (13) exhibit a central zone (14) having a substantially constant width.

12. The flooring element of any one of the preceding claims, wherein the first elements (4) and/or the second elements (6) exhibit a full, non tubular, cross section, optionally wherein the cross section of the

first elements (4) and/or the second elements (6) has a substantially circular, polygonal or substantially elliptical conformation.

13. The flooring element of any one of the preceding claims, wherein the first elements (4) and/or the second elements exhibit a cross section having an area that is greater than $10mm^2$, optionally wherein the first and/or second elements (6) exhibit a cross section having an area that is greater than $20mm^2$.

14. The flooring element of any one of the preceding claims, wherein the flooring element (1) exhibits a plurality of anchoring portions (9) distanced and separated from one another, optionally wherein each anchoring portion (9) exhibits a height (15a, 16b) in at least a transversal direction to the prevalent development plane (3) of the net structure (2) which is at least 4mm.

15. The flooring element of any one of the preceding claims, wherein the anchoring portions, optionally having a polygonal transversal section, are configured in a plurality of development lines (17) extending, in use conditions, inferiorly of the first elements (4) and/or the second elements (6), and wherein the development lines (17) substantially follow the development direction of the first elements (4) or the second elements (6), optionally wherein the development lines (17) are substantially parallel to one another, for example having a straight or undulating development.

16. The flooring element of any one of the preceding claims, wherein the flooring element exhibits:

a specific weight per surface unit which is greater than $900g/m^2$;
a specific resistance to traction in at least a direction that is greater than 6.5 kN/m, the specific resistance to traction being measured using the method set out in the description;
a percentage elongation in the prevalent development direction of the first elements (4) and/or the second elements (6) of greater than 20%, the maximum percentage elongation being measured according to the method set out in the description.

17. The flooring element of any one of the preceding claims, wherein a resistance to delamination between the anti-slip element (10) and the net structure (2) is such that by applying, on a flooring element (1) located horizontally, a tangential force directed parallel to the prevalent development plane (3) of at least 1Kg, optionally of at least 2Kg, and distributed on a surface of $1cm^2$, no separation phenomena of the anti-slip element (10) from the net structure (2) must occur.

18. A process for making the flooring element of any one of the preceding claims, the process comprising a stage of contemporary extrusion of the first elements (4) and the second elements (6) in order to form the net structure (2) and a stage of hot-deposition, by co-extrusion, the anti-slip element (10) on the net structure (2) during the contemporary extrusion stage of the first elements (4) and the second elements (6), optionally wherein the process comprises a stage of stretching in at least a prevalent development direction of the elements (4) and/or the second elements (6).

19. Use of the flooring element of any one of the preceding claims from 1 to 17, comprising positioning the flooring on a ground with the anchoring portions facing towards the terrain and at least partially sunk into the terrain.

