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(54) Artificial turf assembly

(57) The present invention relates to an artificial turf assembly (1) suitable as a horse track, comprising a first water-permeable section (2) comprising a water-permeable layer of artificial turf (5) provided with an infill material (3) within and on top of said artificial turf layer (5) and a second section (4) of drainage material positioned below said first section, wherein the infill material (3) comprises three layers: a top layer (8) comprising sand, optionally provided with a water retaining material such as stone meal, a lower layer (6) comprising sand, and an intermediate layer (7) disposed between the top layer (8) and lower layer (6) and comprising a shock absorbing material.

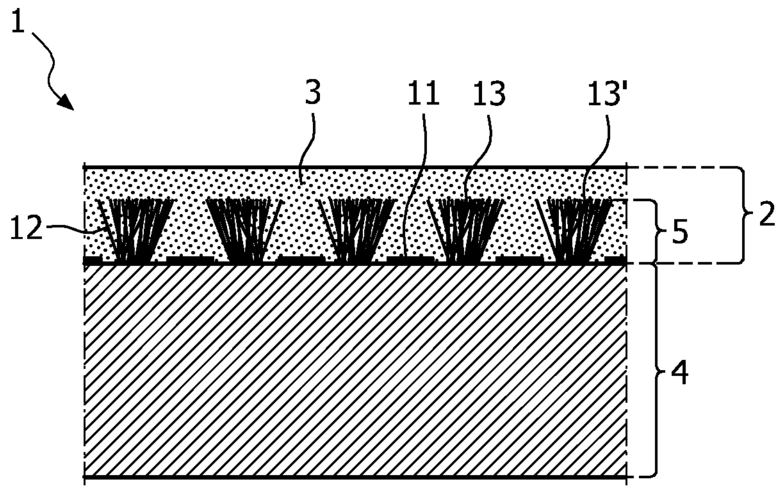

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to an improved artificial turf assembly and, more particularly, to an artificial turf assembly having an optimal drainage and stability performance for a support surface, such as a horse track in order to limit injury to the horses. The improved artificial turf assembly is suitable for horse tracks for use in activities such as for jumping, dressage, horse walking, and for in- and outdoor arenas.

BACKGROUND TO THE INVENTION

[0002] The surfaces suitable for horse riding should fulfill several criteria, the primary consideration being the well-being of the horse. A track that is too hard increases the impact and stress on horses' bones and joints. Conversely a track that is too soft, for example, after rain, does not provide a consistent footing and can lead to a fall. Therefore, drainage systems and/or watering systems become necessary to keep an outdoor track in optimum condition in all seasons. These systems are expensive to maintain and do not necessarily remedy the condition of the ground. Other considerations for a horse track include maintenance and durability, and appearance. Examples of surfaces are mentioned in EP 1 178 155 A1 which describes a surface suitable for playing tennis, and US 6,299,959 B1 that discloses a synthetic grass for playing surfaces.
[0003] It is an object of the present invention to provide an all weather riding turf that maintains a combination of sure footing and cushioning capability for safe use by a horse and rider in a variety of show or private events activities.

SUMMARY OF THE INVENTION

[0004] One embodiment of the invention is an artificial turf assembly (1) suitable as a horse track, comprising a first water-permeable section (2) comprising a water-permeable layer of artificial turf (5) provided with an infill material (3) within and on top of said artificial turf layer (5) and a second section (4) of drainage material positioned below said first section.
[0005] Another embodiment of the invention is an artificial turf as described above, wherein the infill material (3) further comprises an intermediate layer (7) disposed between the top layer (8) and lower layer (6) and comprising a shock absorbing material.
[0006] Another embodiment of the invention is an artificial turf as described above, wherein the height of the infill material (3) exceeds the pile height of the artificial turf (5).
[0007] Another embodiment of the invention is an artificial turf as described above, wherein the height of the infill material (3) exceeds the pile height of the artificial turf by a minimum of 20%, and preferably by at least 60%.
[0008] Another embodiment of the invention is an artificial turf as described above, wherein the height of the infill material (3) exceeds the pile height of the artificial turf by a minimum of 40%, of the height of the artificial turf.
[0009] Another embodiment of the invention is an artificial turf as described above, wherein the infill material (3) is comprised of two layers of infill material: a top layer (8) comprising sand, optionally provided with an water retaining material such as stonemeal, and a lower layer (6) comprising sand.
[0010] Another embodiment of the invention is an artificial turf as described above, wherein the sand of the top layer (8) has a particle size of 0.05 to 0.3 mm.
[0011] Another embodiment of the invention is an artificial turf as described above, wherein the sand of the lower layer (6) has a particle size of 0.9 to 2 mm.
[0012] Another embodiment of the invention is an artificial turf as described above, wherein the shock absorbing material of the intermediate layer (7) comprises rubber.
[0013] Another embodiment of the invention is an artificial turf as described above, wherein the rubber is recycled rubber granules or EPDM rubber granules, having a granule size of 0.5 to 2.5 mm.
[0014] Another embodiment of the invention is an artificial turf as described above, wherein the height of the lower layer (6) or the combined height of the lower layer (6) and optional intermediate layer (7) is less than the pile height of the artificial turf (5).
[0015] Another embodiment of the invention is an artificial turf as described above, wherein the pile height of the artificial turf (5) is between 30 and 80 mm and preferably between 40 and 70 mm, or between 50 and 70 mm and most preferably about 60 mm.
[0016] Another embodiment of the invention is an artificial turf as described above, wherein the depth of the lower layer (6) is between 0.5 and 1.5 cm.
[0017] Another embodiment of the invention is an artificial turf as described above, wherein the depth of the intermediate layer (7) is between 0.5 and 2 cm, preferably between 1.5 and 2.5 cm.

[0018] Another embodiment of the invention is an artificial turf as described above, wherein the top layer (8) is provided at a depth between 5 and 7 cm.

[0019] Another embodiment of the invention is an artificial turf as described above, wherein the filaments (12) consist essentially of any of polypropylene, polyethylene, and preferably from polyolefine fibres such as medium density polyethylene (MDPE).

[0020] Another embodiment of the invention is an artificial turf as described above, wherein filaments (12) consist essentially of a mixture of high density polyethylene (HDPE) and low density linear polyethylene (LLDPE).

[0021] Another embodiment of the invention is an artificial turf as described above, characterised in that the composition of said mixture comprises 20 to 80% HDPE and 80 to 20% LLDPE, preferably 40 to 60% HDPE and 60 to 40% LLDPE, and more preferably approximately 50% HDPE and 50% LLDPE.

[0022] Another embodiment of the invention is an artificial turf as described above, wherein the artificial turf (5) is comprised of continuous strand filaments (17).

[0023] Another embodiment of the invention is an artificial turf as described above, wherein the artificial turf (5) is comprised of composite filaments (18) which are combination of fibrillated filaments (14) and continuous strand filaments (17).

[0024] Another embodiment of the invention is an artificial turf as described above, wherein the continuous strand filaments (17) are monofilaments.

[0025] Another embodiment of the invention is an artificial turf as described above, characterized in that a composite filament (17) has a yarn number between 5000 and 30000 dtex, preferably between 9000 and 20000 and more preferably about 16000 dtex.

[0026] Another embodiment of the invention is an artificial turf as described above, characterized in that said composite filament (18) comprises between 3 to 9 said continuous strand filaments (17), and preferably 6.

[0027] Another embodiment of the invention is an artificial turf as described above, characterized in that said composite filament (18) comprises between 1 to 3 said fibrillated filaments (14) and preferably 1.

[0028] Another embodiment of the invention is an artificial turf as described above, characterized in that the continuous strand filaments (17) comprises a convex or curved cross-section.

[0029] Another embodiment of the invention is an artificial turf as described above, characterized in that the continuous strand filaments (17) comprises a rounded cross-section.

[0030] Another embodiment of the invention is an artificial turf as described above, characterized in that the continuous strand filaments (17) comprises an S-profile or a slightly curved profile.

[0031] Another embodiment of the invention is an artificial turf as described above, characterized in that the continuous strand filaments (17) comprises propeller profile.

[0032] Another embodiment of the invention is an artificial turf as described above, characterized in that the continuous strand filaments (17) comprises a point symmetry.

