Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2666680 A1 2008/05/02

(21) 2 666 680

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2007/10/19
(87) Date publication PCT/PCT Publication Date: 2008/05/02
(85) Entrée phase nationale/National Entry: 2009/04/16
(86) N° demande PCT/PCT Application No.: US 2007/081881
(87) N° publication PCT/PCT Publication No.: 2008/051819
(30) Priorités/Priorities: 2006/10/20 (GB0620895.3); 2007/02/22 (GB0703428.3)

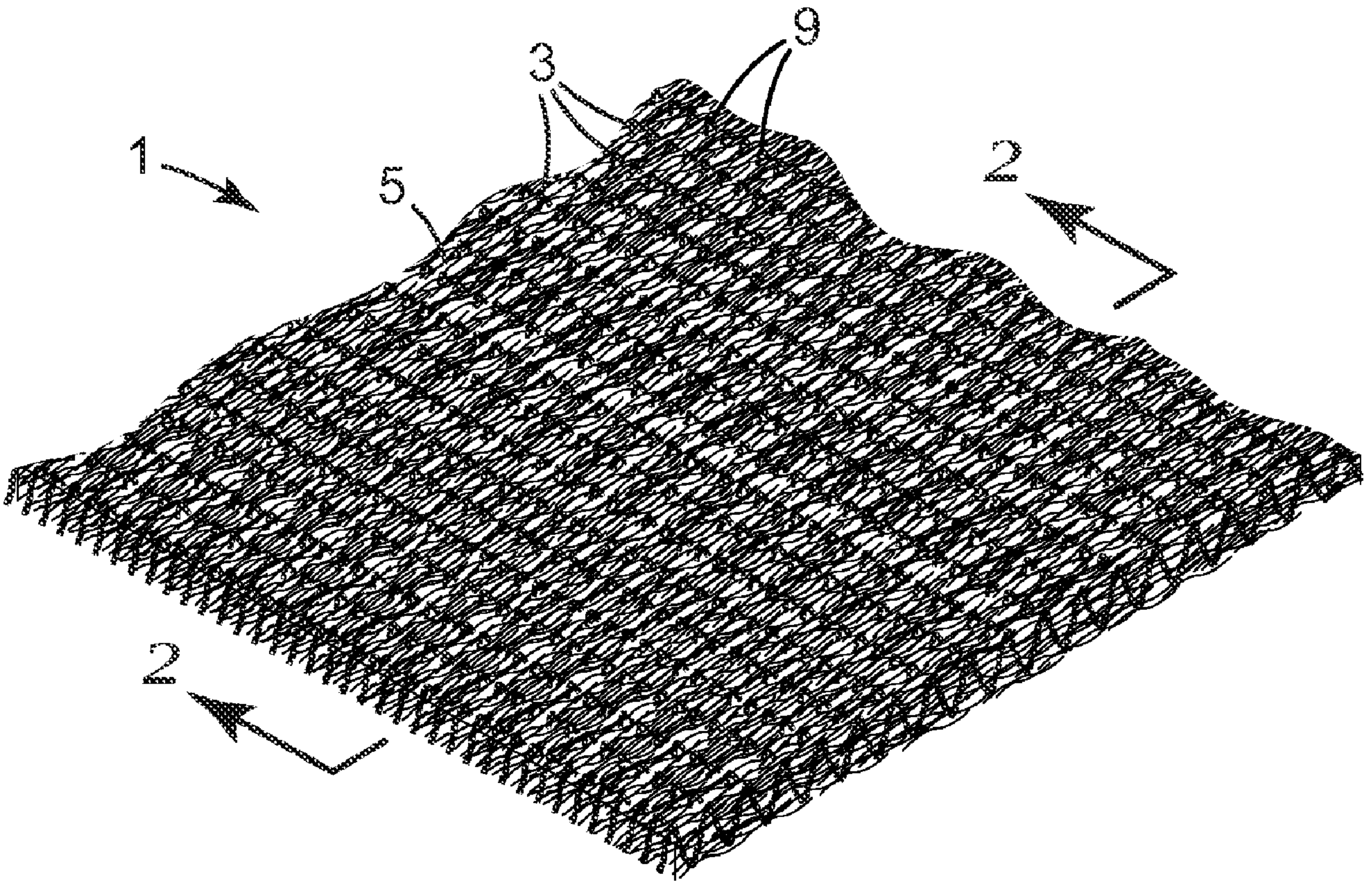
(51) Cl.Int./Int.Cl. *A47L 23/26* (2006.01), *D04H 13/00* (2006.01)

(71) Demandeur/Applicant:
3M INNOVATIVE PROPERTIES COMPANY, US

(72) Inventeurs/Inventors:
BOZOUKLIAN, ERIC, FR;
VINCENT, BERNARD, FR

(74) Agent: SMART & BIGGAR

(54) Titre : TAPIS DE SOL
(54) Title: FLOOR MATTING



(57) Abrégé/Abstract:
Matting material (1) comprises a supporting web (3) of comparatively coarse filaments (11) in which is embedded a web (5) of comparatively fine fibres (15). The upper surface of the embedded fibrous web (5) provides a shoe-wiping surface, and the coarse filaments (11) of the supporting web (3) project above the upper surface of the embedded web (5) to provide shoe-scraping elements.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 May 2008 (02.05.2008)

PCT

(10) International Publication Number
WO 2008/051819 A3

(51) International Patent Classification:
A47L 23/26 (2006.01) *D04H 13/00* (2006.01)

(21) International Application Number:
PCT/US2007/081881

(22) International Filing Date: 19 October 2007 (19.10.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0620895.3 20 October 2006 (20.10.2006) GB
0703428.3 22 February 2007 (22.02.2007) GB

(71) Applicant *(for all designated States except US)*: **3M INNOVATIVE PROPERTIES COMPANY** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **BOZOUKLIAN, Eric** [FR/FR]; Boulevard de L'Oise, F-95006 Cergy Pontoise Cedex (FR). **VINCENT, Bernard** [FR/FR]; Boulevard de L'Oise, F-95006 Cergy Pontoise Cedex (FR).

(74) Agents: **EDMAN, Sean J.**, et al.; 3M Center, Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