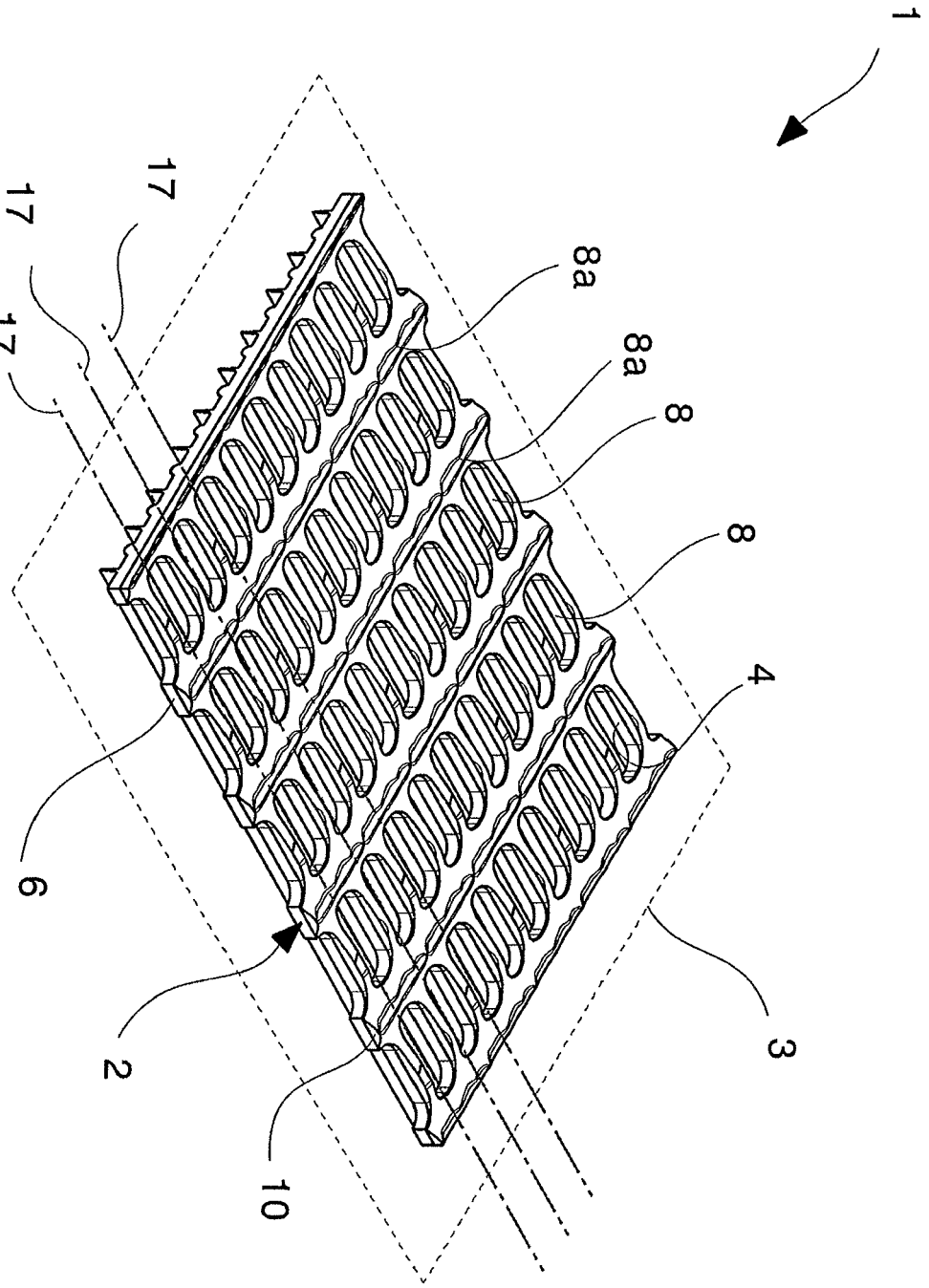

FIG. 1

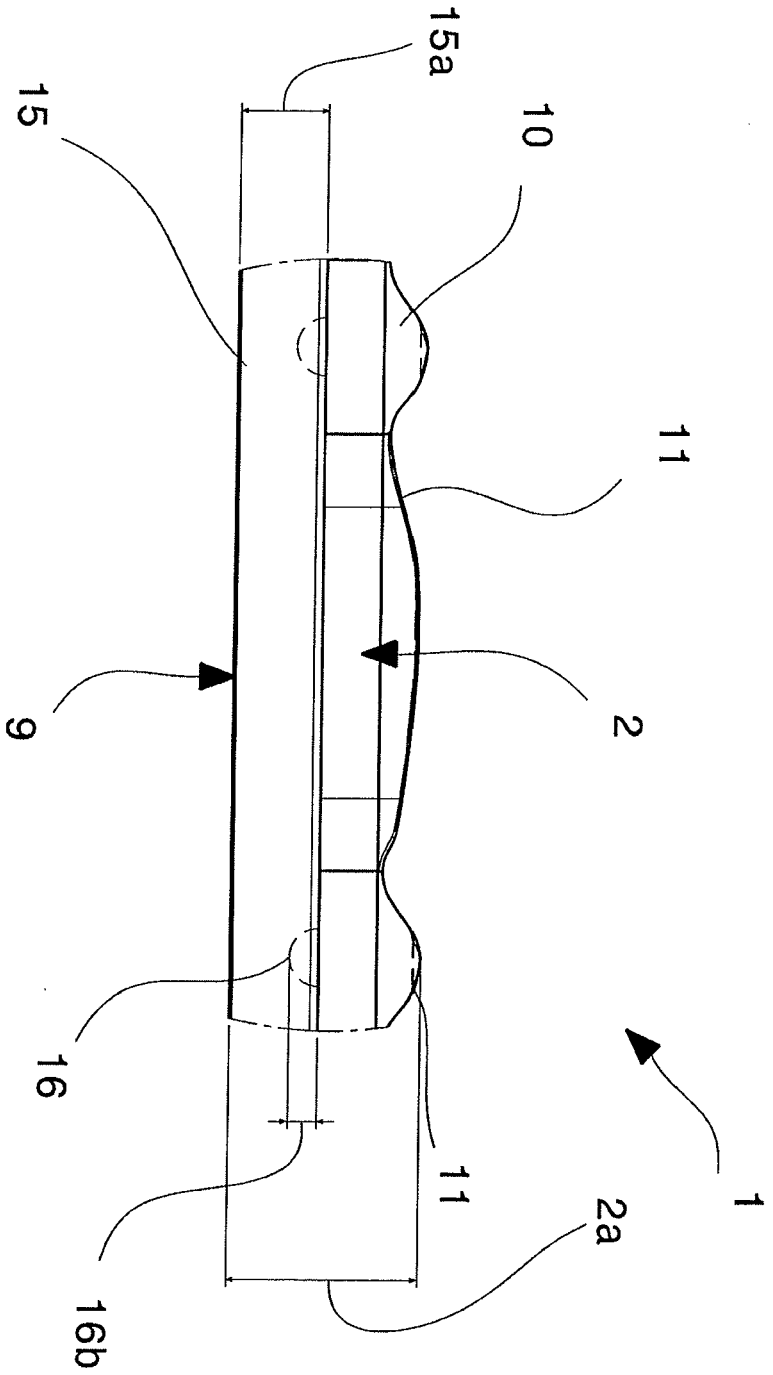

FIG. 1A

