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- (71) Applicant: ÅHUS TURF AB [SE/SE]; Box 300 23, 200
61 Limhamn (SE).
- (72) Inventor: ALBÄCK, Thomas; Landskronavägen 11, 261
73 Häljarp (SE).
- (74) Agent: AWAPATENT AB; Box 5117, 200 71 Malmö
(SE).
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(54) Title: ARTIFICIAL HYBRID TURF

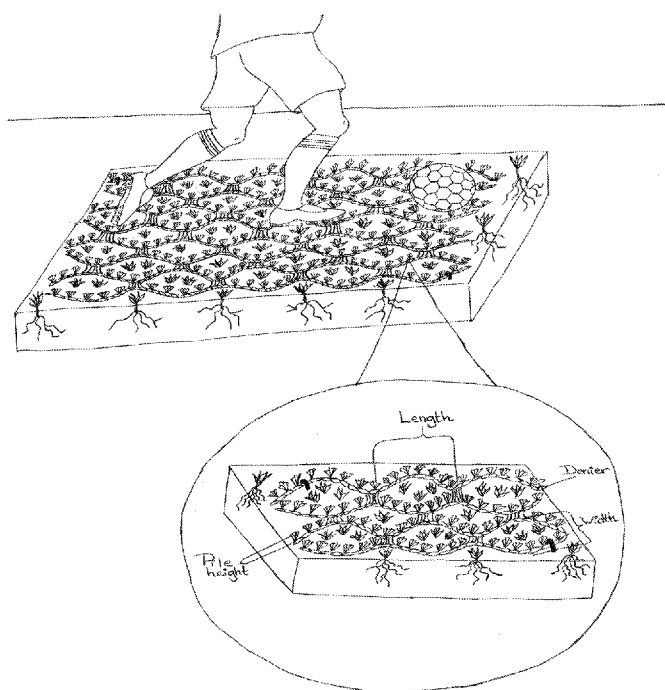


Fig. 1

(57) Abstract: The present invention refers to an artificial hybrid turf comprising a reinforcement, said reinforcement having an open structure with several holes and as such being permeable for grass to grow through it, said reinforcement constituting an underside of the artificial hybrid turf, wherein the artificial hybrid turf also comprises piles which are attached to the reinforcement and which piles as a whole constitute the upside of the artificial hybrid turf, wherein the holes of the reinforcement have a width in the range of 5 – 60 mm and a length in the range of 5 – 60 mm, wherein the strength of the reinforcement is in the range of 1000 – 4000 Denier and wherein the piles have a length in the range of 10 – 60 mm.

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ARTIFICIAL HYBRID TURF

Field of the invention

The present invention relates to an artificial hybrid turf, especially an artificial hybrid turf intended for football grounds and other possible sport fields.

5 Technical Background

Different types of artificial turf are known today. Artificial turf is a surface comprising synthetic fibres and intended to look like grass. It is often used in various sport arenas.

10 Artificial hybrid turf or hybrid artificial turf is a turf in which natural grass is integrated, either already before delivered to the final destination where it will be used, or put for integration of grass at site.

The present invention relates to artificial hybrid turf, both such turf before natural grass has been integrated and of course also after integration of grass.

15 One aim of the present invention is to provide an improved artificial turf, e.g. which is optimized for use at football grounds. It should be noted that the artificial turf according to the present invention has several other possible applications also, which becomes clear from the description below. Common for all optimizations is to allow the best possible growth of natural grass
20 through the artificial turf according to the present invention.

Summary of the invention

The stated purpose above is achieved by an artificial hybrid turf comprising a reinforcement, said reinforcement having an open structure with several holes and as such being permeable for grass to grow through it, said
25 reinforcement constituting an underside of the artificial hybrid turf, wherein the artificial hybrid turf also comprises piles which are attached to the reinforcement and which piles as a whole constitute the upside of the artificial hybrid turf, wherein the holes of the reinforcement have a width in the range of 5 – 60 mm and a length in the range of 50 – 60 mm, wherein the strength
30 of the reinforcement is in the range of 1000 – 4000 Denier and wherein the piles have a length in the range of 10 – 60 mm.

According to one specific embodiment of the present invention, the holes of the reinforcement have a width in the range of 10 – 60 mm and/or a length in the range of 10 – 60 mm, such as e.g. holes of the reinforcement having a width in the range of 10 – 40 mm and/or a length in the range of 10 –
5 40 mm.

According to yet another specific embodiment of the present invention, the piles have a length in the range of 10 – 50 mm.

