The invention relates to a field containing artificial grass consisting of a substructure and a top layer provided thereon, wherein the top layer is a nutrient medium (5) which contains regularly spaced fibres (1) which, when seen in the longitudinal direction of the fibre, extend further into the ground than above the ground, with natural grass (2) seeded between the fibres in a nutrient medium (5) on the substructure (3). The invention also relates to artificial fibres to be used with a field containing artificial grass wherein the fibres have a length of 20 - 60 cm. The invention further relates to a device for inserting artificial fibres into the ground, said device consisting of one or more planting pins (25), which are disposed perpendicularly to a frame (40), one or more tubes (20) being placed in a sliding frame (41) for supplying the fibres (30) to a location under the planting pin (25).
+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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Title: A field containing artificial grass and a device for inserting artificial grass fibres.

The invention relates to a field containing artificial grass consisting of a substructure and a top layer provided thereon.

From European Patent Specification No. 263,566 a field of artificial grass is known which is in particular intended for soccer, whereby measures have been taken to make those fields of artificial grass, which so far have been used for playing hockey thereon, suitable for playing soccer thereon as well. These measures consist of frizzling the fibrous material and applying a substance on said fibrous material, as a result of which the coefficient of friction of the fibrous material is reduced. The field of artificial grass such as described in European Patent Specification 263,566 constitutes a considerable improvement compared to the known fields of artificial grass known at that time, but thanks to further developments it has been found possible to develop a field of artificial grass which more adequately satisfies the demands to be made of fields of artificial grass, in order to be able to practice a certain sport, such as soccer, thereon.

European Patent Specification No. 260,769 teaches that the substructure is important for a field of artificial grass, in particular for those sports whereby jumps are made on the field of artificial grass. So far the influence of such a substructure has been greater with fields of artificial grass on which soccer was played than with fields of artificial grass on which hockey was played. The field of artificial grass according
to the invention proposed herein is less dependent on the substructure, at
least less dependent on the specific measures such as described in European

From European Patent Application No. 174,755 a method is known
for providing a field containing artificial grass on a footway or on a
sports field, by laying a layer with an open structure provided with
artificial grass fibres and providing a particulate material, such as sand
or ground particles, between said fibres. If such a mat is laid on ground
in which natural grass can be made to grow, by providing natural grass
seeds in said mat, the grass can be made to grow through the mat in which
the artificial grass is incorporated. Thus a combination of artificial
glass and natural grass is obtained. From German Offenlegungsschrift No.
2,522,864 a method is known for protecting plants and the like, such as
also natural grass on so-called grid stones, by providing artificial grass
fibres around said grid stones or structural elements. Such grid stones are
unsuitable for laying fields of artificial grass, however. A field
containing artificial grass comparable with the construction such as
described in European Patent Application No. 174,755 is also mentioned in
European Patent Application No. 403,008 (published on December 19, 1990),
which describes a sports field on a mat of artificial grass, rooted through
with roots of grass plants penetrating the mat of artificial grass. Tests
which have been taken, however, show that the growth of the natural grass
is strongly impeded by the mat in which the artificial grass is provided,
in spite of the fact that openings are provided all over the surface of the
mat of artificial grass, as a result of which the grass plants grow from
the foundation (see column 1, lines 46 - 49 of said European Patent
Application No. 403.008).

The field containing artificial grass according to the invention
provides a solution for the above-described problems, so that a combina-
tion of natural grass and artificial grass in a field is obtained, whereby
the artificial grass provides protection for the natural grass, whilst the
growth of the natural grass is not impeded. Consequently the field
containing artificial grass according to the invention is characterized in
that the top layer is a nutrient medium which contains regularly spaced
fibres which, when seen in the longitudinal direction of the fibre, extend
further into the ground than above the ground, with natural grass seeded
between the fibres in a nutrient medium on the substructure.