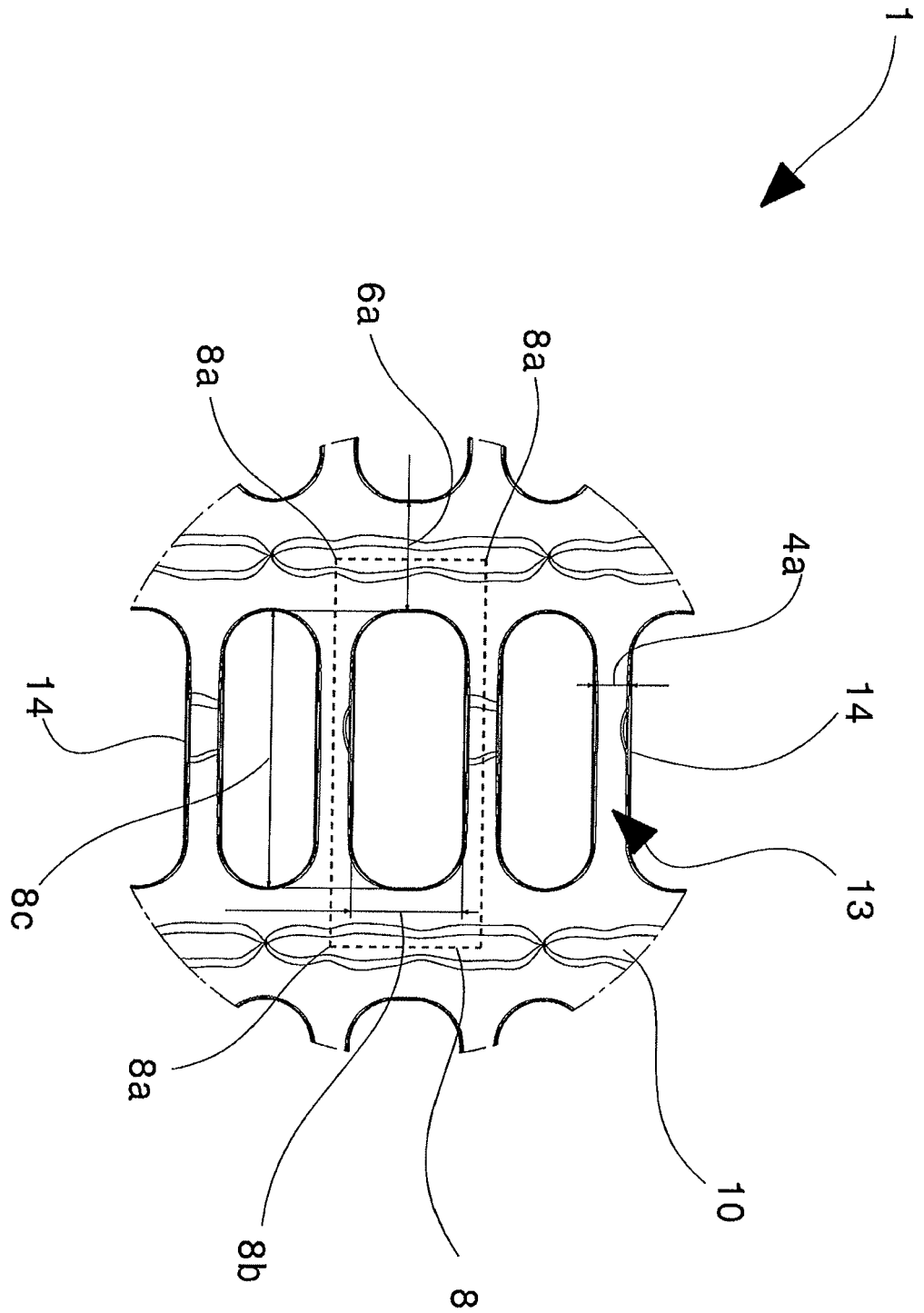

FIG. 1B

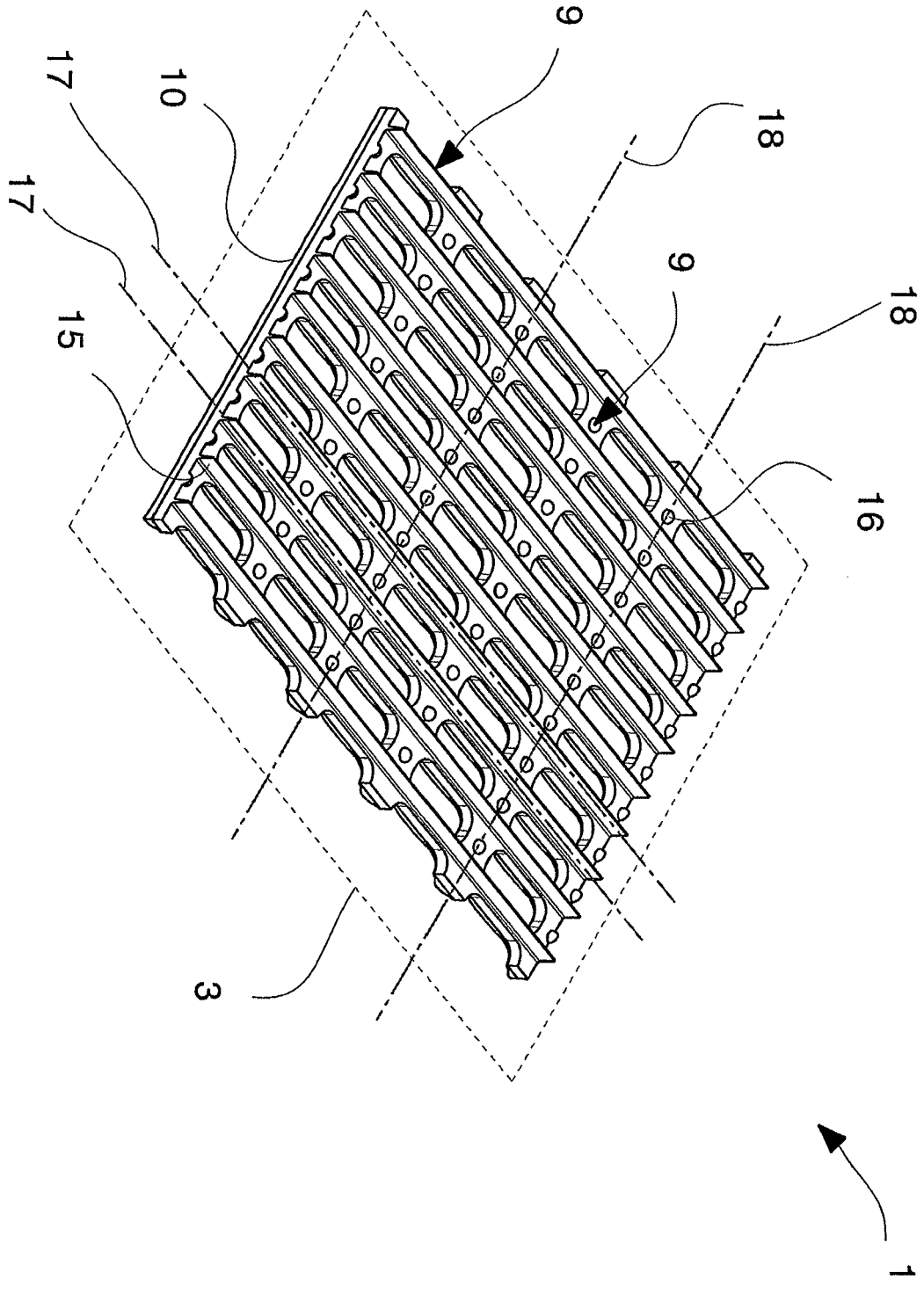

FIG. 1C

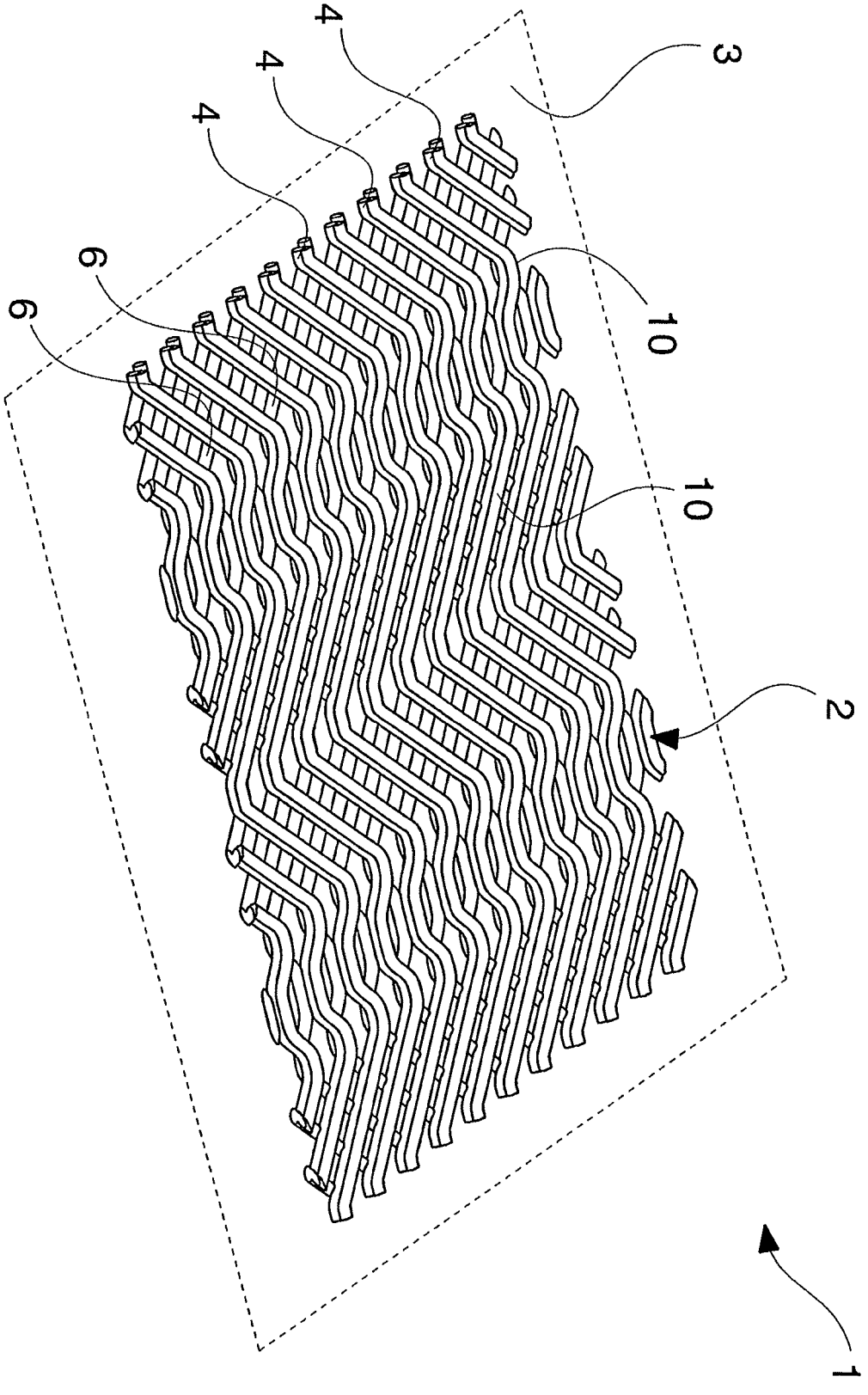