[0033] Another embodiment of the invention is an artificial turf as described above, wherein the second section (4) is comprised of two layers of stone material, whereby the upper layer (9) is comprised of fine crushed stone material and the lower layer (10) is comprised of coarse crushed stone material.

[0034] Another embodiment of the invention is an artificial turf as described above, wherein the first section (2) comprises a shockpad formed from a sheet of shock absorbing material, below the artificial turf (5).

[0035] Another embodiment of the invention is an artificial turf as described above, wherein the shockpad has a thickness between 2 mm and 30 mm.

[0036] Another embodiment of the invention is an artificial turf as described above, wherein the shockpad is made from an elastic material such as recycled rubber, polyurethane (PU) foam, EPP (expanded polypropylene), EPDM (ethylene-propylene-diene monomer).

FIGURE LEGENDS

[0037]

FIG. 1. Vertical cross-section through one embodiment of an artificial turf assembly of the present invention, illustrating the layers of the assembly.

FIG. 2. Vertical cross-section through another embodiment of an artificial turf assembly of the present invention, illustrating the layers of the assembly.

FIG. 3 is a schematic side elevation view on a fibrillated filament to which a lateral tension is exerted.

FIG. 4 is a schematic view of six continuous strand filaments.

FIG. 5 demonstrates the composition of a tuft (2), originated from a composite filament, consisting of one fibrillated filament (14) twined around six continuous strand filaments (17).

FIG. 6 is a cross-sectional view, according to A-A of Fig. 2, of a possible embodiment of a continuous strand filament

(17) having a propeller profile.

FIG. 7 is a cross-sectional view, according to A-A of Fig. 2, of a possible embodiment of a continuous strand filament (17) having a biconvex profile.

FIG. 8 is a cross-sectional view, according to A-A of Fig. 2, of a possible embodiment of a continuous strand filament (17) having a S-like profile.

FIG. 9 is a cross-sectional view, according to A-A of Fig. 2, of a possible embodiment of a continuous strand filament (17) having a waving profile.

FIG. 10 is a cross-sectional view, according to A-A of Fig. 2, of a possible embodiment of a continuous strand filament (17) having a waving profile.

FIG. 11 is a side elevation view on a composite yarn composed of a fibrillated yarn as illustrated in **FIG. 3** and six monofilament yarns as illustrated in **FIG. 4,** the fibrillated yarn and the monofilament yarns being twined together so that the fibrillated yarn is twisted on the outside around the monofilament yarns.

FIG. 12 is a schematic cross-sectional view through a synthetic turf comprising a backing layer and tufts made of the composite yarn illustrated in **FIG. 11,** the synthetic turf being further filled with a three-layer infill.

DETAILED DESCRIPTION OF THE INVENTION

[0038] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as is commonly understood by one of skill in the art. All publications referenced herein are incorporated by reference thereto. All United States patents and patent applications referenced herein are incorporated by reference herein in their entirety including the drawings.

[0039] Throughout this application, the term "about" is used to indicate that a value includes the standard deviation of error for the device or method being employed to determine the value.

[0040] The recitation of numerical ranges by endpoints includes all integer numbers and, where appropriate, fractions subsumed within that range (*e.g.* 1 to 5 can include 1, 2, 3, 4 when referring to a number of objects, and can also include 1.5, 2, 2.75 and 3.80, when referring to, for example, measurements). The recitation of end points also includes the end point values themselves (*e.g.* from 1.0 to 5.0 includes both 1.0 and 5.0)

[0041] The present invention relates to an artificial turf assembly **1** suitable as a horse track, comprising a first water-permeable section **2** comprising a water-permeable layer of artificial turf **5,** provided with an infill material **3** within and above the artificial turf **5** and a second section **4** of shock absorbing material positioned below said first section **2.**

[0042] The construction of the artificial turf **5** is well-known and any water permeable turf may be used in the practice of this invention. In general, however, it should be composed of a plurality of filaments **12,** equivalent to blades of grass, knitted or otherwise attached to a backing sheet **11.** The backing sheet **11** may be of any suitable material (*i.e.* woven, felted or extruded web), so long as it is water permeable and can hold the filaments **12** in stable position. The backing sheet may be a geotextile. Furthermore, the backing **11** may be perforated to enhance its permeability. The backing **11** may be bonded onto the top surface of the second section **4.** The artificial turf **5** helps to keeps the sand in place; the sand becomes embedded between the fibres, so creating a stabilising effect.

[0043] The filaments **12** of an artificial turf **5** are in general arranged as tufts **13, 13',** which tufts are disposed in regular rows across the backing sheet **11.** A typical construction is comprised of a plurality of filaments **12** being threaded through rows of holes in the backing sheet, a single hole giving rise to a tuft. The artificial turf 5, comprising backing sheet **11** and tufts **13, 13',** is in general produced by feeding the filaments through the needles of a tufting machine and inserting them through the backing sheet **11** which is shown in **FIG. 12.** The tufts **13, 13'** are made up by both ends of the filaments **12** projecting from the backing sheet **11** and are secured by stitching said filaments **12** to the backing sheet **11.** The backing sheet **11** may consist for example of a woven PP sheet in combination with a PES fleece whereby the primary backing and the yarn are fixed to each other by means of an adhesive material, such as latex or foam.

[0044] The number of filaments **12** per tuft **13, 13'** can vary, but generally there will be between 2 to 20, 4 to 12 most preferably 4 to 8. The filaments **12** present in a tuft **13, 13'** may be continuous strand filaments **17** (*e.g.* monotape filaments, monofilaments) and/or fibrillated filaments **14.** A tuft **13, 13'** may consist of one kind of filament **12** such as entirely of continuous strand filaments **17** (*e.g.* monotape filaments, or monofilaments) or entirely of fibrillated filaments **14.** Alternatively, a tuft **13, 13'** may comprise a composite filaments **18,** each comprising a mixture of continuous strand filaments **17** (*e.g.* monotape filaments, or monofilaments) and fibrillated filaments **14,** or a mixture of continuous strand filaments **17** (*e.g.* monotape filaments and monofilaments).

[0045] The distances between the rows of tufts **13, 13'** may depend on a number of factors, including the average length of the filaments, and the presence of fibrillated filaments. Usually, the mutual distances between the rows will be comprised between 8 and 24 mm, preferably between 10 and 20 mm, and more preferably between 12 and 18 mm. A mutual distance of 16 mm or larger is most preferred.

[0046] The artificial turf **5** may comprise 5000 to 15000 tufts **13, 13'** per m^2 of backing sheet **11,** preferably between 7000 and 11000, and more preferably 9135 tufts per m^2.

[0047] According to one aspect of the invention, the filaments **12** may be so-called continuous strand filaments **17,** having a continuous, uninterrupted longitudinal surface, resembling blades of grass and devoid of openings or slits in the longitudinal surface. Continuous strand filaments **17** are typically available in two sorts: monotape filaments and monofilaments.

[0048] The filaments **12** may be so-called monotape filaments produced by cutting an extruded film into narrow bands. The extruded film is preferably led over stretching drums to organise the molecules so that the strength of the film is increased. Instead of first producing a film, a more preferred way to produce the individual filament is to extrude them directly into the desired size so that no cutting operation is required. In this way, preferably also after a stretching step, a so-called monofilament is obtained. These filaments **12** have such a thickness and a width that they resemble grass blades.

The width of the continuous strand filament **17** is preferably smaller than 4 mm, more preferably smaller than 3 mm, and most preferably smaller than 2 mm, but larger than 0.8 mm, preferably larger than 1 mm. A fine, natural grass look is for example obtained when the width of the continuous strand filaments **17** comprises about 1.4 mm. The thickness of the continuous strand filaments **17** is important to achieve the required resilience properties. The continuous strand filaments **17** will usually have a thickness of between 100 and 200 μm. Especially for polyethylene filaments, which provide less resiliency than for example polypropylene filaments, the continuous strand filament **17** has preferably a thickness larger than 125 μm, and more preferably a thickness larger than 135 μm.