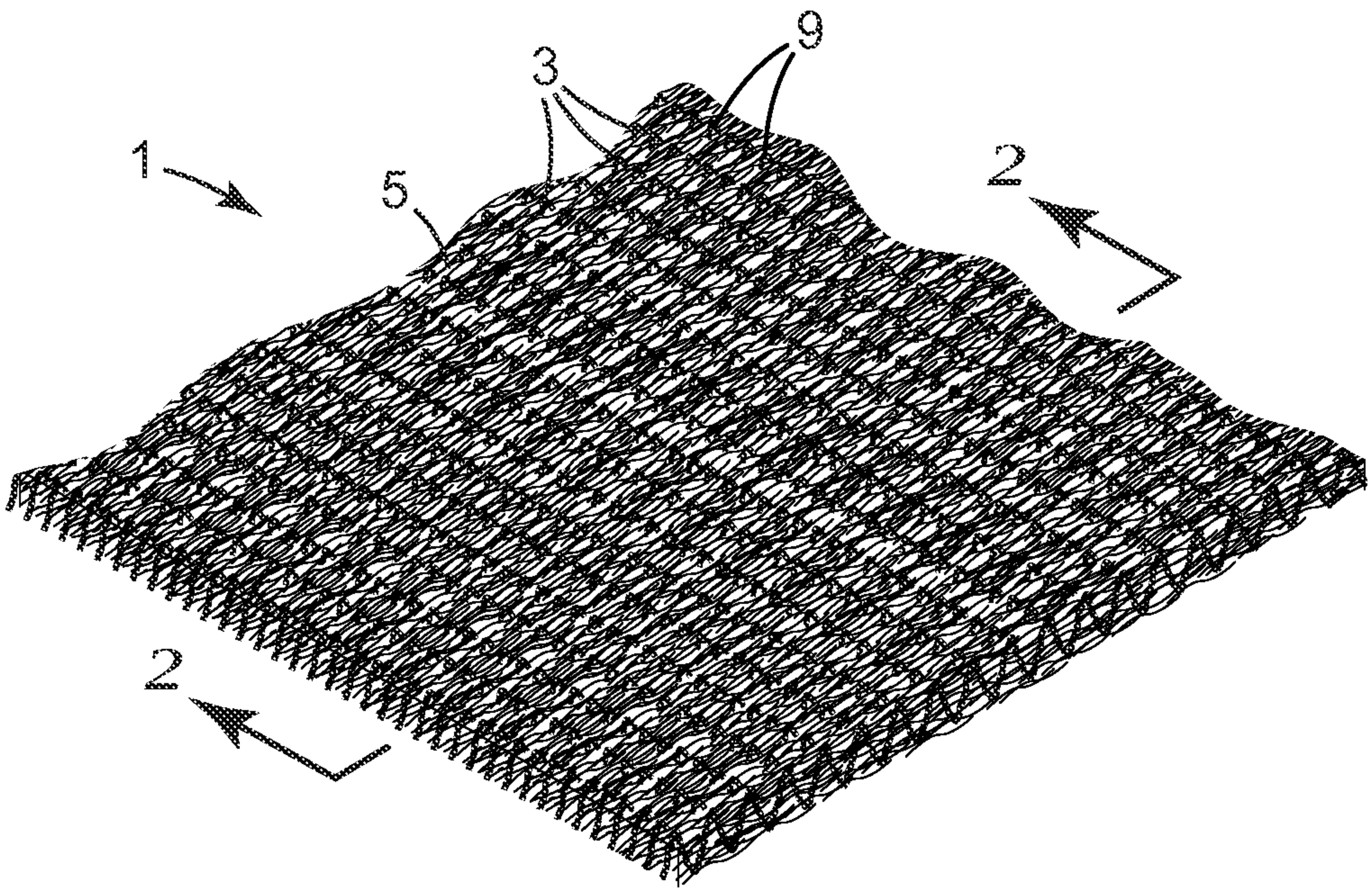
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

[Continued on next page]

(54) **Title:** FLOOR MATTING



(57) **Abstract:** Matting material (1) comprises a supporting web (3) of comparatively coarse filaments (11) in which is embedded a web (5) of comparatively fine fibres (15). The upper surface of the embedded fibrous web (5) provides a shoe-wiping surface, and the coarse filaments (11) of the supporting web (3) project above the upper surface of the embedded web (5) to provide shoe-scraping elements.

WO 2008/051819 A3

WO 2008/051819 A3

(88) Date of publication of the international search report:
19 June 2008

FLOOR MATTING

This application claims the benefit of United Kingdom Patent Application No. UK0620895.3, filed October 20, 2006, and United Kingdom Patent Application No. UK0703428.3, filed February 22, 2007, the disclosure of which is incorporated by reference herein in its entirety.

The present invention relates to floor matting, more particularly matting that is suitable for use at the entrances of buildings or other locations.

Entrance mats are used to remove dirt and water (hereinafter referred to generally as "soil") from the shoes of pedestrians as they enter a building. In some locations, for example supermarket and airport buildings, entrance mats are also required to remove dirt and water from the wheels of trolleys or similar articles. Accordingly, reference herein to the removal of soil from the shoes of pedestrians should be considered to include the removal of soil from all traffic (pedestrian and wheeled) that passes over an entrance mat. It is recognized that an entrance mat that functions efficiently can greatly assist in the maintenance of a building by reducing the amount of cleaning that is required. In addition, the owners/occupiers of buildings are increasingly demanding entrance mats that will enhance the appearance of their premises.

Various forms of entrance mat are known and, depending on their construction and the materials from which they are formed, are placed immediately outside or inside a building. Some entrance mats are intended to be replaced frequently i.e. when they become dirty, they are simply taken up and removed for cleaning (often by washing) and a new mat is put in place. Mats of that type are often provided on a rental basis. Some entrance mats require skilled professional cleaning, which may be carried out on- or off-site; in the latter case, it is again necessary for the mats to be taken up and replaced when dirty. Other mats are intended to be left in position for longer periods of time: they are typically harder-wearing and more-effective in removing soil from shoes, and have a greater capacity for trapping and storing the removed soil (so that it is not subsequently carried into the building) without the appearance and effectiveness of the mat being adversely affected. A mat of that type can be installed in a recess well in a floor or laid directly on the floor as a drop-down mat, and may be constructed so that dirt can fall through the mat onto the underlying surface: in that way, the surface of the mat remains clean and effective on the basis of minimal maintenance, it being necessary to take up or roll back the mat only periodically so that the underlying surface can be cleaned, following which the mat can be replaced. Any water that is removed and trapped by the mat is expected, in time, to evaporate.

Mats generally remove soil from shoes by a scraping and/or wiping action, depending on their construction and the materials from which they are formed. Mats that provide a scraper action typically have an upper, shoe-contacting, surface that comprises scraper edges or projections as described, for example, in US 4 497 858 (Dupont and Laurent); US 2004/0161988 (Yaw); WO 01/60218 (Milliken & Company); and WO 02/15765 (Construction Specialties (UK) Ltd.). Scraper mats that have proved to be both durable and effective in removing dirt from shoes etc. are available, under the trade names “Nomad™ Terra 8100” and “Nomad™ Terra 9100”, from 3M Company of St. Paul, Minnesota, USA. Mats that provide a wiping action typically have a textile upper surface: they are often more aesthetically pleasing than scraper mats, and are available in a wide range of colours and designs and with differing characteristics depending on the textile fibres and textile constructions from which they are formed.

Some entrance mats have an operative surface that provides both wiping and scraping actions. US 4 820 566 (Heine and Tharpe), for example, describes a tufted textile mat comprising fine denier fibres that provide a wiping action, and stiff, crimped, coarse denier fibres that provide a scraping action and also form an open structure in the mat capable of receiving and obscuring dirt. Examples of mats that comprise fine and coarse fibres are those available, under the trade name “Nomad™ Aqua”, from 3M Company of St. Paul, Minnesota, USA. In those mats, the fine and coarse fibres are tufted into a primary backing which is then laminated to a secondary backing formed from either vinyl, latex foam, or a non-woven fleece.

Other entrance mats are available in which the surface of the mat is divided into distinct components having different cleaning functions. Examples of mats of that type are the profile mats available, under the trade name "Nomad™ Optima", from 3M Company of St. Paul, Minnesota, USA. Those mats comprise a plurality of parallel aluminium profiles that are linked together, each profile containing an infill of the above-mentioned "Nomad™ Aqua" matting material. The infill material provides a wiping and a scraping action, the latter being supplemented by the scraping action of the profiles. In addition, soil removed from the soles of shoes is efficiently retained by the mat, either by the infill material or by falling between the profiles into the recess well in which the mat is installed.

It is an object of the invention to provide a mat that will function efficiently to remove soil from shoes and to retain it but is, nevertheless, comparatively cheap to produce so that it can simply be taken up when dirty, damp, or worn and replaced by a new mat thereby simplifying the task of maintaining the appearance of the building in which the mat is installed.

Outside the field of floor matting, it is known to use matting to prevent soil erosion. An example of matting of that type is described in US-A-4 329 392.

The present invention provides matting material comprising a supporting web of comparatively coarse filaments in which is embedded a web of comparatively fine fibres, wherein the upper surface of the embedded fibrous web is a shoe-wiping surface, and the coarse filaments of the supporting web project above the upper surface of the embedded web to form shoe-scraping elements. The embedded web may be embedded in the supporting web by needle-tacking.

The filaments of the supporting web of matting material in accordance with the invention may comprise continuous coiled filaments, which may be bonded to one another at their points of contact. The embedded web may a nonwoven fibrous web.

