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(54) **HYBRID TURF**

HYBRIDRASEN

GAZON HYBRIDE

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Description

Field of the invention

[0001] The present invention refers to the field of turfs and, in particular, to a hybrid turf.

Known art

[0002] As known, hybrid turfs are portions of soil comprising natural (grass) and synthetic fibres, suitably interspersed, to obtain portions of lawn. The reinforcement imparted to natural fibres (natural grass) by synthetic fibres (artificial grass) ensures stability and a uniform playing surface immediately after installation.

[0003] The grass crown (heart) is then located between the artificial fibres covered with sand, where it is protected from wear and tear damage.

[0004] In some cases, synthetic turfs are constrained in an open-weave backing, clogged with specific sand.

[0005] In other cases, synthetic turfs do not provide backing elements and are directly "sewn" into the soil.

[0006] The Applicant has observed that whenever a new hybrid turf mat is to be installed at a site of use, the synthetic components of the old worn-out hybrid turf mat must be completely removed from the soil before the new hybrid turf can be installed. Removing the worn-out hybrid turf mat may not be easy, as the hybrid turf mat is often strongly interconnected with the roots of natural herbaceous plants. The disposal of the worn-out hybrid turf mat is challenging because the mixture of natural grass, dirt and synthetic materials, if undivided and washed, cannot be recycled, is expensive to dispose of and, therefore, has a strong environmental impact.

[0007] The Applicant has therefore observed that an ever increasing number of producers of hybrid and artificial grass have begun to replace the conventional fibres and backing materials with biodegradable materials.

[0008] For example, KR101855284, WO2019/093900 discloses an hybrid turf according to the prior art and in in particular the international patent application WO 2007/114686 describes the use of biodegradable synthetic fibres consisting of starch and polylactic acid (PLA).

[0009] The Applicant has however observed that the biodegradable fibres used to date do not allow a precise estimate of the biodegradability timings.

[0010] In fact, biodegradation is a process that depends on a plurality of environmental factors and on the actual life expectancy of an artificial or hybrid turf mat.

[0011] The Applicant has posed the problem of implementing a hybrid turf which is easy and economical to replace and dispose of and whose disposal does not result in a great environmental impact.

[0012] The Applicant has also posed the problem of implementing a hybrid turf which has precise biodegradability timings.

[0013] The Applicant has also posed the problem of the environmental impact of the current plastics used for this application, since they are in direct contact with the soil and aquifers.

Summary of the invention

[0014] Therefore the invention, in a first aspect thereof, relates to a hybrid turf comprising a plurality of synthetic fibres made of a biodegradable compound, wherein said biodegradable compound comprises polybutylene succinate adipate PBSA, characterised in that the amount of polybutylene succinate adipate is equal to or greater than 60% by weight.

[0015] The present invention, in the aforesaid aspect, may have at least one of the preferred features described hereunder.

[0016] Preferably, the plurality of fibres are grouped into skeins, each comprising a plurality of filiform elements made of said biodegradable compound; said filiform elements being twisted at least for a length of their extent.

[0017] Conveniently, the hybrid turf comprises a backing element for the plurality of fibres.

[0018] Advantageously, the biodegradable compound comprises an amount of polybutylene succinate adipate (PBSA) equal to or greater than 80% by weight.

[0019] Preferably, the biodegradable compound comprises an amount of polybutylene succinate adipate (PBSA) equal to or greater than 90% by weight.

[0020] Conveniently, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 35% by weight of the total weight of the compound.

[0021] Preferably, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or greater than 25% by weight of the total weight of the compound.

[0022] Alternatively, the backing element comprises at least one first layer comprising a first net made of cotton or organic natural material, comprising meshes defining a plurality of openings configured so as to allow the natural grass to take root therein and in any case allow the roots to pass through it.

[0023] Preferably, the backing element comprises a second layer combined with said first layer, said second layer comprising a net made of said biodegradable compound.

[0024] Conveniently, the first net comprises meshes, each mesh being able to be inscribed in a square with side in the range from 0.2 cm to 2 cm.

[0025] Further characteristics and advantages of the invention will become more apparent from the detailed description of some preferred, but not exclusive, embodiments of a hybrid turf according to the present invention.

