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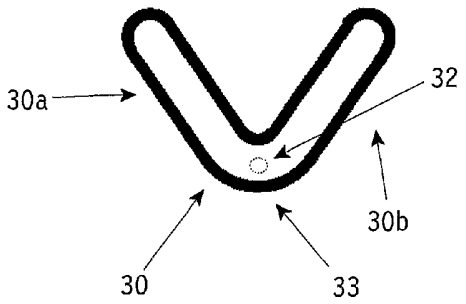
(54) Title: ARTIFICIAL FIBRE FOR USE IN AN ARTIFICIAL GRASS SPORT FIELD



(57) Abstract: The invention relates to an artificial fibre of the monofilament-type for use in an artificial grass sport field wherein, seen in a sectional direction of the fibre, at least part of the fibre is provided with stiffness-enhancing means extending in the longitudinal direction thereof. The invention also relates to an artificial grass lawn suitable for sports fields, consisting at least of a substrate to which one or more artificial fibres according to the invention are attached. The object of the invention is to provide an improved artificial fibre for use in an artificial grass sports field, which fibre is on the one hand less flexible and consequently exhibits less tendency to assume a flat orientation, but which on the other hand does not constitute an increased risk of injuries or have an adverse effect on the playing characteristics. According to the invention, the artificial fibre is characterized in that the fibre is built up of at least two fibre flange portions, at least one fibre flange portion of which forms the stiffness-enhancing means, whilst said at least two fibre flange portions have a uniform thickness.

WO 2006/085751 A1

ARTIFICIAL FIBRE FOR USE IN ARTIFICIAL GRASS SPORT FIELD

DESCRIPTION

The invention relates to an artificial fibre of the monofilament-type for use in an artificial grass sport field wherein, seen in a sectional direction of the fibre, at least part of the fibre is provided with stiffness-enhancing means extending in the longitudinal direction thereof.

The invention also relates to an artificial grass lawn suitable for sports fields, consisting at least of a substrate to which one or more artificial fibres according to the invention are attached.

Many sports, such as field hockey, tennis, American football etc. are now played on artificial grass sports fields, which sports fields are composed of artificial grass lawn as referred to in the introduction, on which artificial fibres as referred to in the introduction are provided. Although sporters sustain fewer injuries on a natural grass sports field when falling or making a sliding tackle, on account of the softer surface thereof, such sports fields are often severely damaged when the above sports are played thereon, precisely because they are used intensively and because of the varying influence of the weather conditions.

A drawback of the artificial fibres that are currently known is that they attend to assume a flat orientation relative to the ground surface upon being played on. This results in so-called "bare patches" in the artificial grass sports field and thus in an increased risk of injuries, etc.

This problem can be eliminated in part, for example by providing a granular infill material such as sand or granules of a plastic material between the artificial fibres. The presence of these infill granules leads to a more upright orientation of the artificial glass fibres. Additionally, the infilled grains not only provide a softer, shock-absorbing playing surface on which players are less prone to injury, therefore. Furthermore, they provide improved playing characteristics, so that the playing characteristics of artificial grass sports fields resemble those of natural grass sports fields as much as possible.

The use of an infill in artificial grass sports fields has a number of drawbacks. Not only is the construction of such An artificial grass sports field more

labour-intensive than the construction of a natural grass sports field, but an artificial grass sports field provided with an infill requires subsequent maintenance as well. The initially uniform distribution of the granular infill can be disturbed by intensive usage. As a result, areas containing hardly any infill may form in particular in places where the field is played on very intensively, for example in the goal area, which has an adverse effect on the quality of play, but which above all leads to an increased risk of injury.

Another solution to the problem as described above is to increase the stiffness of the monofilament by changing the chemical composition and/or the processing method thereof. This is undesirable, however, because it will lead to a more abrasive artificial grass sports field with an increased risk of injuries.

Another solution to the problem as described above is to adapt the geometry of the artificial fibre, for example as proposed in US 2001/033902 or in WO 2005/005730. Both patents disclose fibres provided with stiffness-enhancing means. However, on account of the geometry of the fibre and the location of the stiffness-enhancing means, the artificial fibres that are obtained exhibit an increased risk of splitting and/or fracture as a result of material stresses that may be set up in the fibre, for example due to loads exerted thereon during play or temperature changes that may occur.