Furthermore, according to yet another specific embodiment the piles have a length in the range of 40 – 60 mm. This is especially interesting in an application like the one shown in fig. 2, i.e. for a football soil.
10

The present invention is directed to providing an optimized artificial hybrid turf intended for football field. The artificial hybrid turf according to the present invention exhibits an optimized relation between the hole size of the reinforcement, the strength of the reinforcement and the pile length of the
15 hybrid turf. This relation between these parameters gives the artificial hybrid turf properties and performance. The optimal relation provided by the present invention has several advantages. First of all, the relation provided by the present invention implies an eliminated risk of treading through the artificial hybrid turf with the football boots of a football player when running or sliding
20 tackling. The holes of the reinforcement are small enough, however this is not only enough, if you still want to provide an artificial hybrid turf with holes large enough to provide good growth of grass through the holes of the reinforcement. The pile length is also of importance. The individual piles of the artificial hybrid turf according to the present invention are long enough to
25 be able to extend in the same direction and also protect the reinforcement and holes thereof when this is exposed to the compression of a football boot, both during running and sliding tackling.

In US20140250780 there is disclosed a removable support surface which has knitted loops of yarn, and has piles extending from the knitted yarn
30 to form an artificial turf, or to form a hybrid turf when combined with natural grass which grows between the knitted yarn. In US20140250780 it is mentioned that the net of the backing can be modified in a range of from 600 to 8000 Denier. The size of the holes is said to be possible to adjust from 1/6

inches (4.23 mm) up to 8 inches (203.2 mm). Moreover, the piles are said to be adjusted in a size range of from 1/3 inches (8.46 mm) up to 4 inches (101.6 mm). As notable, all the ranges according to the present invention are well within the ranges mentioned according to US20140250780. All of the ranges provided according to the present invention, i.e. the size of the holes of the reinforcement in form of width and length, the strength of the reinforcement and also the length of the piles, and the relationship between these parameters are key features to provide an optimal artificial hybrid turf, such as shortly described above and further explored below. Such an optimal combination of these parameters and the relationship between them are not disclosed or hinted in US20140250780.

Moreover, in EP2626468 there is disclosed a mixed turf disposed on a soil and comprising a synthetic turf, natural grass disposed inside the synthetic turf, said synthetic turf comprising synthetic filaments adapted to simulate grass blades and a support consisting of a membrane for sustaining the synthetic filaments, the support being further as a whole substantially draining and transpiring and allowing passage therethrough of the root system of said natural grass and being non-biodegradable.

Furthermore, in CN102668830 there is shown a method for planting a natural grass and artificial grass mixed system lawn. Turf formed according to the method is said to provide combines advantages of both the natural lawn and the artificial lawn.

In WO2014125459 there is disclosed a turf of synthetic origin and turf of natural origin, where the turf of synthetic origin and the turf of natural origin are disposed on a substantially elastic permeable substrate, which elastic substrate is configured in such a way that it allows passage of the roots of the natural turf through to a growing layer disposed in a lower position.

Neither of the additional documents shortly mentioned above provide the optimal technical setup of the ranges focused in the present invention, i.e. the size of the holes of the reinforcement in form of width and length, the strength of the reinforcement and also the length of the piles, and the relationship between these parameters. Such an optimal artificial hybrid turf

with an optimal setting of these parameters is not disclosed or hinted in either of these documents.

Another advantage provided according to the present invention is the property related to the artificial turf or piles as such. The piles are arranged in clusters with several piles being adjacent to one another, but still forming small groups of piles. This effect is possible to achieve when the strength of the reinforcement is held in the range according to the present invention. These clusters of piles also provide a very natural-like artificial turf when being compared to regular grass, which as such provides a similar feeling as playing football on a natural grass football field when using the artificial hybrid turf according to the present invention.

At the same time, the pile length cannot be too long. You still want to have the natural grass growing past the length of the piles and also provide an artificial hybrid turf which is simple to mow. Furthermore, you also want to provide a solution which is optimized with reference to the amount of material needed, and too long piles also increase the production costs. In relation to the expression "pile" it may also be mentioned that each pile, when mentioned as such, refers to each straw, but the expression may also refer to the entire pile being the uppermost layer of the artificial hybrid turf according to the present invention.