Brief description of the drawings

[0026] Such description will be set forth hereinafter

with reference to the appended drawings provided for indicative, and therefore non-limiting, purpose only, wherein:

- figure 1 shows a schematic perspective view of a first embodiment of the hybrid turf according to the present invention, with a part partially exploded;
- figure 2 shows a schematic side view of a skein of filiform elements comprising synthetic fibres;
- figure 3 shows a schematic perspective view of a second embodiment of the hybrid turf according to the present invention.

Detailed description of embodiments of the invention

[0027] With reference to the figures, a turf, preferably hybrid, according to the present invention is denoted by the reference numeral 10.

[0028] Figure 1 shows a first embodiment of the hybrid turf 10, according to the present invention, comprising a backing element 2 and a plurality of synthetic fibres 3 combined with the backing element 2.

[0029] The hybrid turf 10 further comprises a plurality of grass blades 15 which are alternated with the synthetic fibres 3, so as to make a substantially continuous mat of grass blades 15 and synthetic fibres 3.

[0030] When installed, the backing element 2 may have a substantially planar configuration comprising at least one first layer 4 made of a first net 5 made of a natural organic material, preferably cotton.

[0031] Preferably, the first net 5 comprises meshes defining a plurality of openings configured so as to allow the natural grass blades 15 to root inside it.

[0032] Conveniently, the first net 5 comprises meshes 8 which can be inscribed in a square with side in the range from 0.1 cm to 2 cm.

[0033] In the embodiment shown in figure 1, the backing element 2 also comprises a second layer 6 made of a second net 7 which is made of a biodegradable material.

[0034] Preferably, the biodegradable material making the second net 7 is the same as the synthetic fibres 3.

[0035] The second net 7 comprises meshes 9 defining a plurality of openings.

[0036] For this purpose, the second net 7 comprises meshes 9 which can be inscribed, in plan view, in a square with side in the range from 0.2 cm to 2 cm.

[0037] In the embodiment shown in figure 1, the first layer 4 is combined with the second layer 6.

[0038] Preferably, the first layer 4 is combined with the second layer 6 by hot-melt gluing.

[0039] Even more preferably, the first layer 4 is combined with the second layer 6 through a hot lamination process.

[0040] In production, during the step of combining the first layer 4 with the second layer 6, there is a substantial overlap between the meshes 8 of the first net 5 with the meshes 9 of the second net 7, so as to leave the openings adapted to allow the natural grass to cross the layers and take root thereunder.

[0041] In the embodiment shown in figure 1, a plurality of synthetic fibres 3 made of a biodegradable compound, described in greater detail below, are constrained to the backing element 2 constituted by the first 4 and second 6 layers combined together.

[0042] The synthetic fibres 3 are grouped into skeins 11 distributed uniformly on the turf 10.

[0043] The synthetic fibres 3 are grouped into skeins 11 distributed uniformly on the hybrid turf 10 so as to form a fibre density per square metre (m^2) in the range from 45000 fibres/m^2 to 80000 fibres/m^2.

[0044] Each skein 11, better shown in figure 2, comprises a plurality of filiform elements 12 made of a biodegradable compound, described in greater detail below.

[0045] The synthetic fibres 3 are therefore depicted by the filiform elements 12.

[0046] Each skein 11 comprises a number of filiform elements 12 or synthetic fibres 3 ranging from five to fifteen, preferably from six to twelve.

[0047] In each skein 11, the filiform elements 12 have the same extent ranging from 2 to 20 cm, including extremes.

[0048] In each skein 11, the filiform elements 12 are twisted together at least for a length T of their extent.

[0049] Preferably, in every skein 11, the filiform elements 12 are twisted together for at least 1/3 of their extent.

[0050] Preferably, in every skein 11, the filiform elements 12 are twisted together for at least 2/3 of their extent.

[0051] In the embodiment shown in figure 1, the skeins 11, suitably folded on themselves, preferably so as to form a "V", are combined with the backing element 2 by means of sewing.

[0052] Preferably, in the embodiment shown in figure 1, the skeins 11, suitably folded on themselves, preferably so as to form a "V", are combined with the backing element 2 by means of a sewing process referred to as "tufting".

[0053] As mentioned above, the synthetic fibres 3 are made of a biodegradable material.

[0054] Preferably, the synthetic fibres 3 are made of a biodegradable compound comprising at least 60% by weight of the total weight of the polybutylene succinate adipate (PBSA) compound.