[0049] The cross-section of the continuous strand filament **17** may have rounded edges and/or an S or slightly curved profile. The cross-section is a transverse cross-section perpendicular to the central axis of a continuous strand filament **17,** which cross-section is depicted the **FIG. 5** across line A-A. The continuous strand filament **17** can also exhibit point symmetry. These enclosed features result in an improved resilience of the continuous strand filament **17.**

[0050] According to one embodiment of the invention, continuous strand filament **17** has a cross-section of a propeller profile, displaying a node and two arms (**FIG. 6**). The node, in the centre of the continuous strand filament **17,** comprises the thickness previously described. The arms, starting from the node and separated from each other over 180°, have, at the node, a thickness of 50 to 100 μm, which gradually decreases towards the ends of the arms to a thickness in between 1 and 50 μm. Also, the propeller shape of the continuous strand filament **17** is characterized in that the ends of the arms are curved in opposite direction over a distance of between 20 and 200 μm and over an angle of between 20° and 70°, and preferably over an angle of 45°.

[0051] According to another embodiment of the invention, illustrated in **FIG. 7,** describes a continuous strand filament **17** with a cross-section of a biconvex profile. The centre of the continuous strand filament **17** displays the same thickness as previously described, and this thickness gradually decreases in a convex way towards the sides of the continuous strand filament **17,** preferably to a point.

[0052] According to another embodiment, illustrated in **FIG. 8,** a continuous strand filament **17** is described with a cross-section of an S-like profile. The thickness in the centre of the continuous strand filament **17** is the same as previously described, but decreases gradually in a convex manner until a thickness of between 1 and 50 μm. The ends of the continuous strand filament **17** are curved in opposite direction over a distance of between 20 and 200 μm and over an angle of between 20° and 70°, and preferably over an angle of 45°.

[0053] Another embodiment of the invention, illustrated in **FIG. 9,** relates to a continuous strand filament **17** displaying the cross-section of a waving profile. The continuous strand filament **17** has a thickness as mentioned before, which remains substantially the same over its entire width, and comprises two curves bent in opposite direction. The ends of the continuous strand filament **17** are rounded.

[0054] According to one embodiment of the invention, illustrated in **FIG. 10,** a continuous strand filament **17** has a cross-section of a propeller profile, displaying a node and two curved arms. The node, in the centre of the continuous strand filament **17,** comprises the thickness, **"b",** of between 0.4 to 0.6 mm, preferably between 0.5 to 0.6 mm, most preferably about 0.587 mm. The length of the node, **"a"** may be between 1 to 3 mm, preferably between 1.5 to 2.5 mm, preferably about 2 mm. The arms, starting from the node and are arranged at opposite ends of the node, have, at the node, a thickness, **"c"** of 0.5 to 1 mm, which gradually decreases towards the ends of the arms to a thickness in between 0.2 and 0.5 mm, preferably 0.3 and 0.4 mm. The end of each arm may have a rounded edge with a radius, **"e",** of between 0.15 and 0.2 mm. Also, the propeller shape of the continuous strand filament **17** is characterized in that the ends of the arms are curved in opposite directions, to give a total distance between the ends of the arms, **"d"** of between 4 and 8 mm, preferably between 5 and 7 mm. The respective curves are preferably continuous.

[0055] Alternative to the continuous strand filaments **17,** the filaments **12** may be fibrillated **14.** Such a fibrillated filament **14** is produced starting from an extruded film which is first cut into bands. In these bands longitudinal slits are made so that laterally interconnected filaments are formed. These slits can be made for example by means of a drum provided with needles (and rotated at a speed different from the speed of the film led over this drum) or teeth as disclosed in US-A-3 496 259. In **FIG. 3** the fibrillated filament is shown in a laterally stretched state so that the slits **15** are drawn open and a structure resembling a honeycomb is obtained. The fibrillated filament **14** has for example a total width of 9 mm, the slits **15** being arranged so that the interconnected filaments **16** have a width which is preferably somewhat smaller than the width of the continuous strand filament **17.** Moreover, the slits **15** are preferably not provided on the same mutual distances so that broader filaments are separated by narrower filaments which provide for a looser connection between the broader filaments. By selecting a smaller width of the filaments and/or a looser connection between the filaments, the filaments become immediately spread in a random manner after the tufting operation thus contributing to achieving immediately the natural look of grass. The yarn number of the fibrillated filament **14** will normally be higher than 2000 dtex and will usually be comprised between 5000 and 13000 dtex, and preferably between 10000 and 12000 dtex.

[0056] When using a fibrillated filament **14** with a smaller yarn number, a composite filament **18** (see below) may contain more continuous strand filament **17** since the maximum yarn number of the composite filament **18** is limited by the tufting technique. The composite filament can for example be made with three fibrillated filaments **14,** having each a yarn number of 2000 dtex. These fibrillated filaments can first be twined together and can subsequently, in a second twining operation, be twined together with continuous strand filaments **17.** The thickness of the fibrillated filament 14 is preferably comprised between 60 and 120 μm, and more preferably between 90 and 100 μm. Since the fibrillated filament has interconnected arrangement, the thickness of the fibrillated filament may be smaller than the thickness of the continuous strand filament **17.** A predetermined minimum thickness is however preferred in view of the increased wear resistance (mechanical wear and/or heat and UV degradation) and the increased resiliency obtained with a larger thickness.

[0057] According to one aspect of the invention, the filaments **12** present in a tuft are a mixture of continuous strand filaments **17** (*e.g.* monotape filaments and/or monofilaments) and fibrillated filaments, giving rise to a composite filament **18.** The shapes and dimensions of the continuous strand filaments **17** and fibrillated filaments **14** are given above, and may apply to the filaments present in the composite filament **18.** The composite filament **18** will usually comprise 4 to 10, preferably 6 to 8 continuous strand filaments **17.** It may comprise more than one fibrillated filament **14** but preference is given to the presence of only one fibrillated filament **14.** When only one fibrillated filament **14** is present, it may have a larger yarn number so that the filaments are better connected with one eachother. The yarn number of the composite filament **18** is preferably formed for at least 40%, more preferably for at least 50%, by the continuous strand filaments **17.**

[0058] On the other hand, in view of better stabilising the top-dressing, preferably at least 30%, and more preferably at least 35% of the yarn number of the composite filament **18** is formed by the fibrillated filaments **14.** In order to be able to provide, on the one hand, a fibrillated filament **14** with a relatively high yarn number and, on the other hand, a relatively large number of continuous strand filaments **17,** the yarn number of the composite filament **18** will usually be larger than 9000, and preferably larger than 11000 dtex. Due to the limitations of the tufting machines, the yarn number of the composite filament **18** will usually be smaller than 20000 and more particularly smaller than 17000 dtex.

[0059] In the composite filament **18** according to the invention the fibrillated filament **6** is preferably twined around the continuous strand filaments **17** so that the composite filament **18** has an outer surface which is mainly formed by the fibrillated filaments **14.**

[0060] In order to make the composite filament **18,** the continuous strand filaments **17** and the fibrillated filaments **14** are twined together. The word "twined" has to be understood here in its broadest meaning and includes for example also a simple twisting of the filaments. The composite filament may further be twined in the S or Z direction. The number of windings (per meter) during the twining process must be limited in such a manner that the filaments will spread themselves again after the tufting process. This can be determined experimentally. When twining the composite filament, the fibrillated filament **14** is preferably twined around the continuous strand filaments **17** so that the composite filament **18** has an outer surface which is mainly formed by the fibrillated filament **14.** This is clearly illustrated in **FIG. 11.** An advantage of such a way of twining is that the composite filament **18** can be tufted more easily and that, when applying the adhesive material on the backing layer, the filaments are kept better in place so that a tidy back finishing is obtained. **FIG. 12** shows as an embodiment of the invention whereby the artificial turf consists of tufts **13, 13'** of composite filaments **18** made from continuous strand filaments **17** and fibrillated filaments **14,** and the particulate/granulated upper section, composed of the lower **6,** intermediate **7** and top layers **8,** is disposed between and above the filaments.

[0061] In another embodiment of the invention, the filaments **12** present in a tuft **13, 13'** are a mixture of monotape filaments and monofilaments, so giving rise to a composite filament **18.** At least a number of the tufts **13, 13'** are made of a composite filament **18** which may be formed by a monotape filament twisted together with a number of monofilaments. The monotape filament and the monofilament are preferably made of polyethylene, although it is possible to make the monofilament, or at least some of them, of another polymer, for example of a polymer which provides a higher resiliency and/or which has better wear properties. Examples of other suitable materials are given below. The synthetic turf is moreover easier to recycle. Another advantage of polyethylene is that it has a higher wear resistance than for example polypropylene. For a skilled person it is clear that the polyethylene contains certain additives such as UV and heat stabilisers. Optionally, it may even contain small amounts of one or more other polymers, more particularly in an amount of less than 10 % by weight, preferably less than 5 % by weight.