The field containing artificial grass according to the invention on the one hand consists of natural grass and on the other hand of fibres which have been provided in the field at regularly spaced intervals, whereby the part of the fibre projecting above the ground functions to protect the grass plant and in particular to protect the growing point of the grass plant. Said growing point is located at the point where the grass emerges from the bottom, which for the field containing artificial grass according to the invention is the nutrient medium. Running movements and especially slidings may cause damage to the natural grass, in particular near the growing point, as a result of which the growth of the grass is hampered. With the field containing artificial grass according to the invention the growing point is covered by the fibre, thus preventing said growing point from being damaged. Furthermore the entire body of fibres makes the sward more stable, as a result of which no sliding away takes place and the load caused by a movement on the field is distributed over the grass and the fibres. After the sliding has been completed the fibrous material will become upright again and the growing point returns to its position prior to the sliding. On the basis of this assumption, although the invention is by no means limited by certain theoretical considerations, the length and the shape of the projecting fibre part only needs to be such that the growing point of the grass is covered upon collapse of the fibre. Furthermore the dimensions of the fibre must be such that the area where the growing point is present is sufficiently covered. Any fibres that project too far above the ground may extend beyond the natural grass, constituting the drawback that a player's falling or sliding movements may lead to injuries, as is the case with known fields of artificial grass, viz. skin burns and grazing caused by the material of which the artificial grass is made. This problem has been reduced by the fields of artificial grass according to European Patent No. 263,566, but the field of artificial grass such as described in said European Patent still does not meet all the requirements which may be made within this scope and will not equal the properties of natural grass, therefore. With the field containing artificial grass according to the invention it is achieved that said field can be played on much more intensively than a field of natural grass and that it does not have certain drawbacks of the fields containing artificial
grass known so far. Fields of natural grass can be played on for an average of 250 hours per year, a field of artificial grass such as known from European Patent No. 263,566 for about 2000 hours and the field containing artificial grass according to the invention for 1200 - 1500 hours. From this it appears that as a result of the insertion of the fibres according to the invention the use of the field of natural grass may be intensified by a factor of 5 - 6.

The fibres which are regularly provided in the field of artificial grass according to the invention preferably have a length of 15 - 25 cm, penetrate at least 15 - 25 cm into the ground and project along 5 - 10% of their length above the ground. The length of the fibre is such that the part projecting from the nutrient medium is held in place and is not moved as a result of a sliding movement on the ground. The fibre extending through the nutrient medium furthermore functions to fix the roots of the grass thereto, which provides an additional reinforcement for both the grass, the fibres and the ground. For this purpose the fibre is put into the ground having the shape of a V, so that prior to being put into the ground a piece of fibre has a length of 20 - 60 cm and is provided with branches or is twisted so as to achieve a better anchoring to the ground and/or to the grass roots.

The invention also relates to a device for planting the artificial grass fibres in the ground. Said planting in the ground of the artificial grass fibres is necessary according to the invention, in contrast to the non-prepublished European Patent Application No. 403,008, wherein use is made of a mat of artificial grass.

The invention will be explained in more detail hereafter by means of the following description, wherein reference is made to the appended drawing, in which:

Figure 1 diagrammatically illustrates the construction of a field containing artificial grass according to the invention;

Figure 2 diagrammatically illustrates the operation of the device according to the invention for planting artificial grass fibres in the ground; and

Figure 3 shows a perspective view of the device according to the invention for planting artificial grass fibres.

In Figure 1 the substructure 3 and the nutrient medium 5 are
superimposed. The fibres 1 are passed through the nutrient medium, whereby
the part 9 of said fibres 1 projects above the nutrient medium 5. The top
layer has been seeded with natural grass, whose blades 2 project from the
nutrient medium, whilst the roots 7 are present in the nutrient medium, the
growing points 8 are present at ground level 6.

Although there are no specific limitations as regards the sub-
structure 3 and the nutrient 5, in order to achieve an optimal growth of
the grass plants it will be preferred to dig away the terrain where the
field of grass with fibres (to be called field containing artificial grass
hereafter) is to be provided to approximately 50 cm under the future ground
level, viz. level 6. Then the cunette produced is filled with foundation
sand to a level of about 35 - 20 cm, in which foundation sand drainage may
be provided. On the foundation sand, at level 3, about 15 - 30 cm of
nutrient medium is provided. Said nutrient medium preferably consists of a
slightly humous sand, suitable for growing grass therein. The composition
as regards grain size of the sand is such that an adequate perviousness to
water is obtained and the the surface at level 6 is flat.

After having prepared the substructure 3 and the nutrient medium
5 the fibres 9 are mechanically inserted, which fibres are e.g. inserted
into the ground to a depth of 20 cm. For this purpose it will be possible
to use a device as illustrated in Figure 3, which will be explained in more
detail hereafter. The fibres project about 1 - 1.5 cm above the surface and
will have the shape of a loop or of a V as soon as they have been provided
in the ground. In that case the length of a fibrous piece of artificial
grass before it is put into the ground will be about twice the insertion
depth. After the insertion of the fibres into the ground the nutrient
medium will be seeded. It is also possible to seed the nutrient medium
first and then insert the fibres 9 into the ground. Preferably the
insertion of the fibres 9 into the ground is done mechanically, whereby it
is especially preferred to have said insertion of the fibres and said
seeding take place simultaneously.