[0055] According to a first embodiment, the biodegradable compound comprises at least 90% by weight of the total weight of the polybutylene succinate adipate (PBSA) compound. Preferably, the biodegradable compound comprises at least 95% by weight of the total weight of the polybutylene succinate adipate (PBSA) compound. Even more preferably, the biodegradable compound comprises at least 97% by weight of the total weight of the polybutylene succinate adipate (PBSA) compound.

[0056] According to another embodiment, the biode-

gradable compound comprises an amount of polybutylene succinate adipate (PBSA) between 65% and 95% by weight of the total weight of the compound. Preferably, according to this embodiment, the biodegradable compound comprises an amount of polybutylene succinate adipate (PBSA) between 75% and 90% by weight of the total weight of the compound. Still according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 25% by weight of the total weight of the compound.

[0057] Preferably, according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or greater than 5% by weight of the total weight of the compound.

[0058] Preferably, according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 20% by weight of the total weight of the compound.

[0059] Even more preferably, according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or greater than 10% by weight of the total weight of the compound.

[0060] According to even another embodiment, the biodegradable compound comprises an amount of polybutylene succinate adipate (PBSA) between 60% and 90% by weight of the total weight of the compound. Preferably, according to this embodiment, the biodegradable compound comprises an amount of polybutylene succinate adipate (PBSA) between 65% and 75% by weight of the total weight of the compound. Still according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 40% by weight of the total weight of the compound.

[0061] Preferably, according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or greater than 20% by weight of the total weight of the compound.

[0062] Preferably, according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 35% by weight of the total weight of the compound.

[0063] Even more preferably, according to this embodiment, the biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or greater than 25% by weight of the total weight of the compound.

[0064] When the hybrid turf is planted on a soil already prepared, it is filled with sand 14, so that the latter has a depth with respect to the backing element 2 of at least 10 cm, preferably a depth with respect to the backing element 2 of at most 30 cm.

[0065] Sands 14 suitable for the purpose are silica sands of various grain sizes, preferably USGA certified.

[0066] Once filled with sand 14, the hybrid turf 10 is sowed so that the grass blades 15 can take root and develop between a skein 11 and the next one.

[0067] As the roots of the grass blades 15 grow, they pass through the meshes of the backing element 2, thus constraining the hybrid turf 10 to the underlying soil.

[0068] Figure 3 shows an alternative embodiment of the hybrid turf 10 according to the present invention. In particular, the hybrid turf 10 of figure 3 is completely similar to the hybrid turf of figure 1, except that it does not have any backing element 2 and that the skeins 11 can have a larger dimension.

[0069] According to this embodiment, the skeins 11, suitably folded on themselves, preferably so as to form a "V", are not combined with the backing element 2 (which is not present) but with the soil through suitable "sewing" machines.

[0070] This hybrid turf, as it is clear from the description above, has the following advantages:

- it allows to reduce the environmental impact of the disposal compared to conventional hybrid turfs;
- it allows to reduce or eliminate disposal costs;
- simplicity of construction, combined with high reliability;
- precise timings of biodegradability.

[0071] Several changes can be made to the embodiments described in detail, all anyhow remaining within the protection scope of the invention as defined by the following claims.

Claims

1. Hybrid turf (10) comprising a plurality of synthetic fibres (3) made of a biodegradable compound; wherein said biodegradable compound comprises polybutylene succinate adipate (PBSA),**characterised in that** the amount of polybutylene succinate adipate is equal to or greater than 60% by weight of the compound.

2. Hybrid turf (10) according to claim 1, **characterised in that** said plurality of synthetic fibres (3) are grouped into skeins (11), each comprising a plurality of filiform elements (12) made of said biodegradable compound.

3. Hybrid turf (10) according to claim 1 or 2, **characterised by** comprising a backing element (2) for said plurality of synthetic fibres (3).

4. Hybrid turf (10) according to claim 3, **characterised in that** said biodegradable compound comprises an amount of polybutylene succinate adipate (PBSA) equal to or greater than 80% by weight of the compound.

5. Hybrid turf (10) according to any one of claims 1 to 4,

characterised in that said biodegradable compound comprises an amount of polybutylene succinate adipate equal to or greater than 90% by weight.

6. Hybrid turf (10) according to any one of claims 1 to 5, **characterised in that** said biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 35% by weight of the total weight of the compound.