[0062] The shapes and dimensions of the continuous strand filaments **17** are given above, and may apply to continuous strand filaments **17** present in the composite filament **18.** The monotape filaments and the monofilaments applied in the composite filament **18** may have such a thickness and a width as to resemble grass blades. The width of the monotape filament is preferably larger than 1.5 mm, more preferably larger than 2 mm and preferably smaller than 3 mm. The thickness of monotape filament is not only important to achieve the look of natural grass, but also to achieve the required resilience properties. The monotape filament will usually have a thickness of between 100 and 150 μm, and preferably of between 100 and 120 μm. The yarn number of the monotape filament will usually be comprised between 1000 and 5000 dtex in order to resemble grass, and will more preferably be comprised between 2000 and 3000 dtex.

[0063] The composite filament **18** will usually comprise 1 to 6 and preferably 1 to 3 monotape filament and 2 to 8, and preferably 4 to 6 monofilaments. The yarn number of the composite filament **18** is preferably formed for at least 30%, more preferably for at least 40% by the monotape filament in view of resembling immediately as much as possible natural grass. More preferably, the yarn number of the composite filament **18** is formed for at least 40% and at most 50% by the monotape filament. The yarn number of the composite filament **18** will usually be higher than 8000, and preferably higher than 9000 dtex. Due to the limitations of the tufting machines, the yarn number of the composite filament **18** will usually be smaller than 20000 and more particularly smaller than 15000 dtex.

[0064] In another preferred embodiment, in the composite filament **18** according to the invention the monotape filament is preferably twined around the monofilament so that the composite filament has an outer surface which is mainly formed by the monotape filament.

[0065] The filaments **12** of the artificial turf **5** may be made from polypropylene, polyethylene, and preferably from polyolefine fibres such as medium density polyethylene (MPDE) which provide a high wear resistance. The blades of the artificial turf may be made of fibrillated or monofilament fibres, but most preferable of fibrillated fibres. The artificial turf should have sufficient density to keep the infill **3** material in place.

[0066] According to one aspect of the invention, a number of the filaments **12** making up the tufts **13, 13'** consist essentially of or comprise a mixture of high density polyethylene (HDPE) and low density linear polyethylene (LLDPE). This mixture comprises between 20 to 80% HDPE and 80 to 20% LLDPE, preferably 40 to 60% HDPE and 60 to 40% LLDPE and even more preferably is the amount of HDPE approximately the same as that of LLDPE.

[0067] According to one aspect of the invention, the artificial turf is that described in PCT/EP2004/002301 which is incorporated herein by reference. According to one aspect of the invention, the artificial turf is that described in PCT/EP2007/002362 which is incorporated herein by reference.

[0068] According to one aspect of the invention, the artificial turf **5** has a pile height of 30, 40, 50, 60, 70, 80, 90 mm, preferably 30 to 80 mm, preferably between 50 and 70 mm, most preferably about 60 mm. The pile height is to be determined by measuring and totalling the height of the different filaments of a number of tufts and dividing the achieved number by the number of filaments.

[0069] According to another aspect of the invention, the tufts **13, 13'** of the artificial turf have preferably an average height of 30, 40, 50, 60, 70, 80, 90 mm, preferably 30 to 80 mm, preferably between 50 and 70 mm, most preferably about 60 mm. The average height of the tufts **13, 13'** is usually smaller than 75 mm and is preferably comprised between 50 and 60 mm. The average height of a tuft **13, 13'** is to be determined by measuring and totalling the height, h, of the different filaments **12** in a tuft and dividing the achieved number by the number of filaments **13, 13'.**

[0070] The combination of filaments **12** and the selected infill **3** materials offers an optimum drainage and stability.

[0071] According to one aspect of the invention, wherein the first section **2** may comprises a shockpad which is a sheet of shock absorbing material, below the artificial turf **5.** Specifically, the shockpad may be located below the backing sheet **11** of the artificial turf **5.** The shockpad is made from a water-permeable sheet of shock absorbing material. The sheet may be made water permeable by a plurality of pores or holes connecting one face of the sheet with the other.

[0072] The shockpad may have a thickness of 2 mm, 4 mm, 6 mm, 8 mm, 10 mm, 12 mm, 14 mm, 16 mm, 18 mm, 20 mm, 22 mm, 24 mm, 26 mm, 28 mm or 30 mm, or a value in a range between any two of the aforementioned values. Preferably the shockpad has a thickness between 5 mm and 20 mm, more preferably about 10 mm, most preferably of 8 mm.

[0073] The shockpad may be made from an elastic material such as recycled rubber, polyurethane (PU) foam, EPP (expanded polypropylene), EPDM (ethylene-propylene-diene monomer) or other materials with shock absorbing properties.

[0074] Preferably, the shockpad is in contact with the backing sheet **11** of the artificial turf **5.** It rests above the second section **4,** preferably in contact with the upper layer **9** of the second section **4.** Preferably, the intermediate layer **7** (see below) is absent when the shockpad is present.

[0075] The infill material **3** is provided above and between the filaments **12** of the artificial turf **5,** and comprises sand. The height of the infill material **3** exceeds the pile height of the artificial turf **5** by a minimum of 20 %, and preferably by at least, 40 %, 55 % or 60 % of the height of the artificial turf **5.** In a more preferred embodiment of the invention the height of the infill material **3** exceeds the pile height of the artificial turf **5** by more than 40 %.

[0076] According to one embodiment of the invention, the infill **3** of the artificial turf assembly comprises two layers:

- a lower layer **6** consisting essentially of or comprising sand, and

- a top (dressing) layer **8** consisting essentially of or comprising sand, optionally provided with an water retaining material such as stonemeal.

[0077] The lower layer **6** is made from sand, preferably dry silica sand. The roundness of the sand may be equal to or more than 60, 70, 75, 80, 85 or 90 % round, preferably between 75 and 80% round, most preferably about 80% round. The granule size of the sand may be between 0.2 to 3 mm, 0.4 to 2 mm, 0.4 to 0.8 mm, most preferably 0.9 to 2mm. The specific density of the sand may be 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, or 3.0 g/cm^3, preferably 2.6 g/cm^3.

[0078] The lower layer **6** is disposed between the filaments **12** of artificial turf **5.** The depth of the lower layer **6** is less than the height of the pile of the artificial turf **5.** The depth of the lower layer **6** may be 10, 15, 20, 25, 30, 35, 37 or 40% of height of the pile of the artificial turf **5,** between 25 and 35%, more preferably between 10 and 20% of the height of the pile of the artificial turf **5.** The lower layer **6** may be between 0.5 and 4 cm deep, between 1 and 3 cm or 1.5 and 2.5 cm deep, preferably between 0.5 and 1.5 cm deep, most preferably about 1 cm deep. The coarse granulometry of the first layer achieves a higher drainage performance.

[0079] Top (dressing) layer **8** comprises silica sand. It may have a specific density less than 2.8, 2.7, 2.6, 2.5 or 2.4 g/cm^3, or a value between any two of the aforementioned values, preferably between 2.6 and 2.7 g/cm^3, most preferably about 2.63 or 2.65 g/cm^3.

[0080] The top layer **8** is between 2 and 20 cm deep, preferably between 4 and 7 cm, 4 and 6 cm, most preferably between 5 and 7 cm deep. The top layer **8** is disposed both between and above the filaments **12** of artificial turf **5.**

[0081] The total depth of the top layer **8** depends partly on the height of the pile of the artificial turf **5** since the depth of the top layer **8** is greater than the height of the pile of the artificial turf **5.**

[0082] The depth of the top layer **8,** above the height of the pile of the artificial turf **5** may be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 cm or a value in the range between any two of the aforementioned values. Examples of ranges include between 2 and 4 cm. Preferably, the depth is between 2 and 6 cm above the height of the pile of the artificial turf **5.**

[0083] According to one aspect of the invention, the depth of the top layer **8** is at least 2 to 3 cm, 4 to 5, or more around 3 cm between filaments **12** of the artificial turf **5,** and between 2 to 20 cm, 2 to 17 cm, preferably between 2 and 6 cm on top of the filaments **12.**

[0084] According to one aspect of the invention, the top layer comprises one of three different kinds of silica sand i.e. sand of types a), b) or c) described below. Preferably the top layer is made from a single type of sand, and not a mixture of a), b) and c).