As used herein:

”comparatively coarse filaments ” means filaments having a linear density of not less than 100 dtex;

”comparatively fine fibres” means fibres having a linear density no greater than 100 dtex

By way of example, matting materials constructed in accordance with the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a piece of matting material in accordance with the invention;

Fig. 2 is an enlarged diagrammatic cross-section of the matting material, on the line 2-2 in Fig. 1;

Fig. 3 is an enlarged perspective view of a component of the matting material of Figs. 1 and 2;

Fig. 4 is an enlarged perspective view of another component of the matting material of Figs. 1 and 2; and

Fig. 5 illustrates, diagrammatically, a process used to manufacture the matting material of Figs. 1 and 2.

The matting material 1 shown diagrammatically in Figs. 1 and 2 comprises a supporting web 3, formed from comparatively coarse filaments, in which is embedded a web 5 formed from comparatively fine fibres. Both webs will be described in greater detail below.

The upper surface 7 of the mat 1 is the surface that comes into contact with the shoes of pedestrians who walk over the mat when it is located at the entrance of a building, or the wheels of trolleys or similar objects that pass over the mat. The upper surface 7 is intended to remove soil from those shoes, wheels etc. and prevent the soil from being carried into the building.

As shown diagrammatically in Figs. 1 and 2, some parts 9 of the filaments 11 of the supporting web 3 project above the upper surface of the embedded web 5. Those projecting parts 9 act as scraper elements that remove soil from the shoes of pedestrians by a scraping action. The embedded web 5, on the other hand, removes soil and water from the shoes of pedestrians by a wiping action.

The structure of the supporting web 3 is shown in greater detail in Fig. 3. It is a three-dimensional structure formed from continuous, polymeric coiled filaments 11 that loop and overlap one another, and are bonded to one another at their points of contact. As described below, the supporting web 3 is structured to allow the fibrous web 5 to be embedded in it.

The filaments 11 of the supporting web 3 are formed from any suitable polymeric material and have a linear density of at least 100 dtex. Typically, the linear density of the filaments 11 will be in the range of from 100dtex to 1000 dtex although, in some cases, filaments having a diameter as large as 5mm can be used. The cross-section of the filaments 11 will typically be circular, although filaments having other cross-sectional shapes (for example, elliptical, trilobal, tetralobal) can be used. Suitable materials for the filaments 11 include polypropylene, polyethylene, polyester, and polyamide.

The supporting web 3 will typically be comparatively open (i.e. it will typically have a comparatively high volume of void spaces), and will typically have a thickness in the range of from 4.0 to 27.0 mm (6.0 to 14.0 mm for most matting applications) and a weight in the range of from 100 to 1000 g/m^2 (200 to 500 g/m^2 for most matting applications). The web 3 should also have some resilience, appropriate to its use in a matting material.

The web 3 may have an undulating structure, exhibiting a regular array of peaks and valleys. The undulations may be present only in the upper surface of the web, or throughout its structure. The peaks and valleys may be arranged in a grid pattern so that the web 3 undulates in both the longitudinal and transverse directions. Alternatively, the undulations may be in the form of corrugations (as illustrated in Fig. 3) extending in either the longitudinal or the transverse direction. The undulations are, however, not essential.

Webs of the general type shown in Fig. 3 and their manufacture are described, for example, in US-A-4 177 312; 4 212 692; 4 252 590 and 4 342 807 (Akzona Incorporated).

It is not, however, essential that the supporting web 3 should be formed from coiled filaments. The supporting web 3 could, for example, comprise cut filaments that project above the upper surface of the embedded web 5 to form shoe-scraping elements.

Specific examples of webs suitable for use as the supporting web 3 are those available, under the trade designations: “ENKAMAT” 5006-H, 5006 I, 7006 I, and 7006 H, from Colbond Geosynthetics Company of St. Denis la Plaine, 93128 France; “Fortrac 3D” from HUESKER Synthetic GmbH of Gescher, 48712 Germany; and “TENSAR MAT” from Tensar International SARL of Mérignac, 33700 France.

The fibrous web 5 that is embedded in the supporting web 3 is illustrated in Fig. 4. It is a dry-laid, open, three-dimensional, semi-finished, non-bonded, non-woven web formed from staple fibres 15 in any suitable manner. The fibres 15 may be formed from any suitable artificial or natural material including, for example, polyamide, polypropylene, polyethylene, and may be of any suitable length. The fibres 15 will typically have a linear density in the range of from 10 to 100 dtex. The weight of the web 5 will be selected having regard to the characteristics of the supporting web 3 and the required characteristics of the matting material 1: typically, the weight of the web 5 will be in the range of from 200 to 400 g/m^2. If desired, a proportion of the fibres 15 used to form the web 5 (typically up to about 60% by weight) may be crimped: generally, this will have the effect of increasing the bulk (volume per unit weight) of the web 5, although it may also increase the raw material cost.

The web 5 can be formed using, for example, a conventional air-laying process or a conventional carding and cross-lapping process. The cohesion of the web 5, prior to its incorporation in the supporting web 3, is comparatively low and, for that reason, the web 5 is manufactured as part of the process for manufacturing the matting material 1 as will be described below.

A process for manufacturing the matting material 1 is illustrated diagrammatically in Fig. 5. The bales of fibres for the fibrous web 5 are first opened and the fibres 15 are placed on the inlet conveyor belt 20 of an opening/mixing machine 22 in which they are teased apart and mixed by rotating combs. The opening/mixing machine 22 may, for example, be a “Cadette” machine commercially-available from LAROCHE S.A. of Cours la Ville, 69470 France. The fibres are then blown into web-forming equipment 24 in which they are formed into the required dry-laid, open, three-dimensional non-woven web 5. A preferred type of non-woven web is one that is formed in an air-laid carding machine, in which case the web-forming equipment 24 may be a "Rando-Webber" device commercially-available from Rando Machine Co., Macedon, N.Y. Alternatively, the web-forming equipment 24 could be one that produces a dry-laid web by carding and cross-lapping, rather than by air-laying. The cross-lapping may be horizontal (for example, using a “Profile Series” cross-lapper commercially-available from ASSELIN-THIBEAU of Elbeuf sur Seine, 76504 France) or vertical (for example, using the “Struto” system from the University of Liberec, Czech Republic or the “Wave-maker” system from Santex AG of Switzerland).

The formed web 5 is then conveyed, together with the separately-supplied supporting web 3, to a needle tacker 26. The webs 3, 5 are fed into the needle tacker 26 with the supporting web 3 positioned underneath the fibrous web 5, and the two webs are needle-tacked together. During this process, the fibrous web 5 is consolidated by the needle-tacking, and is pushed into the supporting web 3 as well as being joined to it. The resulting matting material 1 is as shown in Figs. 1 and 2 and described above, with the peaks 9 of the undulating upper surface of the supporting web 3 projecting above the upper surface of the consolidated web 5. The extent to which the web 5 is consolidated and pushed into the supporting web 3 can be varied by adjusting the needle-tacking process parameters (i.e. the type of needles used, the extent to which they penetrate into the combined webs, and their stroke speed). If a multi-head needle tacker is used, it should be possible to achieve the required consolidation and positioning of the web 3 in a single pass through the machine: in some cases, however, it may be necessary for the webs 3, 5 to make more than one pass, with the orientation of the webs being reversed between passes. Some of the fibres 15 of the embedded web 5 may remain on the peaks 9 of the supporting web, but this would not normally affect the performance of the resulting material 1.