It is furthermore noted in this connection that US 2001/033902 discloses a composite filament fibre (also called multifilament) which, on account of the geometry and the orientation of the stiffness-enhancing means, consciously creates weak lines of fracture in the composite fibre. The fibre is required to split in that case so as to create multiple filament fibres.

Similar weak artificial fibres that are liable to split and/or fracture are disclosed in WO 2005/005730. Said publication, too, discloses a fibre comprising stiffness-enhancing means, but said fibre, on account of its geometry, has undesirable points or lines of fracture at which undesirable material stresses may be set up, for example due to loads being exerted thereon during play (sliding tackles, etc.) or temperature changes that may occur.

It is precisely the object of the present invention to prevent such a weak artificial fibre that remains susceptible to splitting and fracture, but to provide an improved artificial fibre for use in an artificial grass sports field, which fibre is provided with stiffness-enhancing means, to be true, and which is less flexible,

therefore, but which, on account of the geometry of the fibre, will exhibit less tendency to assume a flat orientation or to split or fracture, and which furthermore does not constitute an increased risk of injuries or have an adverse effect on the playing characteristics.

According to the invention, the artificial fibre is characterized in that the fibre is built up of at least two fibre flange portions, at least one fibre flange portion of which forms the stiffness-enhancing means, whilst said at least two fibre flange portions have a uniform thickness.

More specifically, the stiffness-enhancing means extend the full length of the fibre. On the other hand, the stiffness-enhancing means extend at least partially in the sectional direction.

In another functional embodiment, the stiffness-enhancing means are configured as at least one fibre flange portion extending at an angle to the plane formed by the fibre. Said at least one fibre flange portion extends at an angle of 90° or 45° to the plane formed by the fibre in that case.

In other embodiments, said at least one fibre flange portion is straight, curved or spiral-shaped.

The invention will now be explained in more detail with reference to a drawing, in which:

Figures 1-5 show various embodiments of an artificial fibre according to the invention.

Figures 6 and 7 schematically show a few embodiments of an artificial grass sports field provided with an artificial fibre according to the invention.

Figures 1-5 are cross-sectional views of artificial fibres according to the invention, in which each fibre 30-70 is provided with stiffness-enhancing means 33-73 extending in the longitudinal direction of the fibre.

In the embodiment that is shown in figure 1, the fibre 30 is configured as an extruded band of plastic material having a longitudinal direction 32, which artificial fibre 30 has a V-shaped cross-section made up of two fibre flange portions 13a and 13b, respectively, which extend in transverse direction on either side of the longitudinal axis 32. The stiffness-enhancing means are indicated at 33 in the embodiment that is shown in figure 1.

In the embodiment that is shown in figure 2, the stiffness-enhancing means 43 are configured as at least one fibre flange portion 43 extending at an

angle to the plane formed by the artificial fibre 40. In this embodiment, too, the artificial fibre 40 has a V-shaped cross-section made up of two fibre flange portions 40a-40b, which extend symmetrically in transverse direction with respect to the longitudinal axis 42. The stiffness-enhancing means 43 are incorporated in the fibre at the location of the longitudinal axis 42.

In the embodiment that is shown in figure 3, the fibre 50 has two fibre flange portions 50a-50b, which extend symmetrically in transverse direction with respect to the longitudinal axis 52 and which have a curved shape, which curved shape forms the stiffness-enhancing means 43a and 43b, respectively. In this embodiment, the fibre flange portion 50a-50b is curved, with each fibre flange portion 50a-50b comprising a curve.

Figure 4 shows an alternative embodiment of the artificial fibre that is shown in figure 3, in which the artificial fibre 60 is provided with fibre flange portions 60a-60b exhibiting multiple curves (two in this embodiment). Each fibre flange portion 60a-60b exhibits two curves 63a-63a' and 63b-63b', respectively, which form the stiffness-enhancing means.

In the embodiment that is shown in figure 5, the artificial fibre 70 comprises three fibre flange portions 70a-70c, which extend in a star-shaped manner with respect to the longitudinal axis 72. It will be apparent that more than three fibre flange portions extending symmetrically with respect to the longitudinal axis 72 may be used in this embodiment. In this embodiment, too, each fibre flange portion 70a-70c comprises a curve, which curves form the stiffness-enhancing means 73a-73c.