[0085] The silica sand of type a) is preferably equal to or more than 80 % round. The granule size of the sand is between 0.05 and 0.3 mm, 0.05 and 0.5 mm, 0.05 and 1 mm, 0.2 and 3 mm, 0.4 and 2 mm, 0.4 and 0.8 mm or 0.9 and 2mm, most preferably between 0.05 and 0.3 mm. The specific density of the sand may be 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0 g/cm^3, preferably about 2.6 g/cm^3. According to one aspect of the invention, the sand comprises SiO_2 (90 to 99%, preferable 96.4% or more), Al_2O_3 (1.00 to 2.00%, preferably 1.63% or less), Fe_2O_3 (0. 1 to 1 %, preferably 0.51% or less), TiO_2 (0.01 to 0.1%, preferably 0.04% or less), K_2O (0.1 to 1.0%, preferably 0.61 %or less), Na_2O (0.1 to 0.5, preferably 0.21% or less), CaO (0.01 to 0.2, preferably 0.13% or less), MgO (0.01 to 0.1, preferably 0.08% or less).

[0086] The loss on ignition may be between 0.1 to 0.5%, preferably 0.34%. Sand with these properties is shown to have a high hardness and durability.

[0087] The silica sand of type b) may have a D50 (median grain size) of 80, 90, 100, 110, 120, 130, 140, 150, 160 μm, or a value in the range between any two of the aforementioned values; preferably between 100 and 160 μm, more preferably between 120 to 140 μm, most preferably about 130 μm.

[0088] According to one aspect of the invention, the percentage of grain present at a given diameter (granulometry) may be as defined according to any of the following: >250 μm (1%-5%, preferably 1%), >180 μm (1% to 5%, preferably 3% or less), >125 μm (40 % to 60%, preferably 50%), > 90 μm (90% to 95%, preferably 93% or more), > 63 μm (95 to 99%, preferably 99% or more), or <63 μm (1 to 5%, preferably 1% or less).

[0089] The specific density of the sand may be 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0 g/cm^3, preferably about 2.65 g/cm^3. The pH of the sand may be 7.0, 8.0, or 9.0, or a value in the range between any two of the aforementioned values, preferably pH is 8.0. The loss on ignition may be less than or equal to 0.1, 0.2, 0.3, or 0.4%, preferably 0.20% or less. According to one aspect of the invention, the sand of type b) comprises SiO_2 (90 to 99%, preferable 99% or more), Fe_2O_3 (0.01 to 0.1%, preferably 0.05% or less), Al_2O_3 (0.25 to 0.75%, preferably 0.50% or less), TiO_2 (0.05 to 0.15%, preferably 0.10% or less), K_2O (0.1 to 0.3%, preferably 0.02% or less), CaO (0.01 to 0.05, preferably 0.03% or less).

[0090] The silica sand of type c) may have D50 (median grain size) of 110, 120, 130, 140, 150, 160, 170, 180, 190 μm, or a value in the range between any two of the aforementioned values; preferably between 150 and 190 μm, more preferably between 160 to 180 μm, most preferably about 170 μm.

[0091] According to one aspect of the invention, the percentage of grain present at a given diameter (granulometry) may be as defined according to any of the following >250 μm (1% to 5%, preferably 3% or less), >180 μm (10% to 50%, preferably 30% or less), >125 μm (85 % to 95%, preferably 91% or more), or <63 μm (0.1 to 1%, preferably 0.3% or less).

[0092] The specific density of the sand may be 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0 g/cm^3, preferably about 2.65 g/cm^3. The pH of the sand may be 6, 7, or 8, or a value in the range between any two of the aforementioned values, preferably pH is 7.

[0093] According to one aspect of the invention, the sand comprises SiO_2 (90 to 99%, preferably 99% or more), Fe_2O_3 (0.01 to 0.1%, preferably 0.07% or less), Al_2O_3 (0.25 to 0.75%, preferably 0.60% or less), TiO_2 (0.05 to 0.15%, preferably 0.06% or less), K_2O (0.1 to 0.3%, preferably 0.02% or less), CaO (0.01 to 0.05, preferably 0.03% or less).

[0094] Because of the fine granulometry of some types of sand (e.g. b and c) the surface can become dusty during dry periods, therefore, watering the surface may be performed to minimize the dust. To retain the humidity of the first section for long periods, the top dressing may be mixed with any suitable water retaining agent. A suitable water retaining agent is able to retain more than its own weight in water. It should also be non-toxic to the horse and environment, preferably having an ecologically low-impact. It may expand after absorption water, to give elasticity and stability to the ground. It may contribute to the water-draining properties of the artificial turf assembly, by absorbing water, for example after a heavy rainstorm.

[0095] An example of a suitable water retaining agent is stone meal. Stone meal can store approximately forty times its own weight in water. It is an ecological product without toxicity to the horse or environment. It also expands with water to give elasticity and stability to the ground. The surface stays in a good condition even after heavy rain, due to the high water absorption of stone meal. Stone meal, or a product containing stone meal may be mixed with the top (dressing) layer **8** in an amount of 70, 80, 90, 100, 110, 120, or 130 g/m^2, preferably in an amount of 100 g/m^2.

[0096] According to one aspect of the invention, an intermediate layer **7** may be present between lower layer **6** and the top layer **8.** The intermediate layer consists essentially of or comprises a shock absorbing material; it is generally present where the turf assembly must absorb the energy of an impact e.g. during jumping events.

[0097] The depth of the intermediate layer **7** may be 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 28, 30, 32, 34, 36, 38 % of height of the pile of the artificial turf **5,** preferably it is between 30 and 36% of the height of the pile of the artificial turf **5.** The intermediate layer 7 may be 0.5, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8 cm deep, between 0.5 and 2 cm deep 0.5 and 1.5 cm deep, 1 cm deep, preferably between 1 and 2.5 cm deep, most preferably between 1.5 and 2.5 cm deep. The combined height of the intermediate layer **7** and the lower layer **6** may be less than the pile height of the artificial turf **5.**

[0098] The intermediate layer may be made from an elastic material, for example, recycled SBR rubber, EPDM or other materials with shock absorbing properties.

[0099] According to one embodiment of the invention, intermediate layer **7** is comprised of granulated rubber particles of recycled SBR (styrene butadiene rubber) from car tires, EPDM (ethylene-propylene-diene monomer), TPVs (thermoplastic vulcanizates), other vulcanised rubbers, recycled rubber form belts and/or thermoplastic elastomers based on SEBS (styrene-ethylene-butadiene-styrene). Rubbers such as EPDM or TPVs (thermoplastic vulcanizates) in which no sulphur with zinc oxide curing system is used, fulfil requirements of standard norm (DIN 18035-7) and are fire retarding. The granules are preferably spherical. The granule size of the rubber may be between 0.1 and 5 mm, 0.1 and 4 mm, 0.1 and 3 mm, 0.5 and 5 mm, 0.5 and 4 mm, 0.5 and 3 mm, most preferably between 0.5 and 2.5 mm.

[0100] Where the rubber is black recycled rubber (e.g. from car types), the bulk density of the rubber may be 400, 410, 420, 430, 440, 450, 460, 470, 480, 490 or 500 kg/m^3, preferably 470 to 490 kg/m^3, most preferably 480 kg/m^3; the granule size of the black recycled rubber is most preferably between 0.5 and 2.5 mm. Where the rubber is EPDM rubber, the bulk density of the rubber may be 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, or 900 kg/m^3, preferably 840 to 860 kg/m^3, most preferably 850 kg/m^3; the granule size of the EPDM rubber is most preferably between 0.5 and 2.0 mm.

[0101] According to a preferred embodiment of the invention, the intermediate layer is comprised of resilient granules comprising a polyolefin elastomer. Preferably said polyolefin elastomer is a low density ethylene/octene co-polymer. However, it should be clear from the present invention that also other polyolefin elastomers, such as but not limited to EPDM may be applied.