Matting material 1 produced by the process illustrated in Fig. 5 is then cut to the required size to form a mat, having regard to the area in which the mat is to be installed. The matting material may be laminated to a suitable backing material, for example a vinyl material which may extend beyond the cut piece of material 1 to provide a finished edging for the latter. Alternatively, the cut piece of material 1 may be secured to a prepared base that will also provide a suitable edging. As a further alternative, the matting material can be used as an upper, removable, layer of a mat, which can be replaced as required while the base part of the mat remains in position. In that case, the upper removable layer and the base part of the mat could be secured together in any appropriate manner including, for example, by providing the upper removable layer with a tacky backing (see below) or by means of a hook-and-loop reclosable fastener system. In some cases, when the construction of the upper removable layer permits, it may be necessary only for the hooked-component of such a fastener system to be provided on the base part of the mat for direct engagement with the upper layer. An example of a disposable mat combined with a base, which may be either permanent or temporary, is described in US-A-4 609 580 (Rockett et al).

Advantageously, the matting material 1 is used to provide a mat that will resist slipping or being deformed (for example, buckled or stretched) by traffic passing over it when in use. To that end, matting material of the required size may be provided with a backing on its lower surface that imparts those characteristics to the mat. The backing material, preferably, should not add substantially to the weight or thickess of the matting material 1, and should allow the matting material to be rolled up if required. One suitable type of backing material is a fibrous web of any suitable construction that has been coated with a tacky material, at least on the face directed away from the matting material 1, to provide it with the required slip-resistance and deformation-resistance. An example of a suitable backing material of that type is 3M™ Tack Cloth material available from 3M FRANCE SA, of Cergy-Pontoise, France. Other suitable backing materials are non-slip fibrous webs intended for use under mats, for example the material available under the trade designation “Allstop® Classic” from LANDOLT FRANCE SAS of Cernay, France. The backing material can be attached to the matting material 1 by an adhesive, by welding, by needle-punching or in any other suitable way. Alternatively, a backing material can be provided by first attaching a fibrous web to the matting material 1 and then applying a suitable non-slip coating to the exposed face of the fibrous web. As a further alternative, the fibrous web can be omitted and the non-slip coating applied directly to the lower face of the matting material 1. Examples of suitable coating materials include materials available under the trade designation “PRIMAL” from Rohm & Haas of Philadelphia, USA. Yet another suitable backing material is a grid of rubber or similar material, which is attached directly to the lower face of the matting material.

In some cases, it may be desirable to provide the matting material 1 with an impervious backing. That may not be necessary, however, if the water-retention characteristics of the matting material are already appropriate for its intended use.

In the process described above with reference to Fig. 5, the needle-tacker 26 could be replaced by any other apparatus capable of consolidating the fibrous web 5 and embedding it in the supporting web 3. For example, the needle tacker 26 could be replaced by suitable hydro-entangling apparatus known for use in the production of non-woven materials. The characteristics of the supporting web 3 should, of course, be selected having regard to the nature of the mechanism used to embed the fibrous web 5.

In use, a mat formed from the matting material 1 will remove soil from shoes through both a wiping and a scraping action. The scraping action will be provided by the projecting portions 9 of the filaments of the supporting web 3, while the wiping action will be provided by the upper surface of the embedded fibrous web 5. The relative effectiveness of those actions will depend not only on the characteristics of the webs but also on the extent to which the embedded fibrous web 5 is able to contact the shoes of pedestrians passing over that mat (which, in turn, can be varied by changing the depth to which the fibrous web is embedded and the resilience of the supporting web 3). The balance between the scraping and wiping characteristics of the matting material 1 can thus be readily adjusted to suit the normal ambient conditions of the geographic area for which it is produced. For example, the wiping action provided by the fibrous web 5 can be enhanced if the matting material is intended for use in a climate in which shoes will pick up a greater amount of water, while a supporting web 3 with enhanced scraping abilities can be selected for locations in which shoes will pick up a greater amount of dirt.

The mat can, through an appropriate choice of starting materials, be produced comparatively cheaply, making it economically possible for the mat to be disposed of when it becomes soiled, damp, or worn. The weight of the mat may be comparatively low, possibly as low as 300 g/m^2, making it very easy to move for cleaning or replacement purposes. Nevertheless, the efficiency of the mat in removing soil from shoes can be comparable, or even superior, to that of the type of mat typically provided on a rental basis because, unlike the latter (which is usually a textile mat providing a wiping action only), it provides both a wiping and a scraping action. The matting material can also be constructed to retain and store soil in such a way that the mat generally presents a clean appearance, and in such a way that the soil is not subsequently picked up and “tracked’ into the interior of a building. A further advantage can be obtained if the supporting web 3 and the fibrous web 5 (and any backing material) are formed from the same recyclable polymeric material (for example, polyamide or polypropylene) because the entire mat can then be recycled at the end of its useful life. In the case in which a backing material is provided which is not formed from the same recyclable polymeric material as the matting material, the backing material is advantageously readily separable from the matting material so that they can be handled individually for recycling purposes.

If required, however, the properties of the mat can readily be enhanced, either during the manufacturing process or through a suitable choice of starting materials. For example, the durability of the fibrous web 5 can be increased if a proportion of the fibres 15 used to form the web 5 (typically up to about 60% by weight) are heat-bondable fibres that are softened by passing the matting material 1 of Fig. 5 through an oven after it has left the needle tacker 26, to soften the heat-bondable fibres so that they bond to other fibres in the web 3. Any suitable heat-bondable fibres can be used (including those of bi-component form) although, with a view to recycling a mat at the end of its useful life, the heat-bondable fibres should be formed from the same general type of recyclable polymeric material as the supporting web 3 and the other fibres of the fibrous web 5. It is also possible to enhance the water absorption capabilities of the matting material by forming the fibrous web 5 in two layers, the upper layer being suitable for removing soil and water from the shoes of pedestrians by a wiping action, and the lower layer being capable of absorbing the removed water. Suitable fibres for the lower layer are super-absorbent fibres, for example polymeric fibres that have been surface-treated so as to provide them with hydrophilic properties, and fibres made from polymeric material compounded with hydrophilic material. The relative weights of the two layers can be adjusted to alter the characteristics of the matting material as required. Alternatively, a single fibrous web as described above could be used, in which the super-absorbent fibres are mixed with the other fibres.

Enhancement of the mat properties can, if required, also be used to provide a cost-effective mat of “semi-disposable” quality i.e. one that can be cleaned and re-used a limited number of times. That can be achieved by, for example, using a stronger supporting web 3 and/or a heavier fibrous web 5, and/or applying a special treatment to the matting material.

Although the material produced by the process illustrated in Fig. 5 is primarily intended for use as an entrance mat, it could be employed for mats in other locations including, for example, catering facilities, domestic kitchens, and bathroom, and in areas around beverage-dispensing machines. If the mat is used in a location in which it will be stood upon for long periods of time, the supporting web 3 can be selected to provide the mat with a higher degree of resilience to improve its “anti-fatigue” properties.

Specific examples of matting materials in accordance with the invention, and processes for their manufacture, will now be described, together with the results of tests carried out to assess the performance of the matting materials.

The starting materials employed were:

Polypropylene fibres (waste or recycled from the textile industry) having a linear density in the range of from 10 to 60 dtex and a length in the range of from 40 to 90 mm, available from PROCOTEX Company of Mouscron, Belgium under the designations F1-PPESEF-0001 and Y1-PPTCCP-0060 (hereafter referred to as “F1” and “Y1” respectively).

Heat-bondable fibres comprising a polypropylene core with a polyethylene sheath, having a length of 89 mm and a linear density of 72 dtex, available under the designation ESC565 from ES FiberVisions of Osaka, Japan (hereafter referred to as “ES” fibres).

Crimped fibres formed from polypropylene, having 2 crimps/cm and a linear density of 55 dtex, available under the designation IFFw/89900/55/905 from IDEAL Fibres & Fabrics Wielsbeke N.V. of Wielsbeke, Belgium (hereafter referred to as “IFF” fibres).