7. Hybrid turf (10) according to claim 6, **characterised in that** said biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or greater than 25% by weight of the total weight of the compound.

8. Hybrid turf (10) according to claim 6, **characterised in that** said biodegradable compound comprises an amount of poly-β-hydroxybutyrate (PHB) equal to or less than 25% and equal to or greater than 5% by weight of the total weight of the compound.

9. Hybrid turf (10) according to any one of claims 1 to 7, **characterised in that** said backing element comprises at least one first layer (4) comprising a first net (5) that is made of natural organic material and comprises meshes defining a plurality of openings configured so as to allow the natural grass to take root therein.

10. Hybrid turf (10) according to claim 4, **characterised in that** said backing element (2) comprises a second layer (6) combined with said first layer (4), said second layer (6) comprises a net (7) made of said biodegradable compound.

11. Hybrid turf (10) according to claim 9, **characterised in that** said first net (5) comprises meshes, each mesh being able to be inscribed in a square with side in the range from 0.2 cm to 2 cm.

12. Hybrid turf (10) according to any one of claims 1 to 11, comprising a plurality of grass blades (15) interspersed with said plurality of synthetic fibres (3).

Patentansprüche

1. Hybridrasen (10), umfassend eine Vielzahl von synthetischen Fasern (3), die aus einer biologisch abbaubaren Verbindung hergestellt sind;
wobei die biologisch abbaubare Verbindung Polybutylensuccinatadipat (PBSA) umfasst, **dadurch gekennzeichnet, dass** die Menge an Polybutylensuccinatadipat gleich oder größer als 60 Gew.-% der Verbindung ist.

2. Hybridrasen (10) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Vielzahl von synthetischen Fasern (3) in Strängen (11) gruppiert sind, die jeweils eine Vielzahl von fadenförmigen, aus der biologisch abbaubaren Verbindung hergestellten Elementen (12) umfassen.

3. Hybridrasen (10) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** er ein Trägerelement (2) für die Vielzahl von synthetischen Fasern (3) umfasst.

4. Hybridrasen (10) nach Anspruch 3, **dadurch gekennzeichnet, dass** die biologisch abbaubare Verbindung eine Menge an Polybutylensuccinatadipat (PBSA) umfasst, die gleich oder größer als 80 Gew.-% der Verbindung ist.

5. Hybridrasen (10) nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die biologisch abbaubare Verbindung eine Menge an Polybutylensuccinatadipat umfasst, die gleich oder größer als 90 Gew.-% ist.

6. Hybridrasen (10) nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die biologisch abbaubare Verbindung eine Menge an Poly-β-hydroxybutyrat (PHB) umfasst, die gleich oder kleiner als 35 Gew.-% des Gesamtgewichts der Verbindung ist.

7. Hybridrasen (10) nach Anspruch 6, **dadurch gekennzeichnet, dass** die biologisch abbaubare Verbindung eine Menge an Poly-β-hydroxybutyrat (PHB) umfasst, die gleich oder größer als 25 Gew.-% des Gesamtgewichts der Verbindung ist.

8. Hybridrasen (10) nach Anspruch 6, **dadurch gekennzeichnet, dass** die biologisch abbaubare Verbindung eine Menge an Poly-β-hydroxybutyrat (PHB) umfasst, die gleich oder kleiner als 25 % und gleich oder größer als 5 Gew.-% des Gesamtgewichts der Verbindung ist.

9. Hybridrasen (10) nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** das Trägerelement mindestens eine erste Schicht (4) aufweist, die ein erstes Netz (5) umfasst, das aus natürlichem organischem Material hergestellt ist und Maschen aufweist, die eine Vielzahl von Öffnungen definieren, die so konfiguriert sind, dass das natürliche Gras darin Wurzeln schlagen kann.

10. Hybridrasen (10) nach Anspruch 4, **dadurch gekennzeichnet, dass** das Trägerelement (2) eine zweite Schicht (6) umfasst, die mit der ersten Schicht (4) kombiniert ist, wobei die zweite Schicht (6) ein aus der biologisch abbaubaren Verbindung hergestelltes Netz (7) umfasst.

11. Hybridrasen (10) nach Anspruch 9, **dadurch ge-**

kennzeichnet, dass das erste Netz (5) Maschen umfasst, wobei jede Masche in ein Quadrat mit einer Seite im Bereich von 0,2 cm bis 2 cm eingeschrieben werden kann.