[0102] Referring now to the low density ethylene/octene co-polymer, the more efficient and consistent incorporation of octene co-monomer into a polyethylene backbone, made possible by a metallocene catalyst, results in lower density and more narrowly defined polymers with a range of benefits including flexural modulus similar to elastomers, thermoplastic behaviour without plasticizers, exceptional compatibility with other polyolefines providing the opportunity to blend with EPM, exceptional toughness, puncture resistance, flexibility even at very low temperature (below -20°C), very low extractable and surface softness. The resilient infill based on ethylene/octene co-polymer bridges the gap between plastics and elastomers and as such combines many of the physical properties of a rubber with the processing advantages of a thermoplastic. The ethylene/octene copolymers are at the extreme performance end in terms of overall toughness. The resilient infill material, in particular based on ethylene/octene copolymer, can be filled with a filler, preferably chalk or clay, to reduce the costs.

[0103] The intermediate layer 7 is preferably provided in the form of resilient granules, which can be round, spherical or angular, and which are preferably round or spherical. Preferably, the particulate material comprises granules consisting of polyolefin elastomer.

[0104] The amount of polyolefine elastomer in the resilient granules is preferably minimum between 20%-60% and maximum between 40%-100% by weight and more preferably minimum between 30%-50% and maximum between 40%-50% by weight.

[0105] In another preferred embodiment, the synthetic turf according to the invention is characterised in that the amount of filler material in said particulate material is comprised between 50 and 60% by weight and that the amount of polyolefin elastomer in said particulate material is comprised between 40 and 50% by weight.

[0106] In a further preferred embodiment, the resilient granules based on ethylene/octene copolymer can be blended with EPM (ethylene propylene copolymer). The amount of EPM preferably comprises maximum between 0%-20% by weight more preferably maximum between 0%-5% by weight. A higher amount of EPM will affect the mechanical properties. The diameter of the resilient infill granules can be between 0.5 and 3 mm, and preferably between 0.5 and 2.5 mm, and more preferably between 1.0 and 2.5 mm. The compound density of the resilient infill granules is between 1.3 and 1.5 kg/dm^3. The bulk density of the resilient granules is between 0.6 and 1.0 kg/dm^3. Other features are constant granulometry, dust free, the fact that the material is not recycled, not milled from scraps, the thermoplastic elastomer does not need vulcanisation, is recyclable, and can be reused at end-life, and is thus ecological durable, the granules are UV and Ozone stable, non-toxic and not allergic, heavy metal free, PVC and phthalate free and not reactive in tight contact with PP and PE of the artificial turf. The granule material is particularly suitable for use as a shock absorbing layer intermediate layer 7 especially for an artificial turf for use as a horse track.

[0107] In preferred embodiments of the invention, the artificial turf assembly comprises artificial turf (5) between 30 and 80 mm and preferably between 40 and 70 mm and most preferably about 60 mm high, a lower layer (6) between 0.1 to 2 cm deep, preferably between 0.5 and 1.5 cm deep, an intermediate layer (7) between 1.0 and 3.0 cm deep, preferably between 1.5 and 2.5 cm deep, a top layer (8) between 4 and 8 cm deep, preferably 5 and 7 cm deep, wherein the sand of the lower layer (6) has a particle size of 0.7 to 2.5 mm, preferably 0.9 to 2 mm, the sand of the top layer (8) has a particle size of 0.01 to 0.4 mm, preferably between 0.05 to 0.3 mm, and the intermediate layer comprises rubber granules, having a granule size of 0.2 to 3 mm, preferably 0.5 to 2.0 mm or 0.5 to 2.5 mm.

[0108] The second, drainage section, typically comprises crushed stone. According to one aspect of the invention, the second section **4** is comprised of two layers of stone material, whereby the upper layer **9** is comprised of fine crushed stone or lava material **9** and the lower layer **10** is comprised of coarse crushed stone or lava material.

[0109] The depth of the upper layer **9** is 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, cm, or a value in the range between any two of the aforementioned values, preferably between 3 and 15 cm.

[0110] The depth of the lower layer **10** is 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 30 cm, or a value in the range between any two of the aforementioned values, preferably between 15 and 20 cm.

[0111] The particles of fine crushed stone may have a D50 (median grain size) of between 0 and 10 mm or between 0.05 and 10 mm, more preferably between 0 and 4 mm, or between 0.05 and 4 mm.

[0112] The particles of coarse crushed stone may have a D50 (median grain size) of between 0 and 40 mm, or between 0.05 and 40 mm, more preferably between 0 and 20 mm, or between 0.05 and 20 mm.

[0113] The artificial turf assembly of the present invention is suitable for a variety of horse riding applications. It is suitable as turf for use in riding clubs, for horse breeders, for private horse fanciers, for animal/horse clinics, and to anyone involved in the care for horses.

[0114] The shock absorbing and elastic properties of the assembly allow the well being of the horse to be maintained. The properties are conducive to the recovery of a horse from a leg injury as it has excellent grip so reducing the possibility of a fall and good shock absorbance, so reducing stress applied to the joints.

[0115] The artificial turf assembly of the present invention provides numerous advantages over other types of horse track assemblies, which make it suitable particularly for a horsing-riding surface. For example, it exhibits good stability and ideal grip for a horse, with low rotational resistance, which is achieved in part by the combination of the artificial turf and the fine granulometry of the top layer.

[0116] The surface is low maintenance. Furthermore, the surface will provide the advantageous properties in all weather conditions, so it may be used for events and displays all year round. The all weather capability is achieved by the use of infill sand with different granulometry i.e. coarser sand in the bottom of the turf and fine sand on top, and also by the open construction of the artificial turf.

[0117] Compared with the standard horse tracks (e.g. comprising sand or sand/textile mix), it is low maintenance, requiring water only to maintain the stability of the upper layer. The inventors have also found it is more durable, owing to the use of artificial turf with fibres of high performance.

[0118] The present horse track particularly shows superior performance over existing horse tracks based on a sand layer whereby one type of sand is used. Some types of sand compact after a period and create a hard surface which will lead to insufficient drainage. Track of the art try to overcome this problem by mixing the sand with wooden cuttings, artificial turf cuttings or textile cuttings which absorb the water to keep the surface moistened during dry periods and also create a certain elasticity. However, there are several disadvantages with these systems. For example, the wooden cuttings can putrefy. Furthermore, stabilization is often not effective because the sand layer used in these systems, even by mixing with cuttings, is too loose which can lead to injuries to the bones and joints of a horse. To determine the stability of the track, it should also comply with various ISA standards including vertical deformation of less than 30mm (Norm ISA-KNHS2-15.1), shock absorption between 20 and 60% (Norm ISA-KNHS2-15.1), energy restitution between 20 and 40% (Norm ISA-KNHS2-15.1); the track of the invention complies with these standards. Ideally a horse track exhibits good stability and optimum grip for a horse, with low rotational resistance and has a good drainage system. In addition, after a period of heavy rain, the original tracks are not fit for use because of their unsufficient drainage system. Furthermore, during very dry periods the tracks (certainly indoor) become dusty and watering is necessary. The present invention advantageously overcomes problems of the prior art.

EXAMPLES

[0119] The invention is illustrated by way of the following non-limiting examples.

[0120] Tracks having infill material as defined in the tables below (Tracks 1 to 4) were prepared, and tested with an ISA Sport horse track tester for vertical deformation according to Norm ISA-KNHS2-15.1, for shock absorption according to Norm ISA-KNHS2-15.1, and for energy restitution according to Norm ISA-KNHS2-15.1. Tracks that comply with ISA standards have a vertical deformation < 30mm, shock absorption between 20 and 60% and energy restitution between 20 and 40%. The infill material exceeded the pile height of the artificial turf. The second section was formed an upper layer of fine crushed stone and a lower layer of coarse crushed stone material.