Superabsorbent polypropylene fibres having a linear density of 2.2 dtex and a length of 40 mm, available under the designation HY-Repeat 111 from ES FiberVisions of Osaka, Japan (hereafter referred to as “SAF” fibres).

Coiled webs formed from polypropylene, having with a thickness of 6.0 mm and a weight, in one case, of 400 g/m^2 and, in the other case, of 250 g/m^2 available under the trade names “ENKAMAT” 5006-H and 5006-I respectively from Colbond Geosynthetics Company of St. Denis la Plaine, France.

The equipment used was:

A **fibre opening/mixing machine** available under the trade name “Cadette” from LAROCHE S.A. of Cours la Ville, 69470 France.

An **air-laid carding machine** available under the trade name “RANDO™ webber” from Rando Machine Co., Macedon, N.Y.

A **needle tacking machine** available from AUTOMATEX Non Woven, Pistoia, 51100 Italia, using needles of the type 15x25x3.5 R222 available from Groz Beckert KG of Albstadt, 72458 Germany.

An **oven,** suitable for pilot manufacturing lines, available from CAVITEC of Münchwilen, Switzerland.

The tests used were:

(i) A **soil-trapping test**, in which the ability of a matting material to remove dirt from the soles of shoes is measured. Calibrated sand is used to simulate dirt and is applied in predefined amounts to the soles of specified shoes worn by pedestrians who cross a predefined length of the matting material. The amount of sand trapped in the mat is measured so that the percentage of the sand removed by the matting material can be determined. The test is repeated in an identical manner for different matting materials and the results are compared.

(ii) A **water-trapping test**, in which the ability of a matting material to remove water from the soles of shoes is measured. Water is applied in predefined amounts to the soles of specified shoes worn by pedestrians who cross a predefined length of the matting material. Any water remaining on the soles is removed using an absorbent material, and the amount is measured so that the percentage of the water removed by the matting material can be determined. The test is repeated in an identical manner for different matting materials and the results are compared.

(iii) An **ageing test**, in which the ability of a matting material to withstand wear is assessed. A sample of the product is subjected to wear over a predetermined number of cycles in a conventional Vettermann drum tester available from Feingeräte Baumberg, Schönberg GmbH of Monheim, 40789 Germany. The appearance of the sample is then assessed visually and rated.

(iv) A **durability test**, in which the ability of a matting material to withstand wear is measured in an alternative manner. A sample of the product is weighed and then subjected to abrasion by moving the sample backwards and forwards relative to the face of an abrasive disc that is resiliently-biased into contact with the surface of the sample. The sample is weighed after a specified number of passes over the abrasive disc, to determine the quantity of fibres that had been removed by the abrading process. Any loose fibres remaining on the sample are removed by hand and with an air jet before the sample is weighed the second time.

EXAMPLE I

Sample matting materials of the type shown in Fig. 1 were produced using the method described above with reference to Fig. 5 at an ambient temperature of 23°C and relative humidity of 47%. The coiled web used had a weight of 400 g/m^2. Fibres of a selected type (either F1 or Y1 in these examples), supplied in bales, were teased apart and mixed in the opening/mixing machine which was operated with an entrance speed of 1 m/min, an intermediate speed of 2 m/min and an exit speed of 3 m/min, and with both combing blocks rotating at a speed of 1500 rpm. The fibres were then blown into the carding machine which was operated with the parameters shown in the following Table 1 to produce webs of different weights (shown in the final column of the Table):

TABLE 1

Fibre type	Lickerin speed	Depression Webber	Depression Feeder	Line Speed	Feed Roll speed	Elevator speed	Stripper Belt speed	Exit gap	Web Weight
	(rpm)	(Pa)	(Pa)	(m/mn)	(rpm)	(rpm)	(rpm)	(mm)	(g/m²)
F1	1900	51.71×10^3	62.05×10^3	1	0.6	550	350	mini	200
F1	1900	51.71×10^3	62.05×10^3	1	1.2	600	350	15	400
Y1	1900	51.71×10^3	58.61×10^3	1	0.65	550	350	mini	200
Y1	1900	51.71×10^3	58.61×10^3	1	1.4	600	350	15	400

Each fibrous web was then conveyed, with coiled web, to the needle tacker which was operated with the parameters shown in the following Table 2 to consolidate the fibrous web and embed it in the coiled web. Three passes through the needle tacker were required, with the orientation of the webs being reversed between passes.

Table 2

Stroke speed (rpm)	Entry speed (m/min)	Output speed (m/min)	Top board position (graduation)	Bottom board position (graduation)
350	1	1	17	14

The resulting matting materials were as follows:

Sample 1: a material in which the embedded fibrous web comprised F1 fibres and had a weight of 200 g/m^2.

Sample 2: a material in which the embedded fibrous web comprised F1 fibres and had a weight of 400 g/m^2.

Sample 3: a material in which the embedded fibrous web comprised Y1 fibres and had a weight of 200 g/m^2.

Sample 4: a material in which the embedded fibrous web comprised Y1 fibres and had a weight of 400 g/m^2.

The samples were subjected to the soil-trapping and water-trapping tests, and compared with a conventional cut pile textile mat with a rubber backing (of a type typically supplied on a rental basis) that had been subjected to the same tests:

In the soil-trapping test, samples 1 and 3 showed comparable performance to the textile mat, and samples 2 and 4 showed improved performance (i.e. superior soil-trapping abilities).

In the water-trapping test, samples 2 and 4 showed comparable performance to the textile mat, all being superior to samples 1 and 3.

The samples were also subjected to the ageing test, and it was found that samples 3 and 4 showed the best final appearance.

Samples 1 to 4 also offered, in addition to the environmental advantage of utilizing waste/recycled fibres for the embedded air-laid web, the further environmental advantage of being recyclable at the end of their useful lives.

EXAMPLE II

Further sample matting materials of the type shown in Fig. 1 were produced as described above under EXAMPLE I except that the coiled web had a weight of 250g/m^2 and the operating parameters of the air-laid carding machine were changed to produce webs having a weight of 300 g/m^2. Other differences were as noted below:

Sample 5: a material in which the embedded fibrous web comprised a mixture of Y1 fibres (33.3% by weight), IFF fibres (33.3% by weight) and ES fibres (33.3% by weight). Following the three passes through the needle tacker, the material was passed through the oven (not shown in Fig. 5), which was set at a temperature of 145°C. The dwell time in the oven was 2 minutes, sufficient to soften the heat-bondable fibres and allow them to bond to the other fibres in the embedded fibrous web.

Sample 6: a material in which the embedded fibrous web comprised Y1 fibres only.

Sample 7: a material in which the embedded fibrous web comprised IFF fibres only.

Sample 8: a material in which the embedded fibrous web comprised a mixture of Y1 fibres (66.6% by weight) and IFF fibres (33.3% by weight).

Material of samples 5 to 8 were subjected to the durability test, and it was found that sample 5 performed noticeably better than the others (lowest fibre loss) and that sample 7 performed noticeably worse (greatest fibre loss). Of the other two samples, sample 6 showed a better performance than sample 8.
Material of sample 5 was also subjected to the soil-trapping and water-trapping tests, and compared with a conventional cut pile textile mat with a rubber backing (of a type typically supplied on a rental basis, as used in EXAMPLE I) that had been subjected to the same tests. In the soil-trapping test, the material of sample 5 showed comparable performance to the textile mat. In the water-trapping test, it showed a slightly lower performance than the textile mat when the mats were dry but a comparable performance when the mats were moistened with water at a rate of 2 l/m^2.

EXAMPLE III

A sample matting material (sample 9) of the type shown in Fig. 1 was produced as described for sample 5 above, except that the embedded web comprised two fibrous webs, each having a weight of 200 g/m^2, placed one on top of the other. The upper fibrous web comprised the same fibre mixture as that of sample 5 above. The lower fibrous web comprised SAF fibres only, and was consolidated by being passed through the needle tacker so that it could be handled before being placed underneath the upper web and embedded with it in the coiled web.