The fibrous material may be selected from the fibrous materials
used so far for laying fields of artificial grass, preferably the fibres
will be green, so that they are as inconspicuous as possible among the
natural grass. A different colour may be chosen for those places in the
field where a pattern of lines is to be provided. The material of which the
fibres are made may also be another material than that which has been used so far for artificial grass, however, such as a natural or other material, provided the mechanical strength of the fibres used is sufficient. Preferably a material is used whose coefficient of friction is comparable to that of natural grass. With regard to the shape of the fibres it is necessary that the projecting part 9 of the fibre is able to cover the growing point 8. Furthermore it may be desirable for the fibres to have branches, so that an adequate anchoring to the roots 7 of the grass on the one hand and to the sand on the other hand is obtained, so that the ground is more stable than of the known fields with artificial grass.

The length along which the fibre 1 projects above the surface 6, viz. 1 - 1.5 cm, has been selected to be less than the length at which the natural grass is mown. When the grass is being mowed the projecting fibre parts 9 do not form an impediment, therefore.

Furthermore it is preferred for the fibres 1 to be inserted into the nutrient medium at regularly spaced intervals. Said regular spacing may be achieved by providing the fibres in a certain pattern, such as in the corner points of an imaginary equilateral triangle. The dimension of the sides of said equilateral triangle may vary from a preferred 1 cm to 3 cm, whereby in the case of the larger dimension of said side fewer fibres per square metre of field are inserted in the ground. The more fibres that are provided in the ground, the better the growing points are protected and the more intensive such a field of artificial grass can be used. This also means that in those places of a field, e.g. a soccer field, where a great part of the game takes place, such as in the goal area, more fibres per square metre may be provided, so that in those places the side of the equilateral triangle is e.g. 10 mm and in those places where much less of the game is played the spacing between the fibres may be larger, e.g. 30 mm.

In order to insert the fibres 1 into the nutrient medium in an efficient manner, a fibre planting machine such as illustrated in Figure 3 has been developed. Before describing the device shown in Figure 3 in more detail, reference is first made to Figure 2, which diagrammatically indicates the operation of the fibre planting machine according to the invention. In Figure 2 step A shows the first situation of the device as illustrated in Figure 3, so as to provide the end 31 of the fibre between
the clamping blocks 21 - 22. In situation B the tube 20 is retracted from the clamping blocks whilst leaving the fibre 30 behind, the clamping blocks 21 and 23 being provided on the lower clamping blocks 22 and 24 respectively, so that the fibre 30 is fixed between the clamping blocks at its ends. The projecting end of the fibre indicated at 31 in situation A is clamped between the clamping blocks 21 and 22. In situation B the knife 26 is furthermore moved upwards, so that the fibre 30 is cut through and the end 32 can be released after the clamping blocks 23 and 24 have been separated. Furthermore the planting pin 25 is moved downwards, so that it will rest on the fibre 30.

According to situation C the fibre 30 is moved downwards under the influence of the planting pin 25, because the clamping blocks 21 and 23 are moved upwards as soon as the planting pin 25 comes into contact with the fibre 30, so that the fibre 30 is released from the clamping blocks at its ends 31 and 32 and is pressed into the ground, in particular into the nutrient medium 5, under the influence of the planting pin 25. In situation D the device is ready for the next cycle again. As soon as the planting pin 25 has been returned to its highest position, the tube 20 may be moved forward, so that the fibre end 32 is placed between the clamping blocks 21 and 22 and subsequently becomes the end 31, as is indicated in situation A.

After the explanation of the principle of the operation of the fibre planting machine, the machine itself will be explained in more detail by means of the description below, wherein reference is made to Figure 3, wherein parts that correspond with parts in Figure 2 have been given the same reference numbers as in Figure 2.