Fig.2

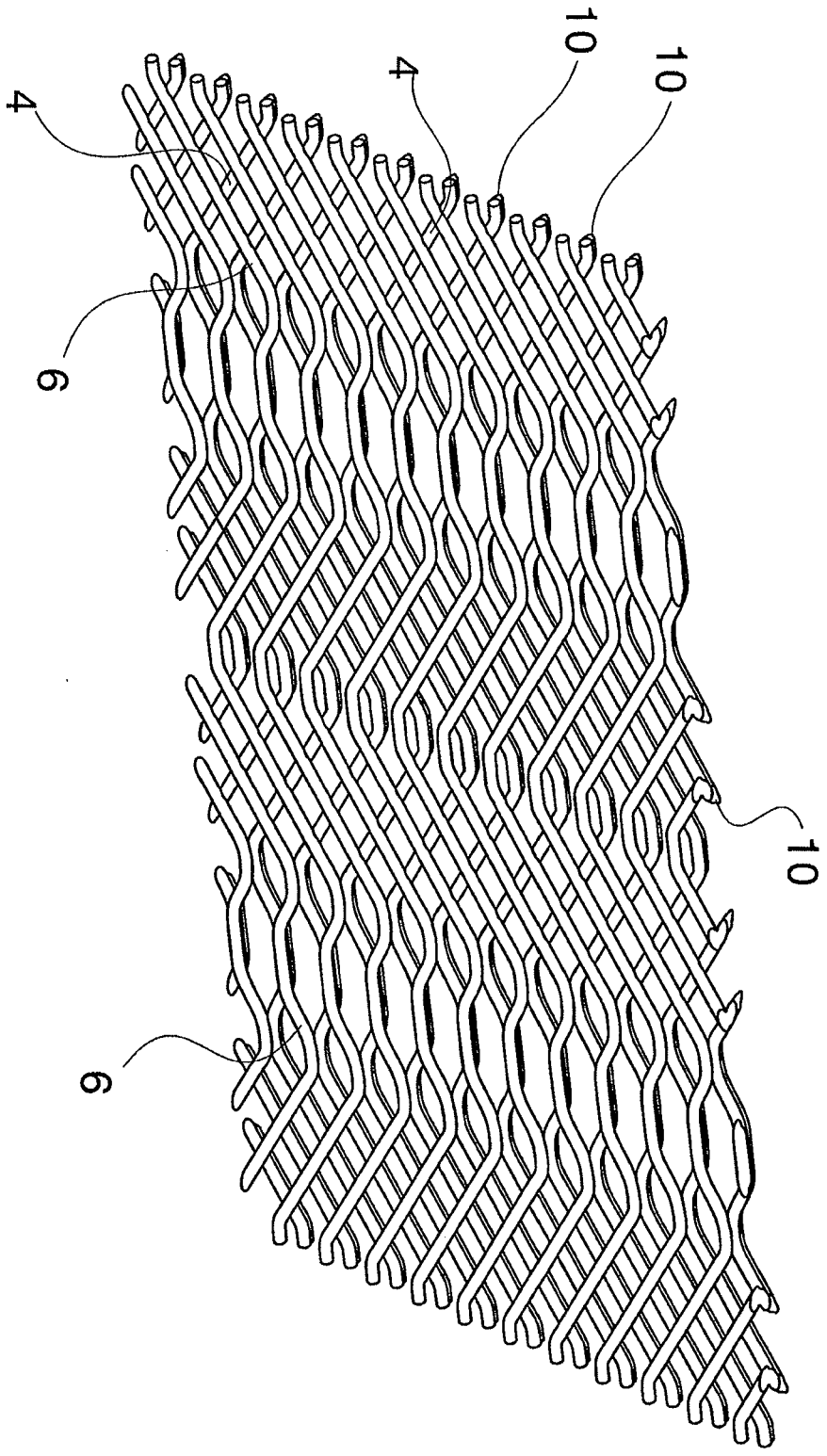

Fig.3

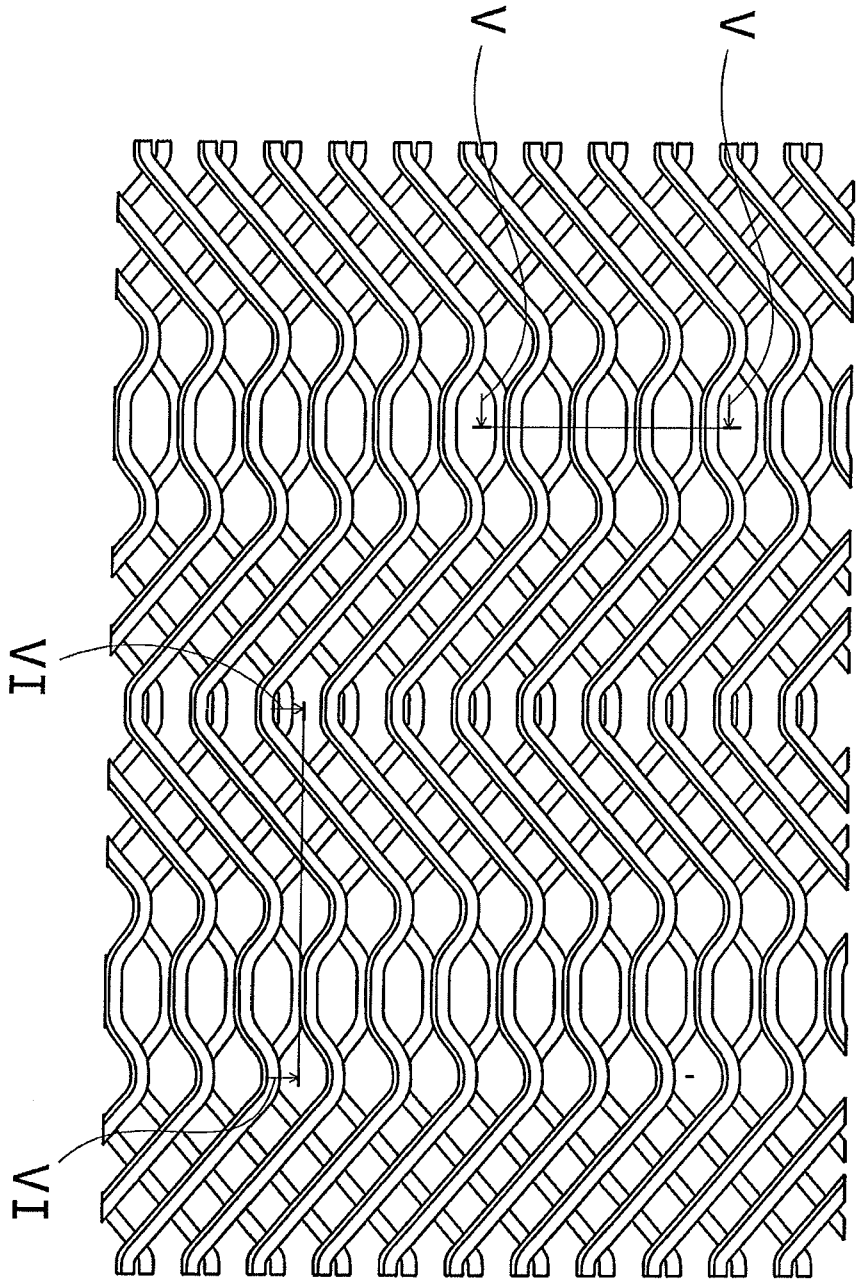