Material of sample 9 and sample 5 was subjected to the water-trapping test, in a dry condition and also after having been moistened with water at a rate of 2 l/m^2. The material of sample 9 showed a better performance than that of sample 5 when the material was dry. In addition, the material of sample 9 maintained its performance after it had been moistened whereas the performance of the material of sample 5 declined.

CLAIMS

1. Matting material comprising a supporting web of comparatively coarse filaments in which is embedded a web of comparatively fine fibres, wherein the upper surface of the embedded fibrous web is a shoe-wiping surface, and the coarse filaments of the supporting web project above the upper surface of the embedded web to form shoe-scraping elements.

2. Matting material as claimed in claim 1, in which the supporting web has a thickness in the range of from 4.0 to 27.0 mm, preferably in the range of from 6.0 to 14.0 mm.

3. Matting material as claimed in claim 1 or claim 2, in which the filaments of the supporting web comprise continuous coiled filaments.

4. Matting material as claimed in claim 3, in which the filaments of the supporting web are bonded to one another at their points of contact.

5. Matting material as claimed in claim 3 or claim 4, in which portions of the filament coils project above the upper surface of the embedded web to form shoe-scraping elements.

6. Matting material as claimed in claim 5, in which the projecting portions of the filament coils are regularly arranged over the upper surface of the matting material.

7. Matting material as claimed in any one of claims 3 to 6, in which the upper surface of the supporting web has an undulating structure.

8. Matting material as claimed in any one of the preceding claims, in which the filaments of the supporting web are extruded polymeric filaments.

9. Matting material as claimed in any one of the preceding claims, in which the filaments of the supporting web have a linear density in the range of from 100 to 1000 dtex.

10. Matting material as claimed in any one of the preceding claims, in which the embedded web is a nonwoven fibrous web.

11. Matting material as claimed in any one of the preceding claims, in which the embedded web comprises heat-bondable and/or crimped fibres.

12. Matting material as claimed in any one of the preceding claims, in which the fibres of the embedded web have a linear density in the range of from 10 to 100 dtex.

13. Matting material as claimed in any one of the preceding claims, in which the embedded web is embedded in the supporting web by needle-tacking.

14. Matting material as claimed in any one of the preceding claims, in which the supporting web has a weight in the range of from 100 to 1000 g/m^2 100, preferably in the range of from 200 to 500 g/m^2, and the embedded web has a weight in the range of from 200 to 400 g/m^2.

15. A mat comprising matting material as claimed in any one of the preceding claims.

16. A mat as claimed in claim 15, in combination with a base on which the mat is located.

17. A mat as claimed in claim 16, in which the mat is releasably-secured to the base.

18. A mat as claimed in claim 15, further comprising a backing material attached to the lower surface of the matting material.