12. Hybridrasen (10) nach einem der Ansprüche 1 bis 11, umfassend eine Vielzahl von Grashalmen (15), die mit dieser Vielzahl von synthetischen Fasern (3) durchsetzt sind.

Revendications

1. Gazon hybride (10) comprenant une pluralité de fibres synthétiques (3) réalisées en un composé biodégradable;
dans lequel ledit composé biodégradable comprend du polybutylène succinate adipate (PBSA), **caractérisé en ce que** la quantité de polybutylène succinate adipate est égale ou supérieure à 60% en poids du composé.

2. Gazon hybride (10) selon la revendication 1, **caractérisé en ce que** ladite pluralité de fibres synthétiques (3) est groupée en écheveaux (11) chacun comprenant une pluralité d'éléments filiformes (12) réalisés en ledit composé biodégradable.

3. Gazon hybride (10) selon la revendication 1 ou 2, **caractérisé en ce qu'**il comprend un élément de support (2) pour ladite pluralité de fibres synthétiques (3).

4. Gazon hybride (10) selon la revendication 3, **caractérisé en ce que** ledit composé biodégradable comprend une quantité de polybutylène succinate adipate (PBSA) égale ou supérieure à 80% en poids du composé.

5. Gazon hybride (10) selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** ledit composé biodégradable comprend une quantité de polybutylène succinate adipate égale ou supérieure à 90% en poids.

6. Gazon hybride (10) selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** ledit composé biodégradable comprend une quantité de poly-β-hydroxybutyrate (PHB) égale ou inférieure à 35% en poids du poids total du composé.

7. Gazon hybride (10) selon la revendication 6, **caractérisé en ce que** ledit composé biodégradable comprend une quantité de poly-β-hydroxybutyrate (PHB) égale ou supérieure à 25% en poids du poids total du composé.

8. Gazon hybride (10) selon la revendication 6, **caractérisé en ce que** ledit composé biodégradable comprend une quantité de poly-β-hydroxybutyrate (PHB) égale ou inférieure à 25% et égale ou supérieure à 5% en poids du poids total du composé.

9. Gazon hybride (10) selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** l'élément de support comprend au moins une première couche (4) comprenant un premier filet (5) réalisé en une matière organique naturelle et comprend des mailles définissant une pluralité d'ouvertures configurées de sorte à permettre à l'herbe naturelle d'y prendre racine.

10. Gazon hybride (10) selon la revendication 4, **caractérisé en ce que** ledit élément de support (2) comprend une seconde couche (6) associée à ladite première couche (4), ladite seconde couche (6) comprenant un filet (7) réalisé en ledit composé biodégradable.

11. Gazon hybride (10) selon la revendication 9, **caractérisé en ce que** ledit premier filet (5) comprend des mailles, chaque maille pouvant s'inscrire dans un carré avec des faces comprises entre 0,2 cm et 2 cm.

12. Gazon hybride (10) selon l'une quelconque des revendications 1 à 11, comprenant une pluralité de brins d'herbe (15) entrecoupés par ladite pluralité de fibres synthétiques (3).