Fig. 4

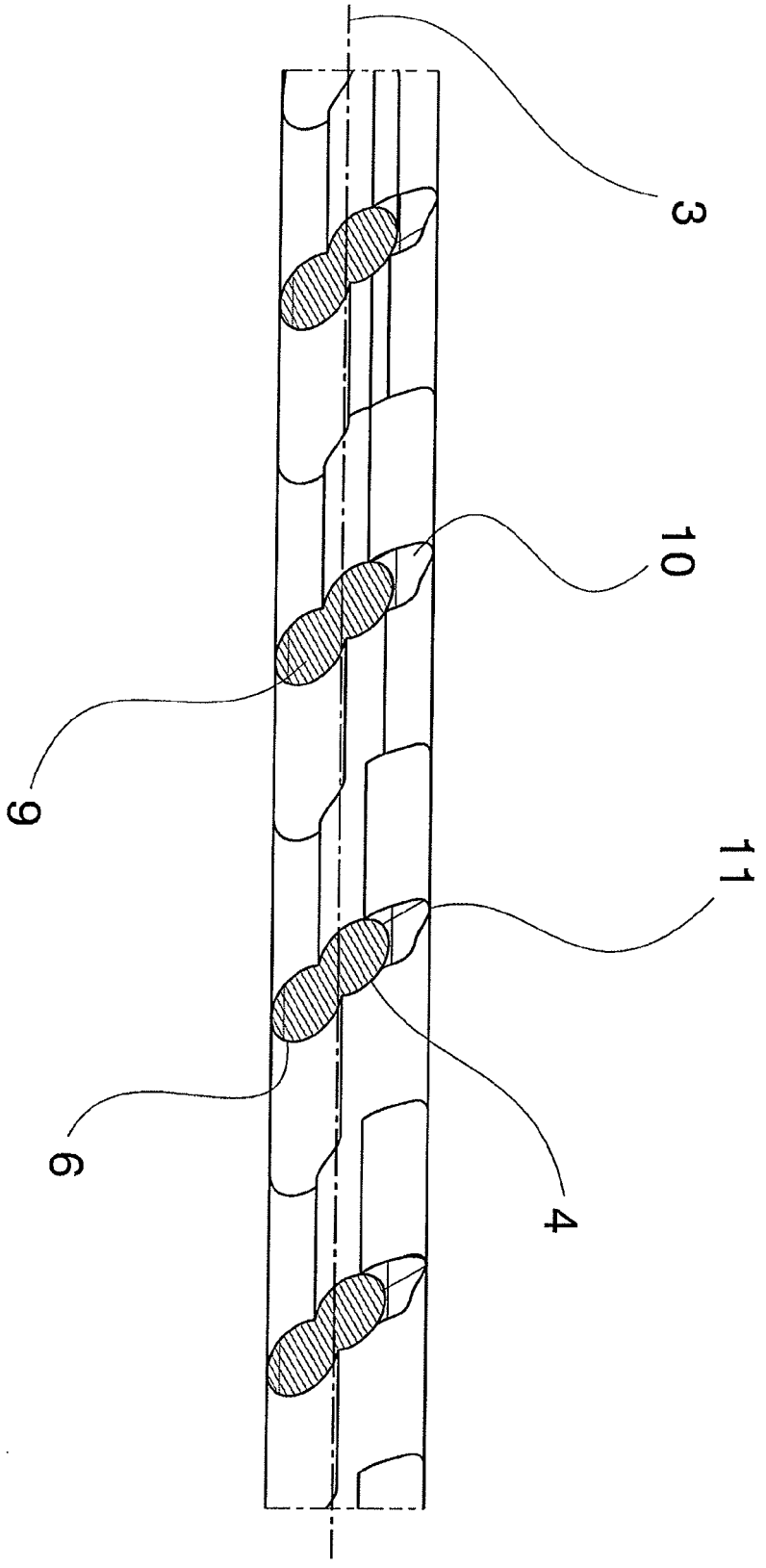

Fig.5

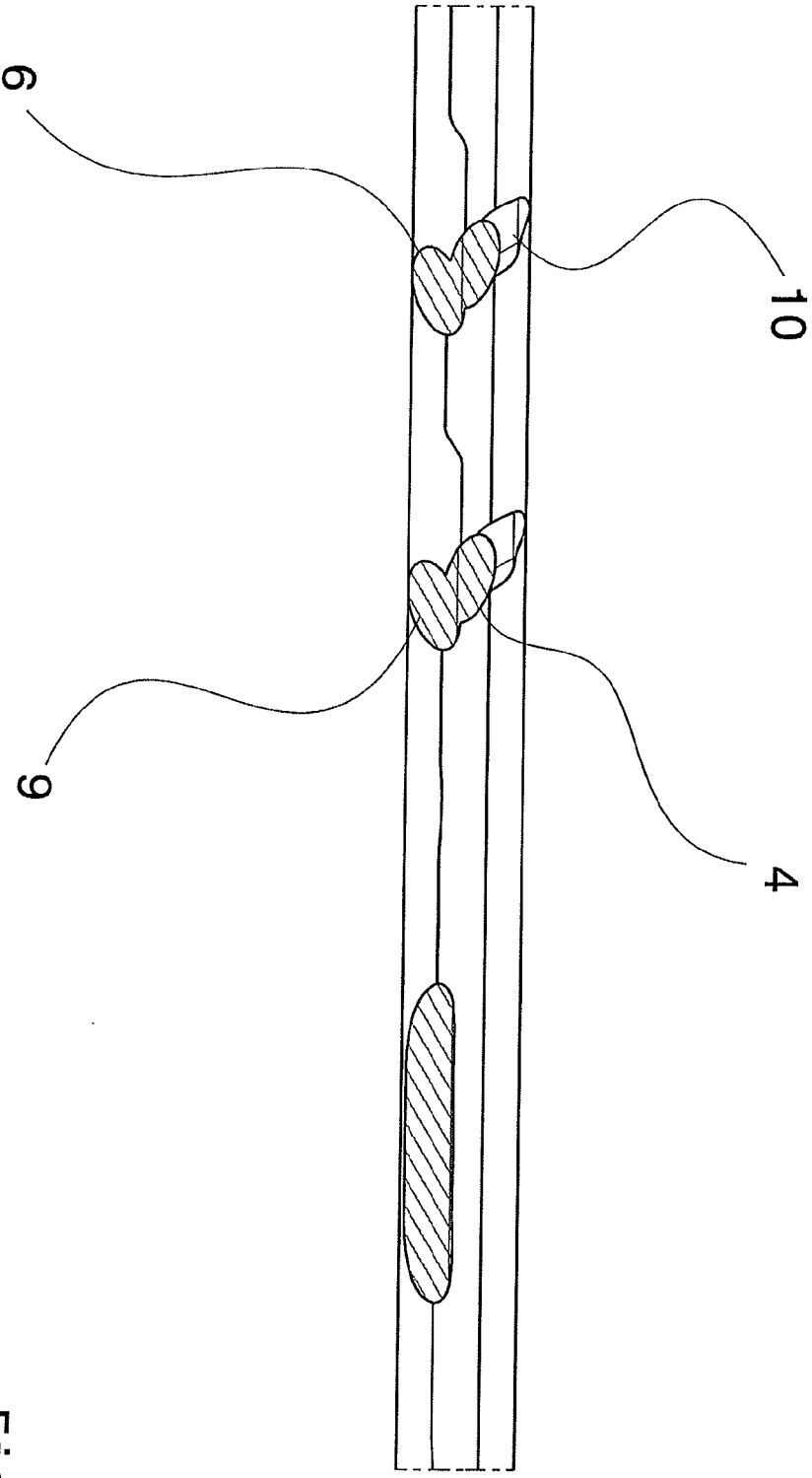

Fig. 6