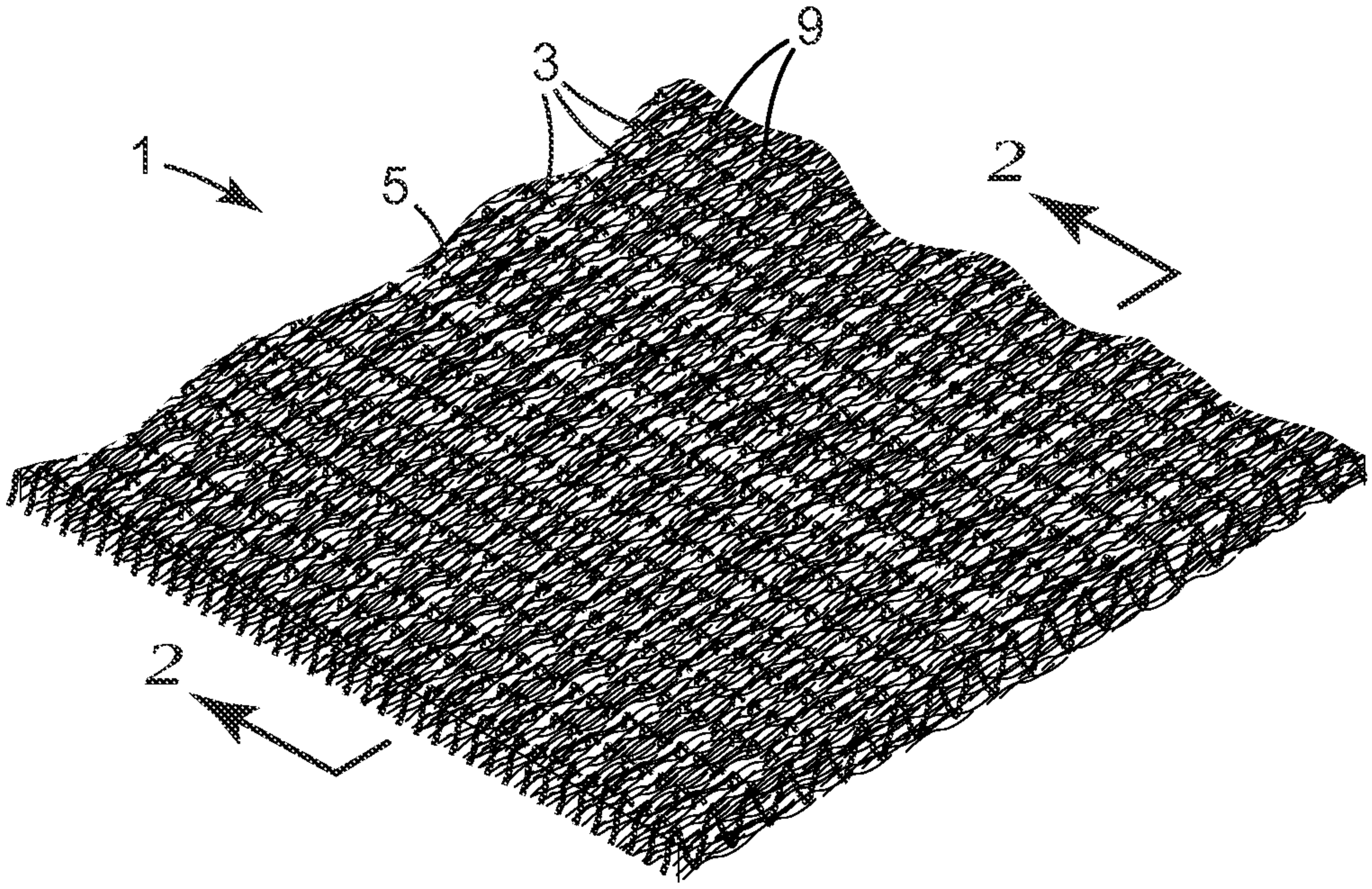


FIG. 1

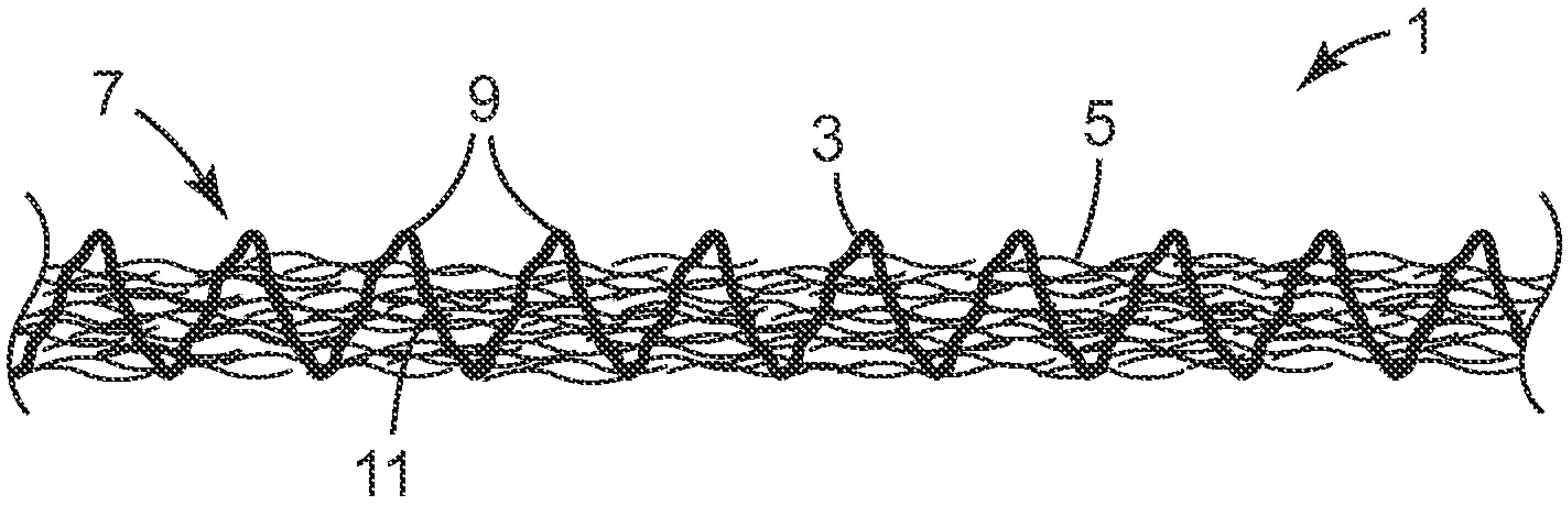


FIG. 2

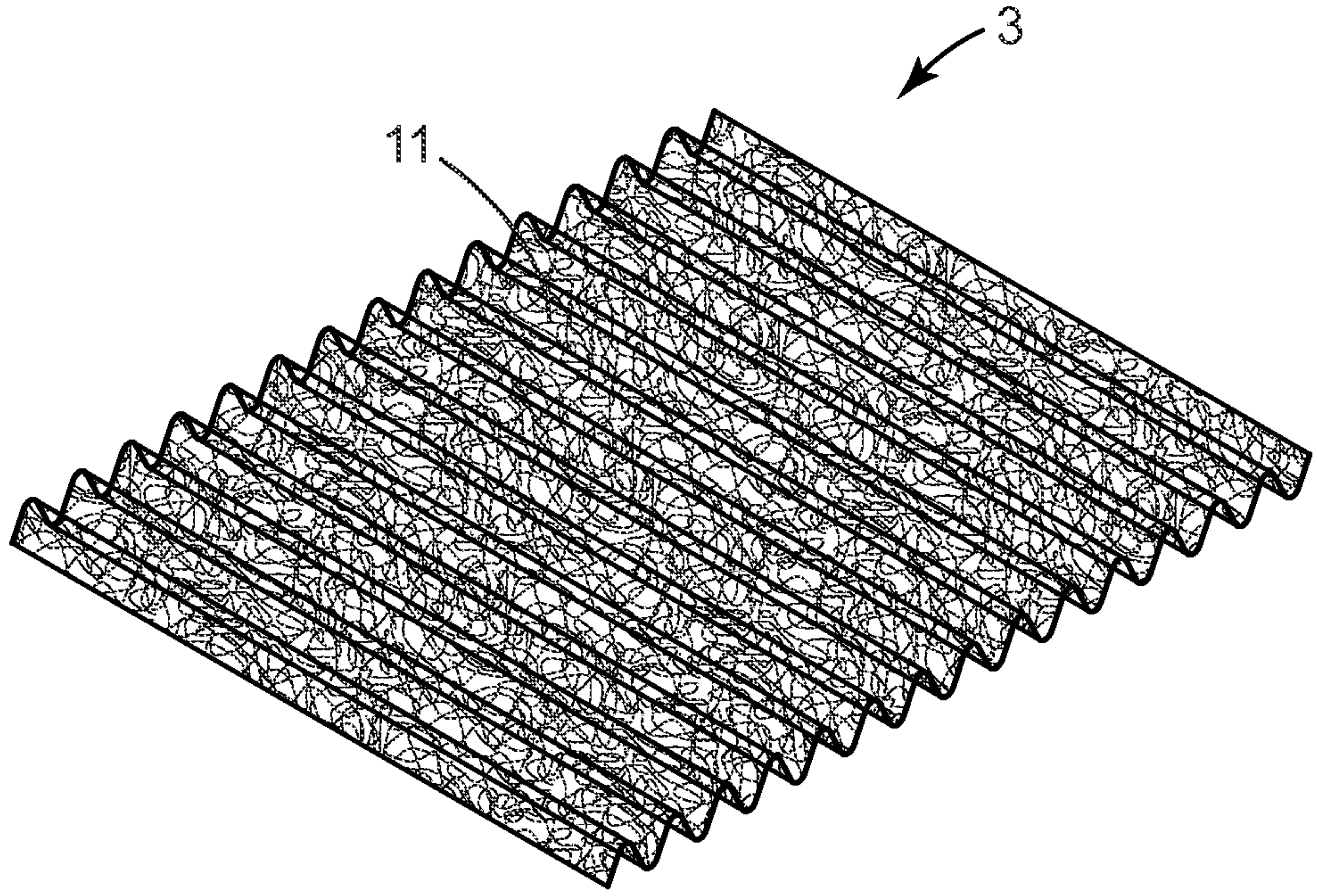


FIG. 3