Track 1
Lower layer: 1 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: 1.5 cm recycled rubber, granule size 0.5 to 2.5 mm, specific density 480 kg/m^3 Top layer: 7 cm silica sand, granule size 0.05 to 0.3 mm, >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 60 mm
Result: vertical deformation = 15 mm, shock absorption = 39 %, energy restitution = 20 %

Track 2
Lower layer: 1 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: 2.5 cm recycled rubber, granule size 0.5 to 2.5 mm, specific density 480 kg/m^3 Top layer: 5 cm silica sand, granule size: 0.05 to 0.3 mm, >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 60mm
Result: vertical deformation = 22 mm, shock absorption = 52 %, energy restitution = 25 %

Track 3
Lower layer: 1 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: 2 cm recycled rubber, granule size 0.5 to 2.5 mm, specific density 480 kg/m^3. Top layer: 6 cm silica sand, granule size: 0.05 to 0.3 mm, >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 60mm
Result: vertical deformation = 17 mm, shock absorption = 47 %, energy restitution = 21 %

Track 4
Lower layer: 1 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: 2 cm EPDM rubber, granule size 0.5 to 2 mm, specific density 850 kg/m^3.

(continued)

Track 4
Top layer: 6 cm silica sand, granule size: 0.05 to 0.3mm, >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 60mm
Result: vertical deformation = 19mm, shock absorption= 45 %, energy restitution = 22 %

Track 5
Lower layer: 1 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: - Top layer: 3 cm silica sand, granule size: 0.05 -0.3 mm , >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 30mm
Result: vertical deformation = 5mm, shock absorption = 6% energy restitution = 19%

Track 6
Lower layer: 1 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: - Top layer: 6 cm silica sand, granule size: 0.05 -0.3 mm, >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 40mm
Result: vertical deformation: 7mm, shock absorption: 7%, energy restitution: 18%

Track 7
Lower layer: 2 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Intermediate layer: - Top layer: 7 cm silica sand, granule size: 0.05 -0.3 mm, >80 % round, specific density of 2.65g/cm^3 Artificial turf pile height: 60mm
Result: vertical deformation: 9 mm, shock absorption: 11 %, energy restitution:38%

Track 8
Lower layer: 2 cm silica sand, granule size: 0.9 to 2 mm, >80 % round, specific density of 2.6g/cm^3 Top layer: 7 cm silica sand, granule size: 0.05 to 2 mm, >80 % round, specific density of 2.65g/cm^3 Shockpad: rubber mat 8 mm Artificial turf pile height: 40mm
Result: vertical deformation: 35mm, shock absorption:26%, energy restitution: 19%

[0121] The results indicate that Tracks 1 to 4 shows good stability, optimum grip, and good shock absorption. Moreover, they comply within the limits of the ISA norm.

Claims

1. An artificial turf assembly (1) suitable as a horse track, comprising a first water-permeable section (2) comprising a water-permeable layer of artificial turf (5) provided with an infill material (3) within and on top of said artificial turf layer (5) and a second section (4) of drainage material positioned below said first section, wherein the infill material (3) comprises three layers: a top layer (8) comprising sand, optionally provided with a water retaining material such as stone meal, a lower layer (6) comprising sand, and an intermediate layer (7) disposed between the top layer (8) and lower layer (6) and comprising a shock absorbing material.

2. The artificial turf assembly (1) according to claim 1, wherein the height of the infill material (3) exceeds the pile height of the artificial turf (5).

3. The artificial turf assembly (1) according to claim 2, wherein the height of the infill material (3) exceeds the pile height of the artificial turf by a minimum of 40%, of the height of the artificial turf.

4. The artificial turf assembly according to any of claims 1 to 3, wherein the combined height of the lower layer (6) and intermediate layer (7) is less than the pile height of the artificial turf (5).

5. An artificial turf assembly (1) according to any of claims 1 to 3, wherein the shock absorbing material of the intermediate layer (7) comprises rubber.

6. An artificial turf assembly (1) according to claim 5, wherein the rubber is recycled rubber granules or EPDM rubber granules, having a granule size of 0.5 to 2.5 mm.

7. An artificial turf assembly (1) according to any of claims 1 to 5, wherein the sand of the top layer (8) has a particle size of 0.05 to 0.3 mm.

8. An artificial turf assembly (1) according to any of claims 1 to 6, wherein the sand of the lower layer (6) has a particle size of 0.9 to 2 mm.

9. The artificial turf assembly (1) according to claim any of claims 1 to 8, wherein the pile height of the artificial turf (5) is between 50 and 70 mm.

10. The artificial turf assembly (1) according to claim any of claims 1 to 9, wherein the depth of the lower layer (6) is between 0.5 and 1.5 cm.

11. The artificial turf assembly (1) according to claim any of claims 1 to 10 wherein the depth of the intermediate layer (7) is between 1.5 and 2.5 cm.

12. The artificial turf assembly (1) according to any of claims 1 to 11, wherein the top layer (8) is provided at a depth between 5 and 7 cm.

13. The artificial turf assembly according to any of claims 1 to 12, wherein the filaments (12) consist essentially of any of polypropylene, polyethylene, and preferably from polyolefine fibres such as medium density polyethylene (MDPE).

14. The artificial turf assembly according to any of claims 1 to 13, wherein filaments (12) consist essentially of a mixture of high density polyethylene (HDPE) and low density linear polyethylene (LLDPE).

15. The artificial turf assembly according to claim 14, **characterised in that** the composition of said mixture comprises 20 to 80% HDPE and 80 to 20% LLDPE, preferably 40 to 60% HDPE and 60 to 40% LLDPE, and more preferably approximately 50% HDPE and 50% LLDPE.