Figure 3 illustrates the fibre planting machine, whereby the tubes 20 are in a situation between A and B of Figure 2 because the tubes 20 are making a retracting movement, since the fibres 30 are clamped between the clamping blocks 21 and 22. The fibres 30 present in the tubes 20, which are partially detached from the clamping blocks 21 - 22, are arranged within a frame 40, on which a sliding-frame 41 is mounted, which frame 41 can move as a whole in the directions such as indicated by the double arrow 45. The front end of the frame 41 is provided with a sloping end 42 which, as soon as it comes into contact with the clamping blocks 21 and 22, will move the clamping blocks 21 upwards, so that the tubes 20 can take care of it that the end 31 of the fibre 30 will come to lie between
the clamping blocks 21 and 22. The ends of the tubes 20 are brought together in the tube holder 46. The guide 43 for the aggregate planting pins 25 extends perpendicularly to the frame 40. Said guide 43 can be moved up and down, as is indicated by the double arrow 48. In the supporting beam 47 the guide 44 for the planting pins is shown in cut-away view. It will be apparent that the pin guides must be placed accurately with respect to the fibres 30, because the fibres 30 must be taken along when the planting pins 25 move downwards. The clamping block 23 is shown to contain the knife 26. The drawing furthermore shows a few adjusting means near the clamping blocks 21 and 23, although said adjusting means will not be described in more detail. Furthermore it will be apparent that although the planting pins 25 are placed in one row in the beam 47, it is also possible to provide the planting pins 25 in a mutually staggered relation in the beam 47, so that it is possible to obtain a certain desired pattern of the fibres 30 inserted into the nutrient medium 5. Furthermore it is possible that several rows of guides 43 for planting pins are provided on the frame 40. The various movable parts on the frame 40 can be driven by means of a hydraulic motor and geared to each other.

With this fibre planting machine it is possible to provide fibres into the ground in an efficient manner.

The field according to the invention now used constitutes an ideal combination of the fields of artificial grass known so far and a field of natural grass and it will be apparent that such a field is not limited to playing soccer thereon. Also all other sports, such as hockey, tennis, handball and golf can be successfully played on such a field of natural grass and fibres.
CLAIMS

1. A field containing artificial grass consisting of a substructure and a top layer provided thereon, characterized in that the top layer is a nutrient medium (5) which contains regularly spaced fibres (1) which, when seen in the longitudinal direction of the fibre, extend further into the ground than above the ground, with natural grass (2) seeded between the fibres in a nutrient medium (5) on the substructure (3).

2. A field containing artificial grass according to claim 1, characterized in that the fibres having a length of 15 - 25 cm are provided at least substantially perpendicularly to the nutrient medium (5) and the substructure (3) and project above the surface (6) along 5 - 10% of their length.

3. A field containing artificial grass according to claims 1-2, characterized in that the fibres are placed at the corner points of an imaginary equilateral triangle having sides of 10 - 30 mm.

4. A field containing artificial grass according to claims 1-3, characterized in that the fibres are made of a material of which artificial grass is made.

5. A field containing artificial grass according to claims 1-3, characterized in that the fibres are made of a natural or other material, which is resistant to wear under mechanical loads.

6. A field containing artificial grass according to claims 1-5, characterized in that the density of the fibres per unit of area is larger in those places where the field is used more intensively.
7. A field containing artificial grass according to claims 1-6, characterized in that the substructure construction consists of a foundation layer (3), on which 15 - 30 cm of nutrient medium (5) is provided for growing natural grass (2) thereon.

8. A field containing artificial grass according to claims 1-7, characterized in that the fibres (1) have branches along substantially their entire length or they are twisted, in order to achieve a better anchoring of the fibres in the nutrient medium (5) as a result of their contact with the roots (7).

9. A field containing artificial grass according to claims 1-8, characterized in that the fibres (1) are V-shaped after having been inserted into the ground.

10. Artificial fibres to be used with a field containing artificial grass according to claim 1, characterized in that the fibres have a length of 20 - 60 cm.

11. A device for inserting artificial fibres into the ground, said device consisting of one or more planting pins (25), which are disposed perpendicularly to a frame (40), one or more tubes (20) being placed in a sliding frame (41) for supplying the fibres (30) to a location under the planting pin (25).

12. A device according to claim 11, characterized in that said frame is provided with clamping means (21, 22) and (23, 24), for clamping down the ends (31) and (32) of the fibre (30), said clamping means being spaced from each other, by a distance which is slightly larger than twice the insertion depth of the fibre into the ground.

13. A device according to claims 11 and 12, characterized in that said clamping means (23, 24) is provided with a knife (26).