While the fibre flange portions 70a-70c extend in a star-shaped albeit curved manner with respect to the longitudinal axis 72 in figure 5, the flange portions 70a-70c of the fibre 70 of another embodiment (not shown) may be straight. The fibre flange portions 70a-70c (the legs) may be identical in length in that embodiment, whilst in another embodiment the legs may be different in length, similar to the embodiment that is shown in figure 2.

It is noted that the artificial fibre as shown in figures 1-5 is configured as a monofilament fibre obtained by means of an extrusion process. On account of the geometries as shown in figures 1-5, in which use is made of stiffness-enhancing means, which preferably extend in the longitudinal direction of the fibre and which may optionally extend in the transverse direction of the fibre, which fibre

is less flexible, therefore, and will thus exhibit less tendency to assume a flat orientation in the artificial grass sports field.

In spite of the use of less flexible artificial fibres that are according to the invention obtained by using the stiffness-enhancing means that are incorporated in the fibre, it has become apparent that the risk of injuries does not significantly increase and that furthermore the playing characteristics of an artificial grass sports field comprising such artificial fibres 10-100 are not adversely affected.

It is furthermore pointed out that in particular the embodiments that are shown in figures 1-5 provide a possibility of absorbing or retaining water, which has a positive effect on the playing characteristics.

In addition to that it is pointed out that in figures 1-5 the fibre flange portions 30a-30b; 40a-40b; 50a-50b; 60a-60b and 70a-70b each have a uniform thickness. Thus, no material stresses that might lead to undesirable deformation occur in the fibre material. In addition to that, the uniform thickness significantly adds to the life of the fibre, as wear is prevented.

Figures 6 and 7 show a few embodiments of an artificial grass sports field in which An artificial fibre according to the invention can be used. In both figures the artificial grass sports field comprises a substrate 1, to which several artificial fibres 2 (corresponding to the fibres 30-70 in figures 1-5) are attached at the locations indicated at 3. The extruded artificial fibre to may be provided on the substrate either individually or in the form of a bundle of fibres 2a-2c, which are twined together, for example.

In another embodiment, as shown in figure 7, the artificial fibre according to the invention may be a monofilament. In this embodiment, too, several monofilaments may be combined into bundles by twining, after which each bundle is attached to the substrate 1. The substrate that is shown in figure 7 has an open structure, being composed of a grid of supporting yarns 1a-1b, on which the artificial fibres 2 are provided.

CLAIMS

1. An artificial fibre of the monofilament-type for use in an artificial grass sport field wherein, seen in a sectional direction of the fibre, at least part of the fibre is provided with stiffness-enhancing means extending in the longitudinal direction thereof, **characterized in that** the fibre is built up of at least two fibre flange portions, at least one fibre flange portion of which forms the stiffness-enhancing means, whilst said at least two fibre flange portions have a uniform thickness.

2. An artificial fibre according to claim 1, **characterized in that** the stiffness-enhancing means extend the full length of the fibre.

3. An artificial fibre according to claim 1 or 2, **characterized in that** the stiffness-enhancing means extend at least partially in the sectional direction.

4. An artificial fibre according to any one or more of the claims 1-3, **characterized in that** the artificial fibre has a star-shaped section comprising at least three fibre flange portions configured as legs.

5. An artificial fibre according to claim 4, **characterized in that** said legs have a uniform length.

6. An artificial fibre according to any one or more of the claims 1-5, **characterized in that** the stiffness-enhancing means are configured as at least one fibre flange portion extending at an angle to the plane formed by the fibre.

7. An artificial fibre according to claim 6, **characterized in that** said at least one fibre flange portion extends at an angle of 90° to the plane formed by the fibre.

8. An artificial fibre according to claim 6 or 7, **characterized in that** said at least one fibre flange portion extends at an angle of 45° to the plane formed by the fibre

9. An artificial fibre according to any one or more of the claims 6-8, **characterized in that** said at least one fibre flange portion is straight.

10. An artificial fibre according to any one or more of the claims 6-9, **characterized in that** said at least one fibre flange portion is curved.

11. An artificial fibre according to any one or more of the claims 6-10, **characterized in that** said at least one fibre flange portion is spiral-shaped.