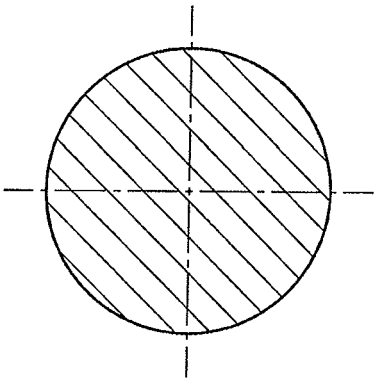

FIG. 7C

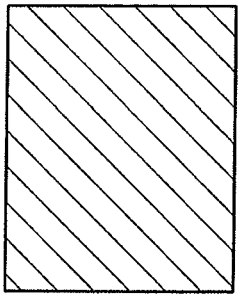

FIG. 7A

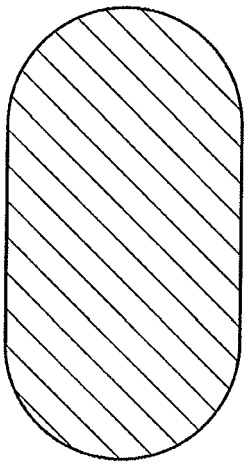

FIG. 7B

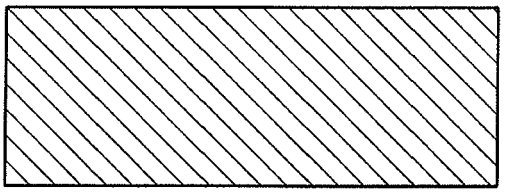

FIG. 8A

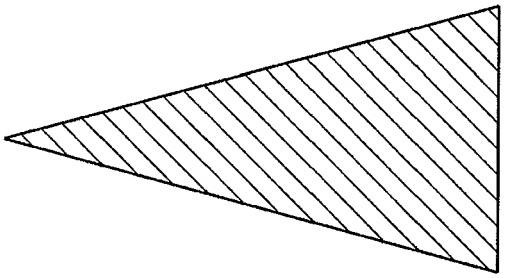

FIG. 8B

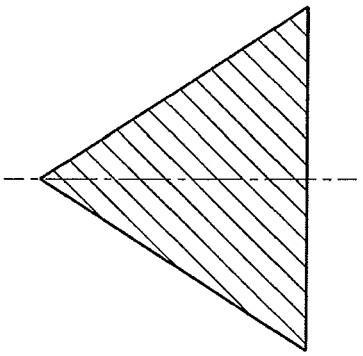

FIG. 8C

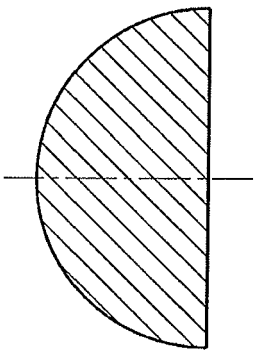

FIG. 8D