As understood from above, the artificial hybrid turf according to the present invention is optimized for football fields considering all possible aspects, such as high performance making sure to provide an effective growth of natural growth through the artificial hybrid turf, during the actual play providing an eliminated risk for the players, providing an effective handling so that mowing the artificial hybrid turf is simple and also with reference to keeping the total production costs down. No existing artificial hybrid turfs provide all these advantages or are directed to providing such an optimal solution for all these aspects.

30 Brief description of the drawing

In fig. 1 there is shown an artificial hybrid turf according to the present invention in a football ground.

In fig. 2 there is shown a football soil comprising an artificial hybrid turf according to the present invention.

Fig. 3 shows one possible type of a piece of reinforcement which may be the type used according to the present invention.

5 Fig. 4a – 4c show possible other applications for use of an artificial hybrid turf according to the present invention.

Specific embodiments of the invention

Some specific embodiments of the present invention are disclosed and discussed below.

10 As understood from above, the parameter ranges of hole size and strength of the reinforcement as well as the length of the piles are important according to the present invention to obtain the optimal properties.

According to one preferred specific embodiment of the present invention, the strength of the reinforcement is in the range of 2000 – 4000
15 Denier.

In addition to the strength, also the shapes and size of the holes of the reinforcement are important aspects. The shape of the holes may vary, e.g. quadratic, rectangular, round and oval are some possible shapes, but also irregular or unsymmetrical shapes are totally possible. One example is oval
20 hole shapes. Such oval shapes have a larger length of the holes than the width of the holes. In the case of round holes, then the length and width of the holes are the same or at least about the same.

According to one specific embodiment of the present invention, the holes of the reinforcement have a length in the range of 15 – 29 mm.

25 According to yet another specific embodiment of the present invention, the holes of the reinforcement have a width in the range of 12 – 25 mm. Preferably the holes have a length in the range of 15 – 29 mm and a width in the range of 12 – 25 mm.

Moreover, also the length of the piles is of importance. According to
30 one preferred embodiment of the present invention, the piles have a length in the range of 20 – 32 mm.

One interesting embodiment of the present invention refers to an artificial hybrid in which the holes of the reinforcement has a width in the

range of 12 – 25 mm and a length in the range of 15 – 29 mm, where the strength of the reinforcement is in the range of 2000 – 4000 Denier and where the piles have a length in the range of 20 – 32 mm.

Also the material and structure of the artificial hybrid turf are important aspects of the present invention. According to one specific embodiment, the reinforcement is a knitted structure. One example is a hexagonal honeycomb structure. The reinforcement and the structure and shape thereof should enable growth of grass through the holes and also make sure to protect the roots and root system of the natural grass.

According to yet another embodiment of the present invention, the material of the reinforcement surrounding one hole is knitted together with the material of the reinforcement surrounding another hole by use of filaments. One such example of a reinforcement according to the present invention is shown in fig. 3.

Regarding different materials of most interest, then it may be said that the reinforcement may preferably comprise polyester, polyamide, polyethylene, polypropylene. Moreover, the pile preferably comprises polyester, polyamide, polyethylene or polypropylene, or a combination thereof. Moreover, the pile may comprise a coating, e.g. a styrene-butadiene rubber (SBR), often called SBR latex, or polyurethane.

Moreover, the pile preferably has a green colour. The actual colour of the pile may vary, such as different tones of green, depending in the intended application and purpose of the artificial hybrid turf according to the present invention.

Below in table 1 there is provided different examples of possible usage of the artificial hybrid turf according to the present invention, both public and private applications.

Examples

Application	Pile height (mm)	Hole size (mm)	Strength (Denier)	Installation	Delivery form
Play Ground	25-32	5-20	Min 2000	On ground	Raw/Roll
Play Slope	25-32	5-20	Min 2000	On ground	Raw/Roll
Football Top	20-32	Min 12	Min 2000	On ground	Raw/Roll

Football Soil	40-60	Min 12	Min 1000	In soil	Roll
Sport Top	20-28	Min 12	Min 2000	On ground	Raw/Roll
Sport Soil	40-55	Min 12	Min 1000	In soil	Roll
Golf Ground	12	Min 10	Min 2000	On ground	Raw/Roll
School Ground	25-40	20-30	Min 2000	On ground	Raw/Roll
Walking Ground	28-40	20-30	Min 2000	On ground	Raw/Roll
Shadow Ground	20-32	40	Min 1000	On ground	Raw/Roll
Decoration Ground	55	60	Min 1000	On ground	Raw/Roll
Fire Ground	55	30-40	Min 1000	On ground	Raw/Roll
Landscaping Ground	22-40	20-40	Min 1000	On ground	Raw/Roll
Protecting Ground	12-55	Min 10	Min 2000	On Ground	Raw/Roll

Table 1

Explanation to table:

Application is examples but not limited to applications where the artificial hybrid turf according to the present invention may serve as a solution on the problem.