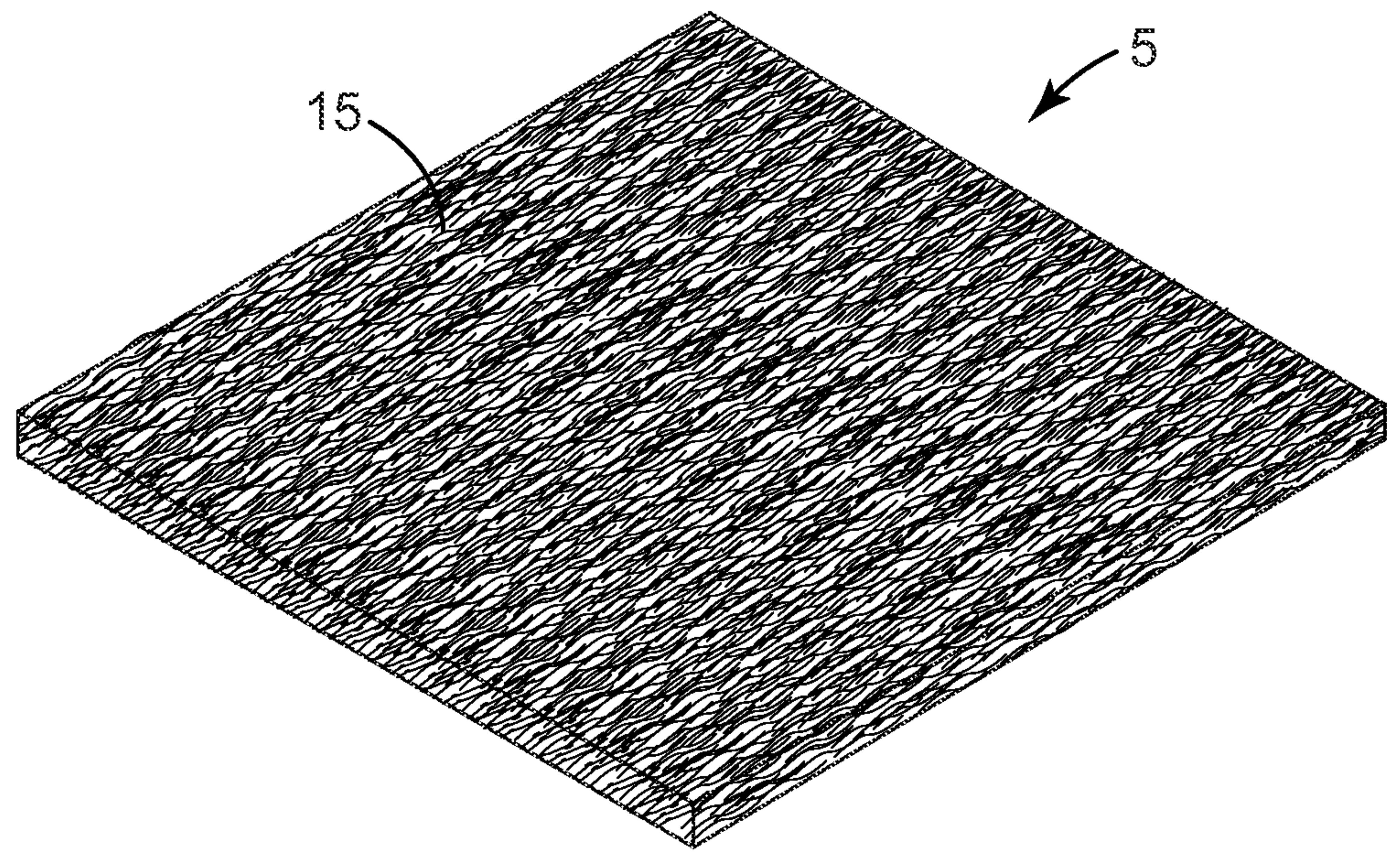


FIG. 4

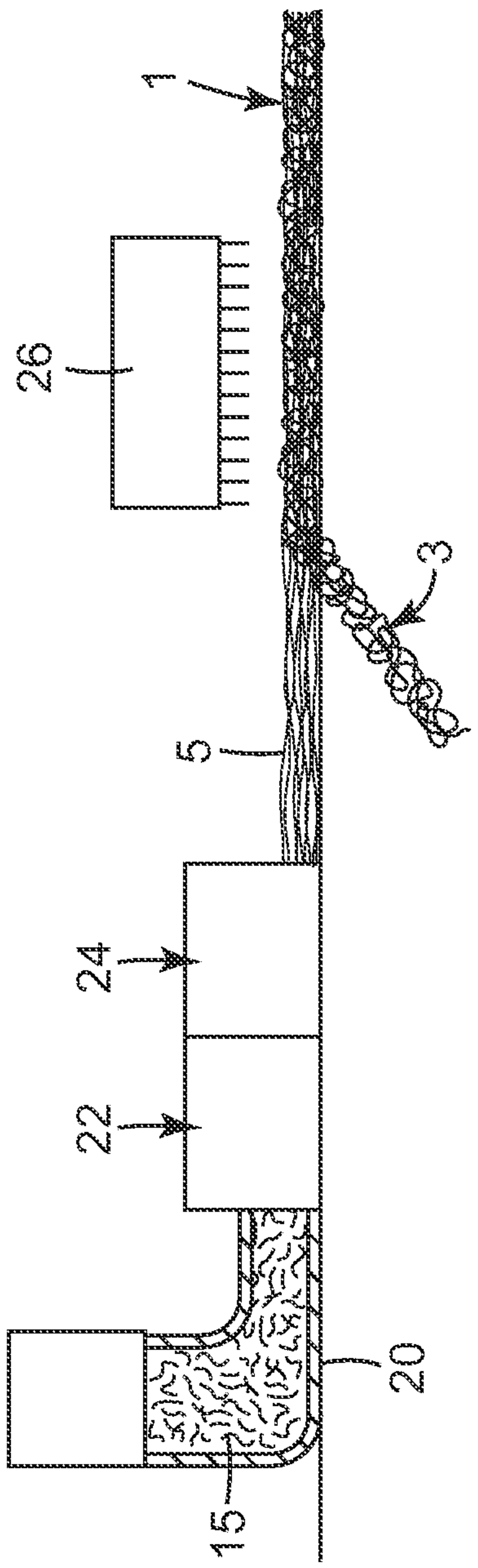
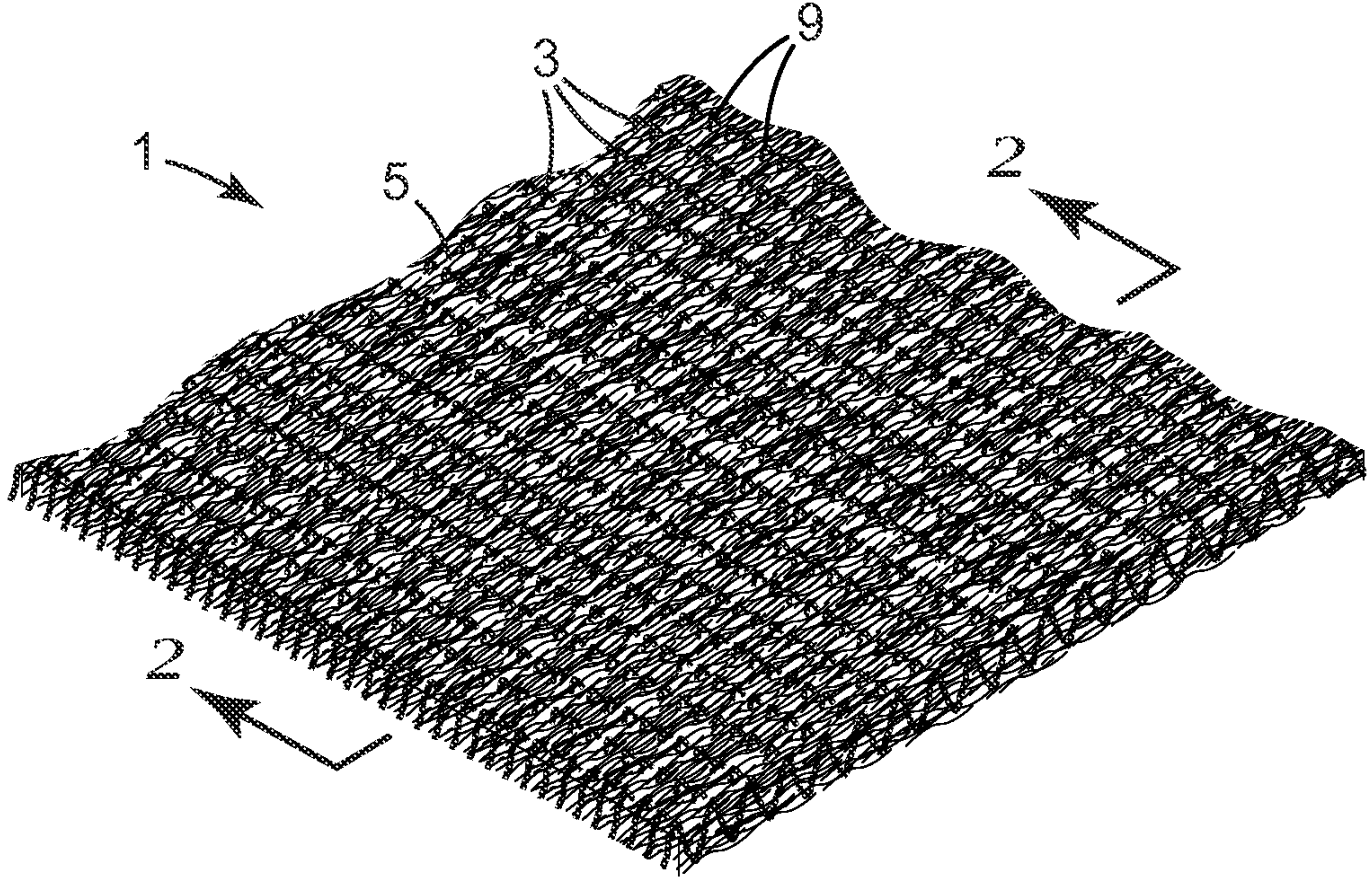


FIG. 5


3
9
1
5
2
2