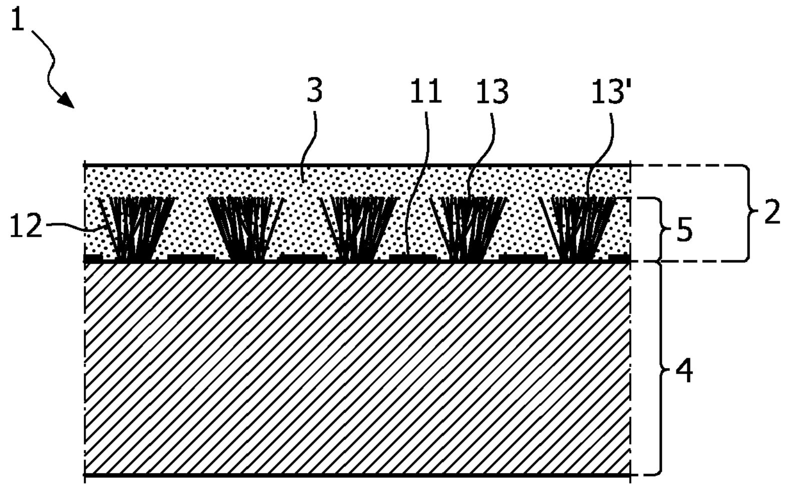

FIG. 1

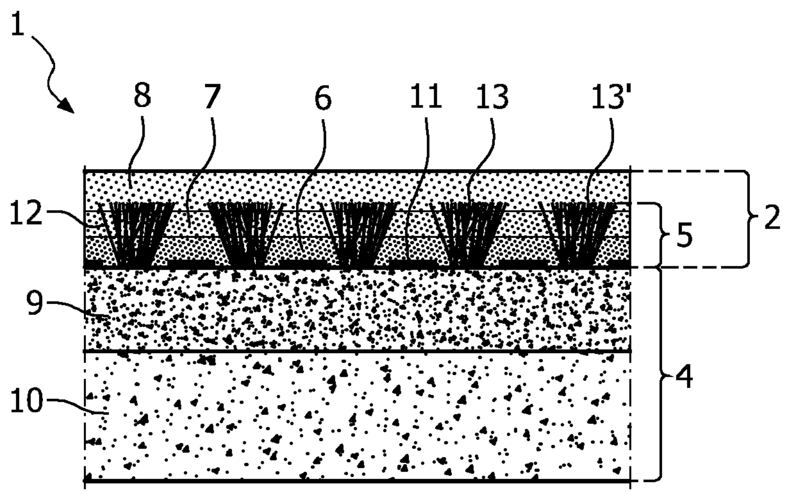

FIG. 2

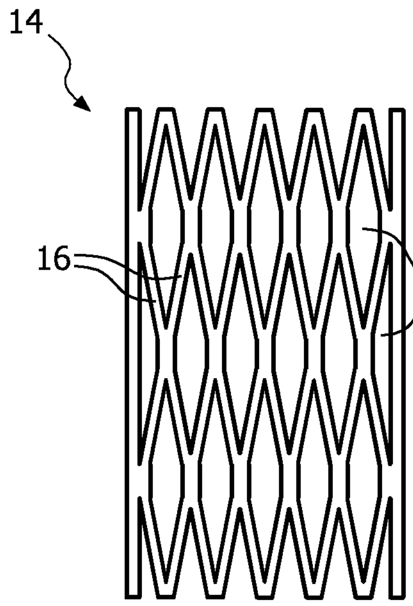

FIG. 3

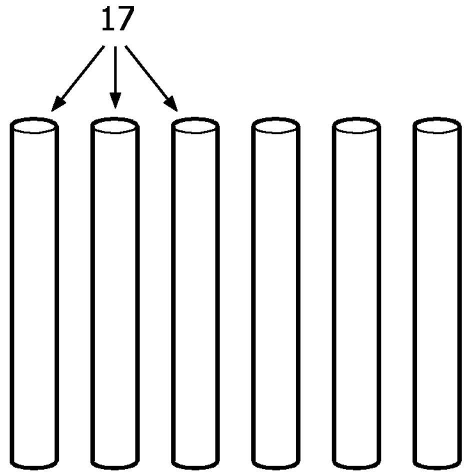

FIG. 4

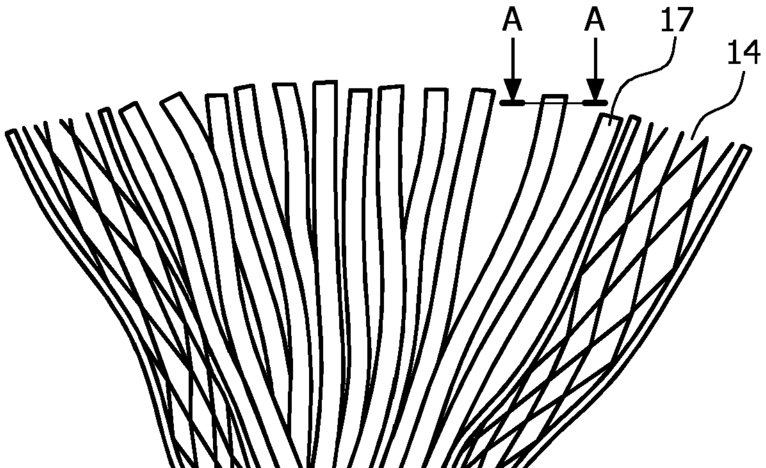

FIG. 5

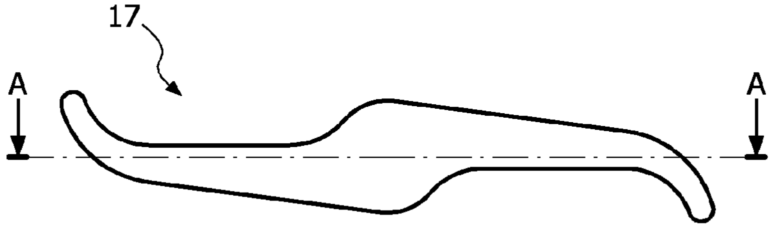

FIG. 6

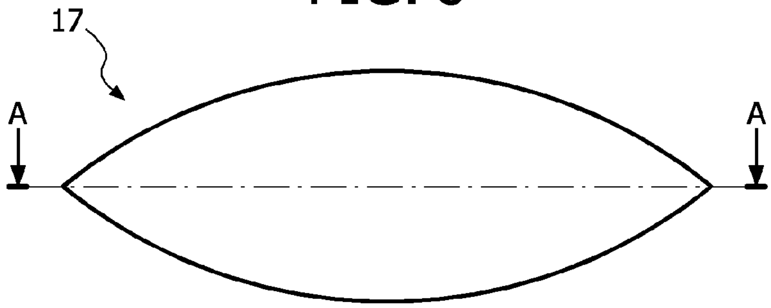

FIG. 7

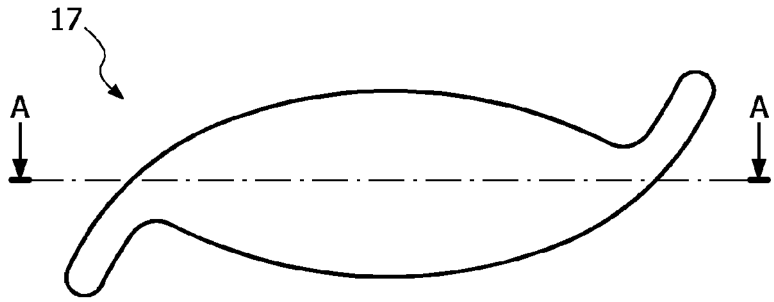

FIG. 8

FIG. 9

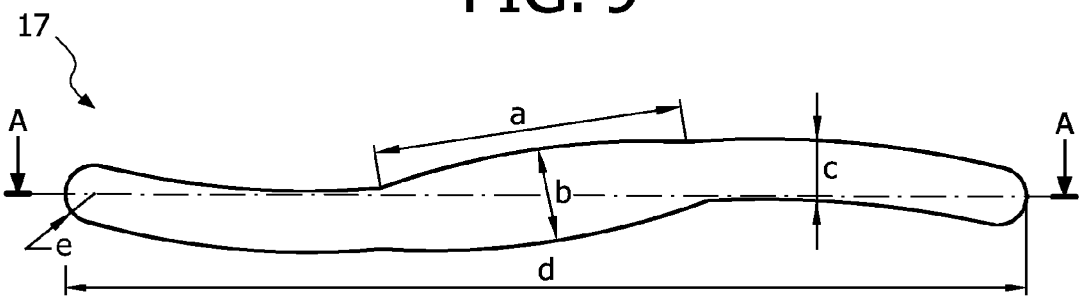

FIG. 10

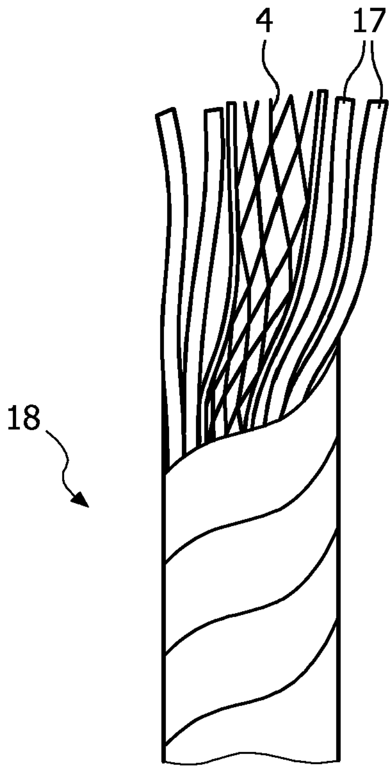

FIG. 11

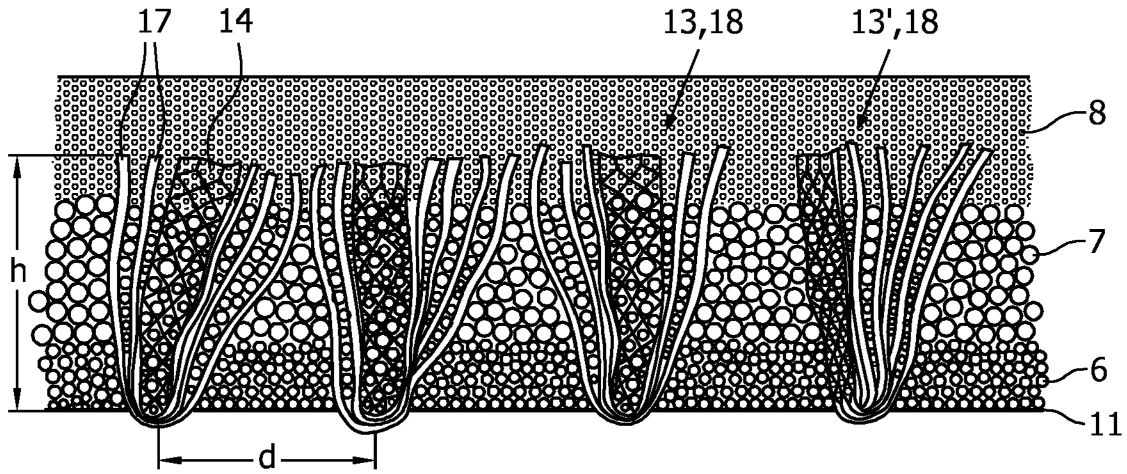

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
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