Installation on ground relates to when the artificial hybrid turf according to the present invention is placed and anchored on top of the application surface that is to be protected.

Installation in soil relates to when the artificial hybrid turf according to the present invention is placed below application surface and a mixture of growth material is placed on top of the back side but within the piles in order to create a new grass.

Delivery form is how the product can be delivered to the application surface.

Raw means not integrated with grass and roll means integrated with grass and delivered as a grass roll.

Detailed description of the drawing

In fig. 1 there is shown an artificial hybrid turf according to the present invention in a football ground. As shown, real grass has grown through the holes of the reinforcement. From bottom to top there is shown, first the grass roots and grass which grows up and through the holes of the reinforcement. The reinforcement is provided as a twisted wire, which normally also is provided with a synthetic backing. Furthermore, in the top you will see the synthetic piles which are provided along the reinforcement and also knitted

into the reinforcement. As notable, the natural grass will grow up through the reinforcement and will together with the synthetic pile provide the lawn or football field. It may further be said that e.g. fastening means, such as sod staples, may be used to anchor the reinforcement in the ground before the
5 actual grass has grown enough to provide for the anchoring. Furthermore, the width and the length of the holes of the reinforcement, the strength of the reinforcement or thickness in Denier and the length of the piles are all depicted in fig. 1.

In fig. 2 there is shown a football soil comprising an artificial hybrid turf
10 according to the present invention, seen from the side together with a football boot. Moreover, the definition of the pile height is also shown.

Fig. 3 shows one possible type of a piece of reinforcement which may be the type used according to the present invention. The synthetic pile is shown as the lighter thread in the reinforcement. This is knitted into warp
15 threads and weft threads to create a reinforcement with inbuilt synthetic pile which then also constitute the artificial grass. As notable, in this case the holes have an oval shape. Furthermore, one string of the reinforcement is knitted together with another string with weft threads or filaments. As such, an entire reinforcement net structure is created.

Fig. 4a – 4c show possible other applications for use of an artificial
20 hybrid turf according to the present invention. In fig. 4a there is shown a grass beneath a baby stroller walking on a pathway, in fig. 4b there is shown a golf grass and in fig. 4c the artificial hybrid turf according to the present invention is used in a playground, e.g. as a protection to the grass around an entire
25 playing area, slide in this example.

Claims

1. Artificial hybrid turf comprising a reinforcement, said reinforcement having
5 an open structure with several holes and as such being permeable for grass
to grow through it, said reinforcement constituting an underside of the artificial
hybrid turf, wherein the artificial hybrid turf also comprises piles which are
attached to the reinforcement and which piles as a whole constitute the
upside of the artificial hybrid turf, wherein the holes of the reinforcement have
10 a width in the range of 5 – 60 mm and a length in the range of 5 – 60 mm,
wherein the strength of the reinforcement is in the range of 1000 – 4000
Denier and wherein the piles have a length in the range of 10 – 60 mm.
2. Artificial hybrid turf according to claim 1, wherein the holes of the
15 reinforcement have a width in the range of 10 – 60 mm and/or a length in the
range of 10 – 60 mm.
3. Artificial hybrid turf according to claim 1 or 2, wherein the holes of the
reinforcement have a width in the range of 10 – 40 mm and/or a length in the
20 range of 10 – 40 mm.
4. Artificial hybrid turf according to any of claims 1-3, wherein the piles have a
length in the range of 10 – 50 mm.
- 25 5. Artificial hybrid turf according to any of claims 1-4, wherein the piles have a
length in the range of 40 – 60 mm.
6. Artificial hybrid turf according to any of claims 1-5, wherein the strength of
the reinforcement is in the range of 2000 – 4000 Denier.
- 30 7. Artificial hybrid turf according to any of claims 1-6, wherein the holes of the
reinforcement have a length in the range of 15 – 29 mm.

8. Artificial hybrid turf according to any of claims 1-7, wherein the holes of the reinforcement have a width in the range of 12 – 25 mm.

5 9. Artificial hybrid turf according to any of claims 1-8, wherein the piles have a length in the range of 20 – 32 mm.