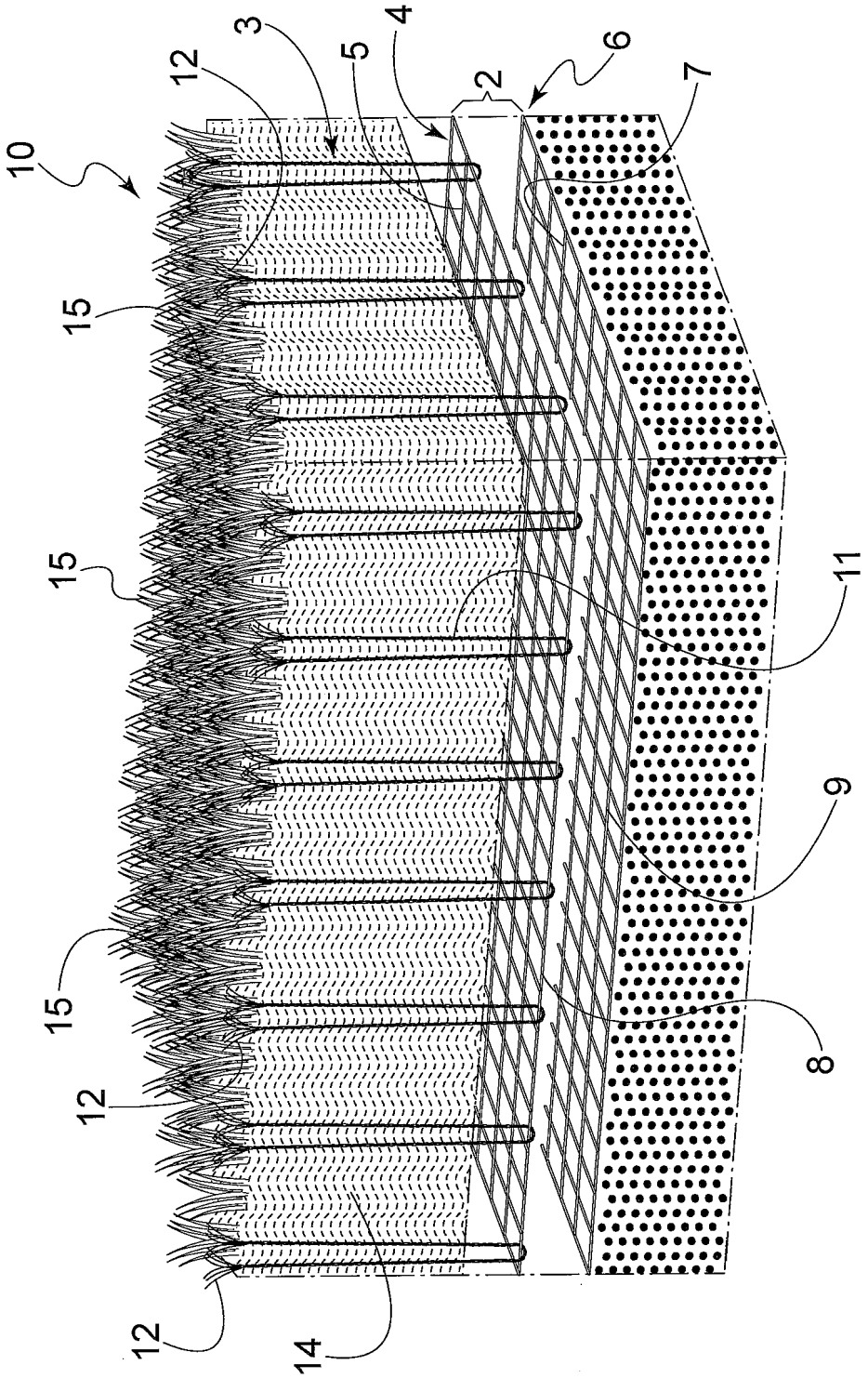

Fig. 1

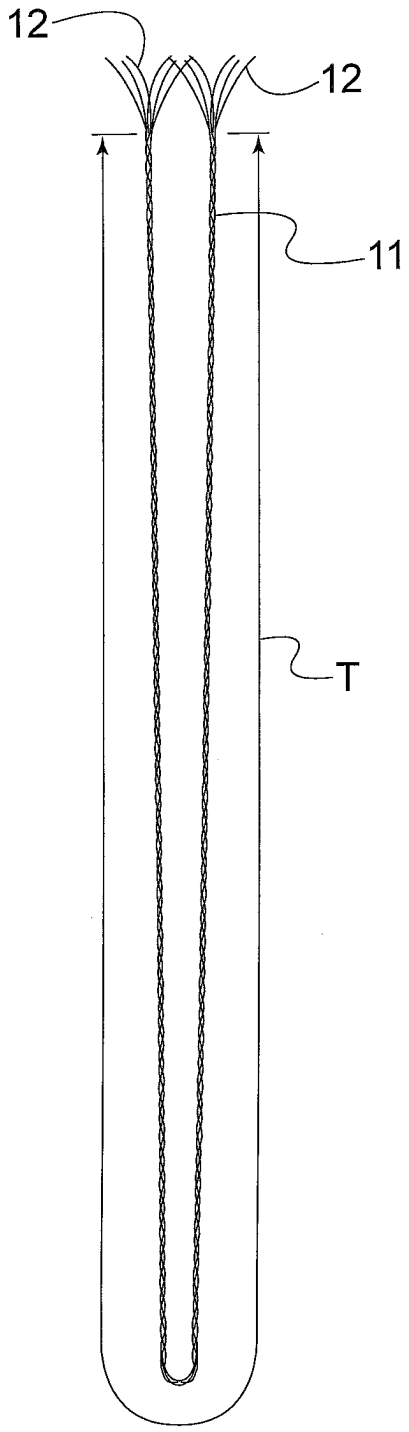

Fig. 2

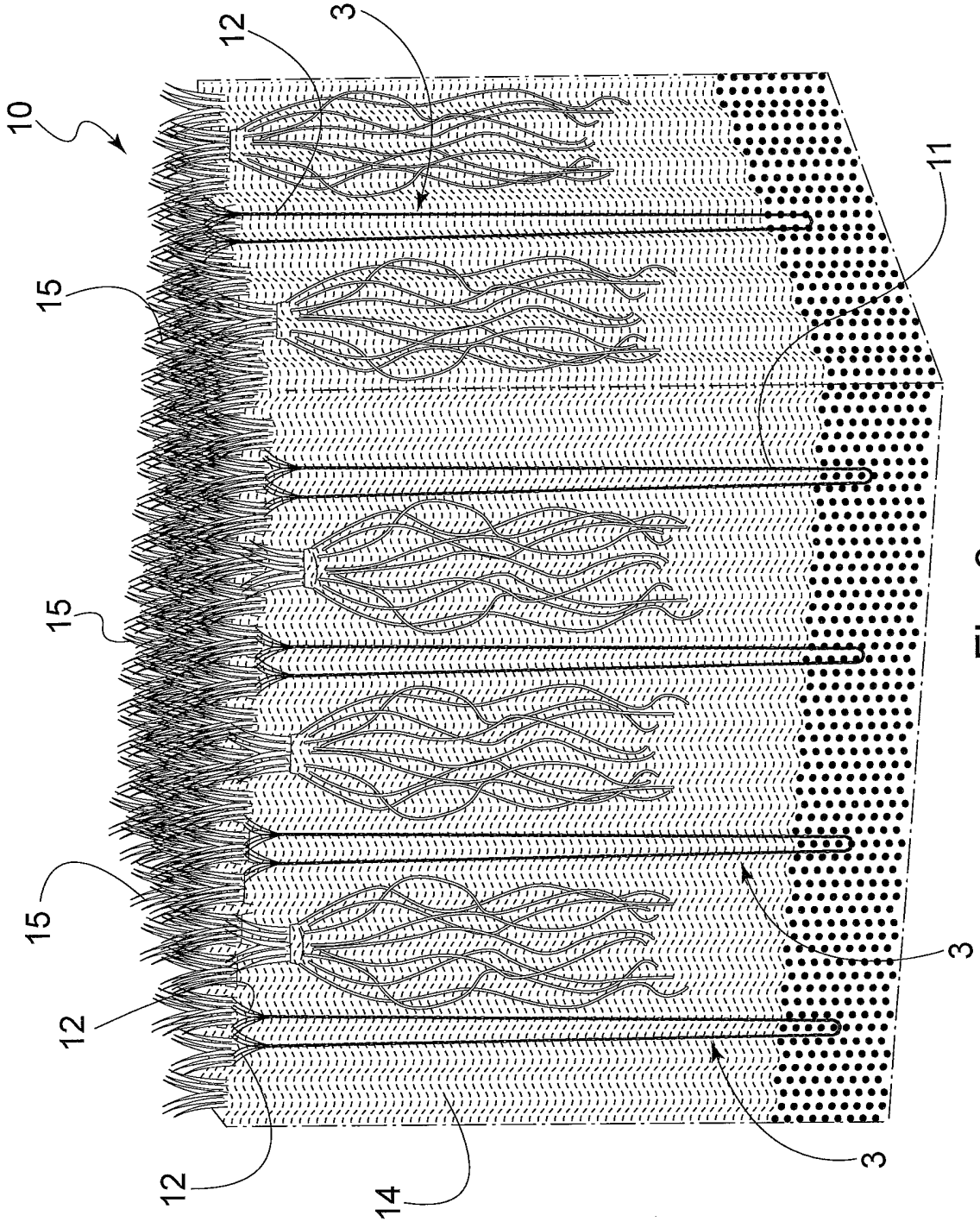

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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