10 10. Artificial hybrid turf according to any of claims 1-9, wherein the holes of the reinforcement has a width in the range of 12 – 25 mm and a length in the range of 15 – 29 mm, wherein the strength of the reinforcement is in the range of 2000 – 4000 Denier and wherein the piles have a length in the range of 20 – 32 mm.

11. Artificial hybrid turf according to any of claims 1-10, wherein the reinforcement is a knitted structure.

15

12. Artificial hybrid turf according to any of claims 1-11, wherein the material of the reinforcement surrounding one hole is knitted together with the material of the reinforcement surrounding another hole by use of filaments.

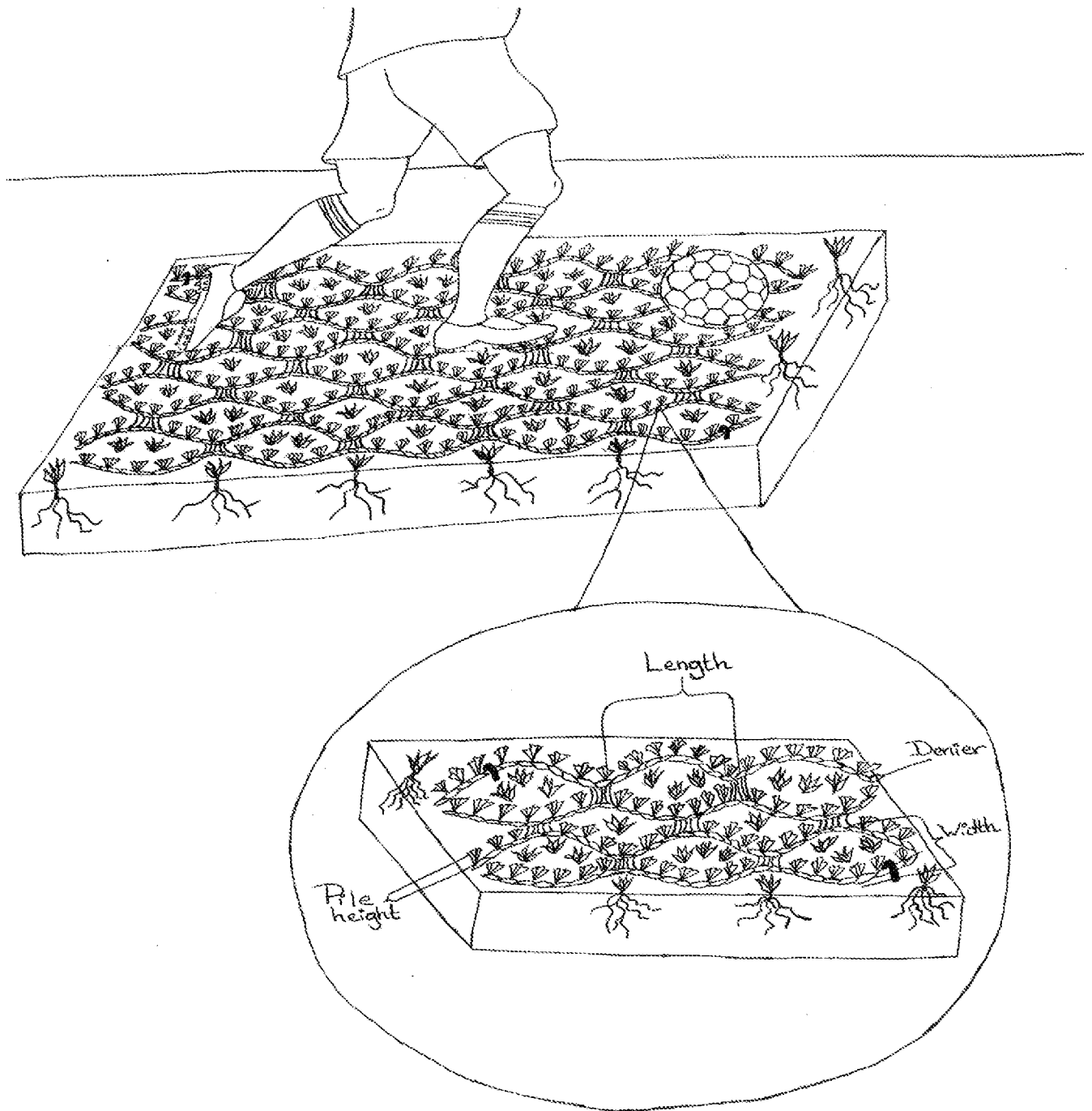


Fig. 1

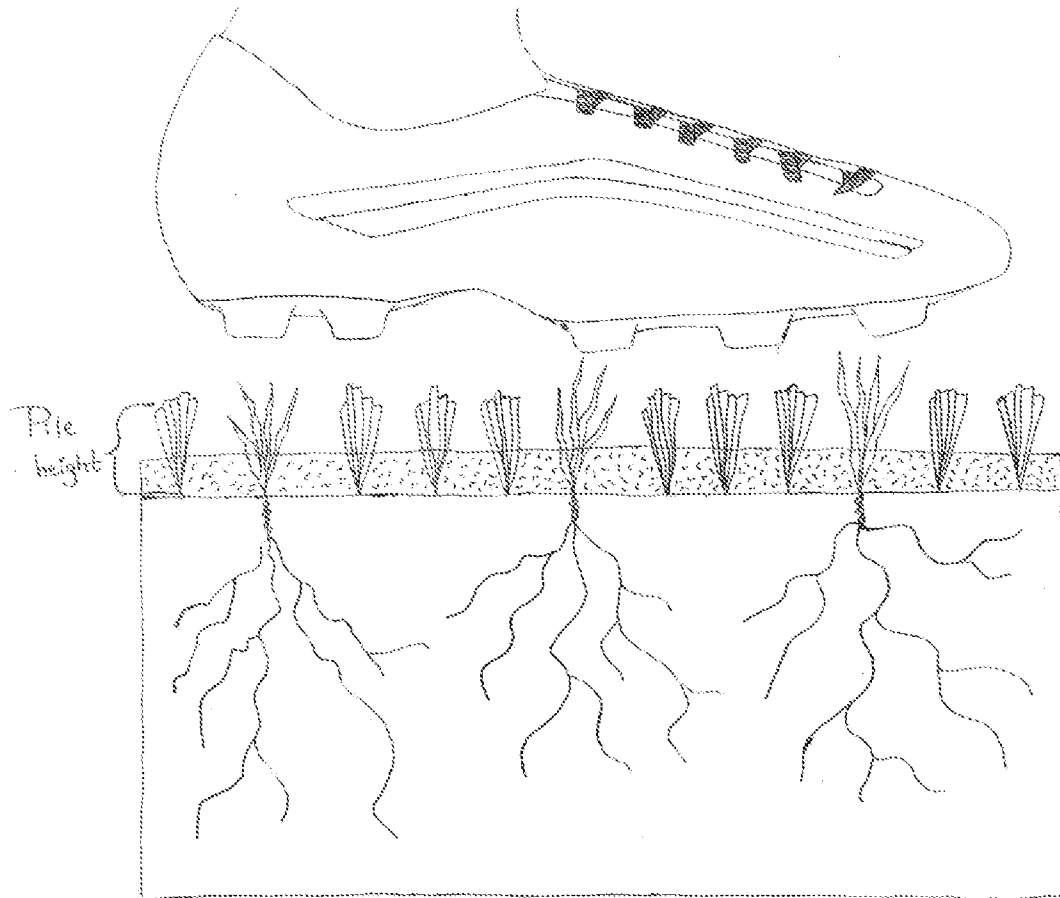


Fig. 2

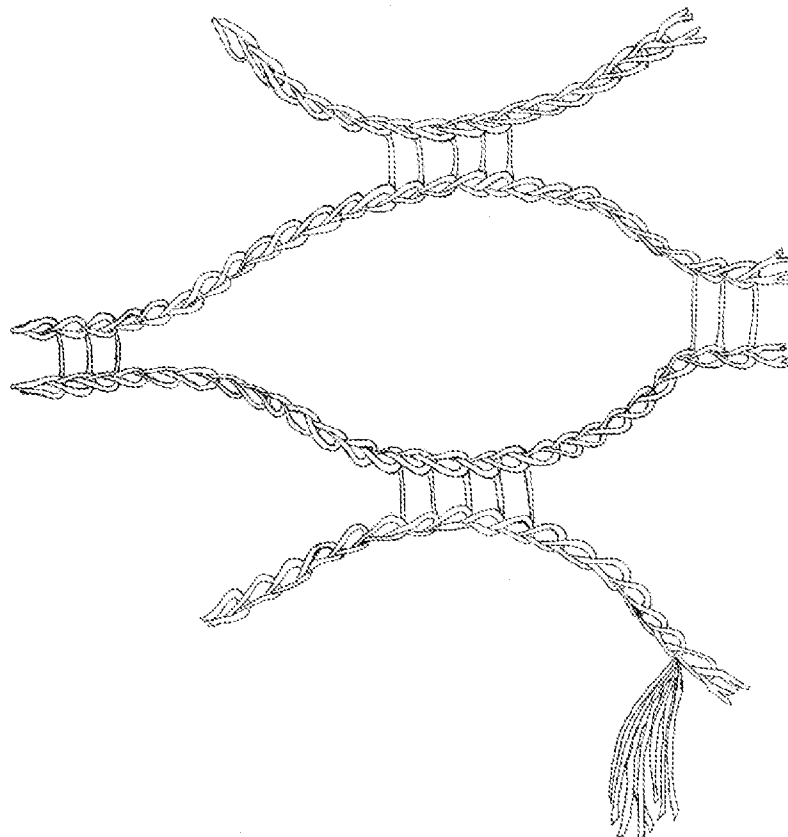


Fig. 3

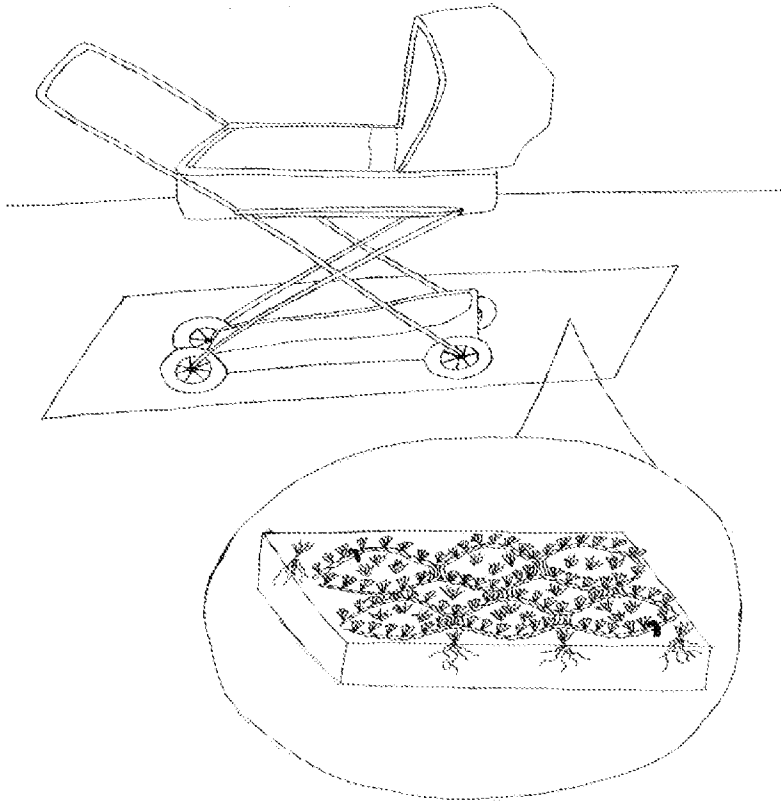


Fig. 4a

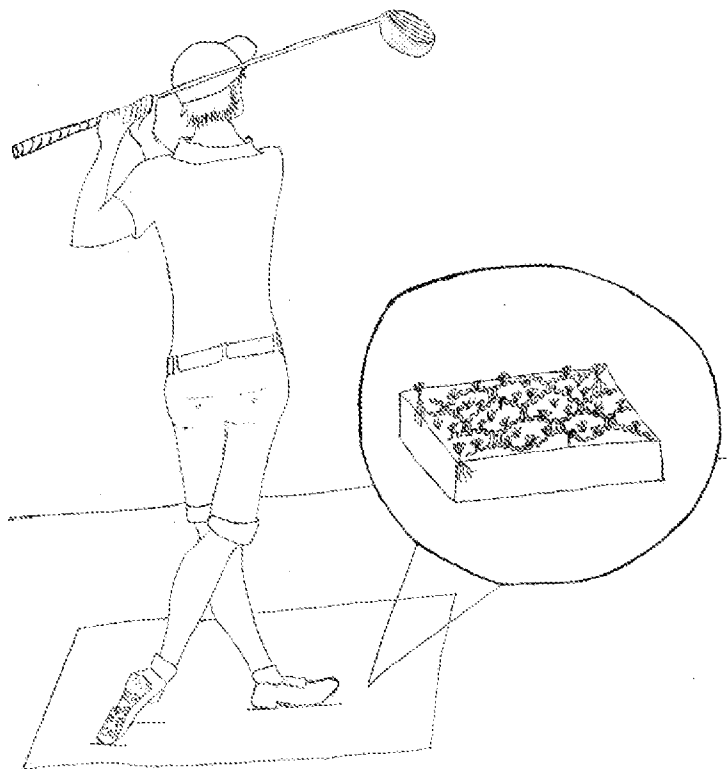


Fig. 4b

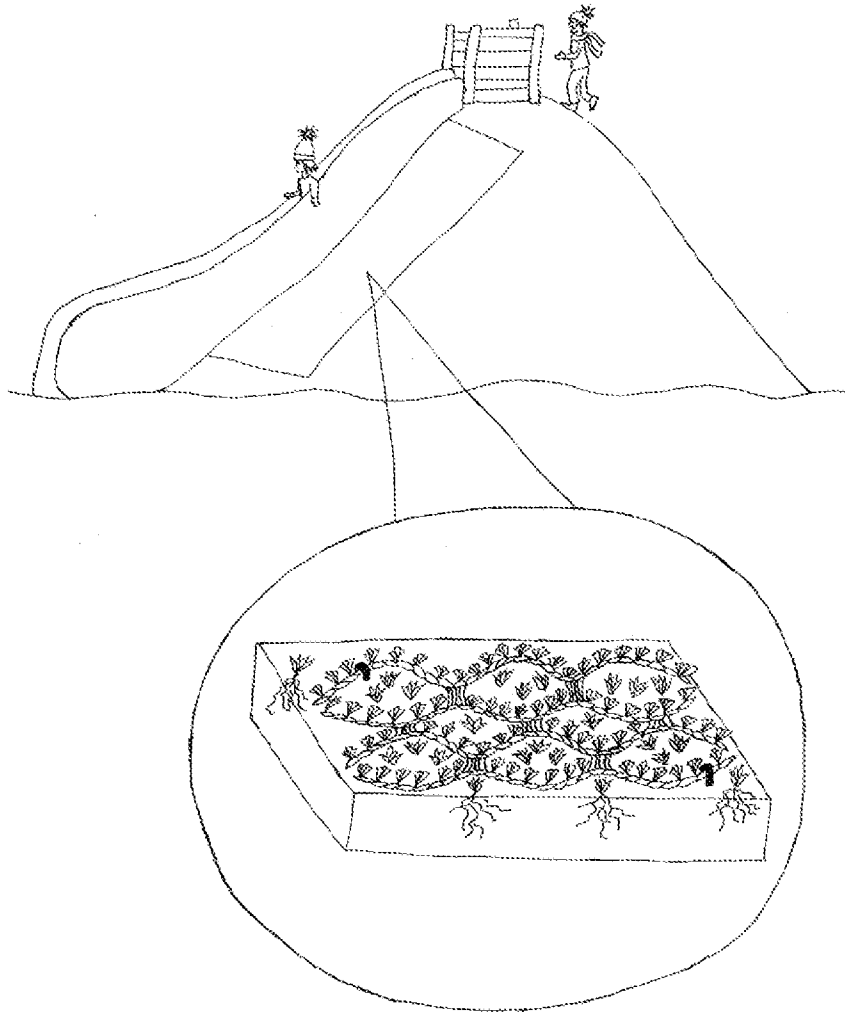


Fig. 4c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050059

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20140250780 A1 (LEE HYO-SANG ET AL), 11 September 2014 (2014-09-11); abstract; paragraphs [0040]-[0044]; figures --	1-12
X	WO 2014125459 A1 (PROFESIONAL SPORTSVERD FUTBOL S L), 21 August 2014 (2014-08-21); whole document --	1-12
X	EP 2626468 A1 (SARRIS NIKOLAOS), 14 August 2013 (2013-08-14); whole document --	1-12
X	CN 102668830 A (UNIV BEIJING FORESTRY), 19 September 2012 (2012-09-19); whole document -- -----	1-12

 Further documents are listed in the continuation of Box C.
 See patent family annex.

* Special categories of cited documents:	
“A” document defining the general state of the art which is not considered to be of particular relevance	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Continuation of: second sheet
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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US	20140250780 A1	11/09/2014	NONE			
WO	2014125459 A1	21/08/2014	CA	2900612 A1	21/08/2014	
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			KR	20150121035 A	28/10/2015	
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			EP	2815028 A1	24/12/2014	
			ES	2559354 T3	11/02/2016	
			HR	P20160028 T1	12/02/2016	
			US	20150047259 A1	19/02/2015	
			WO	2013121348 A1	22/08/2013	
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