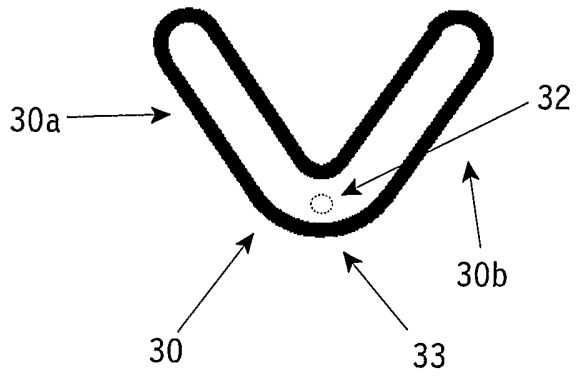


Fig. 1

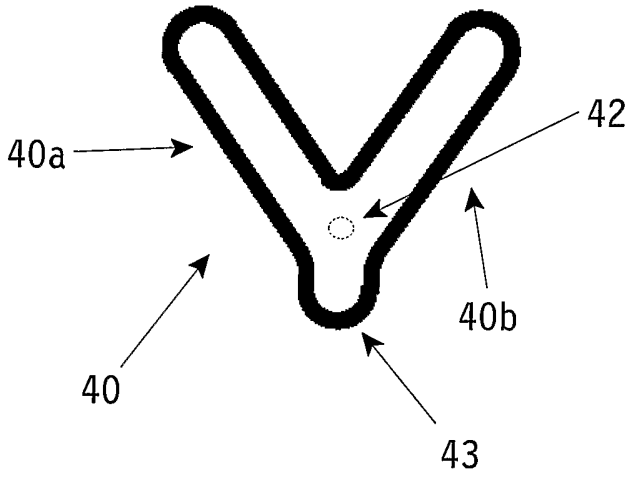


Fig. 2

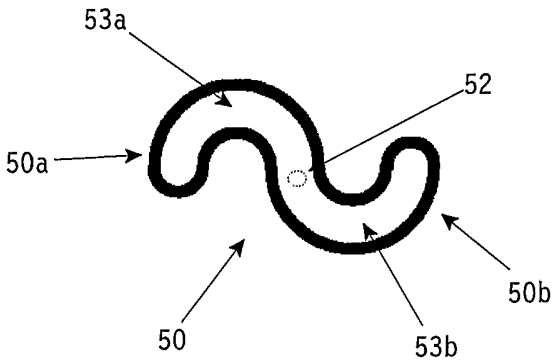


Fig. 3

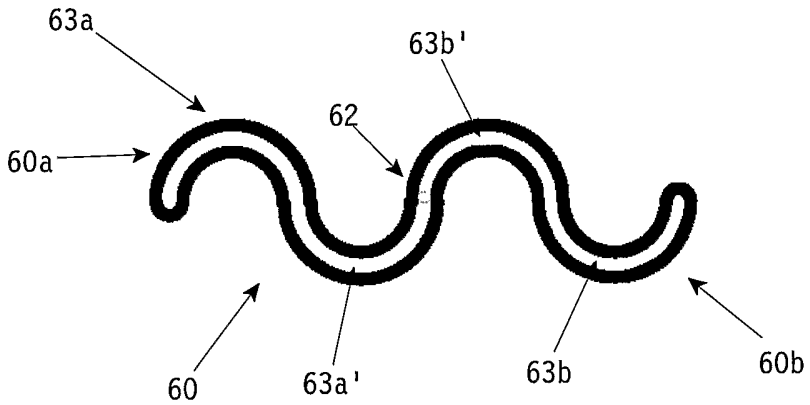


Fig. 4

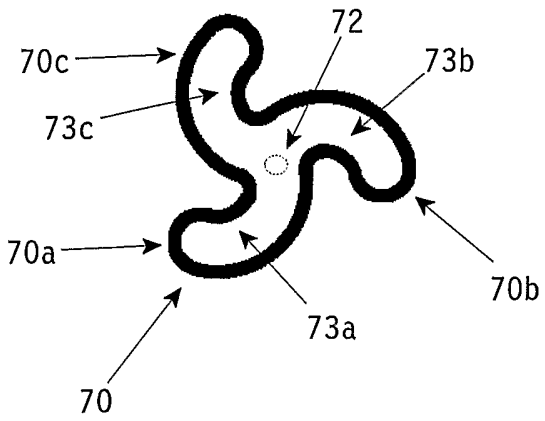


Fig. 5

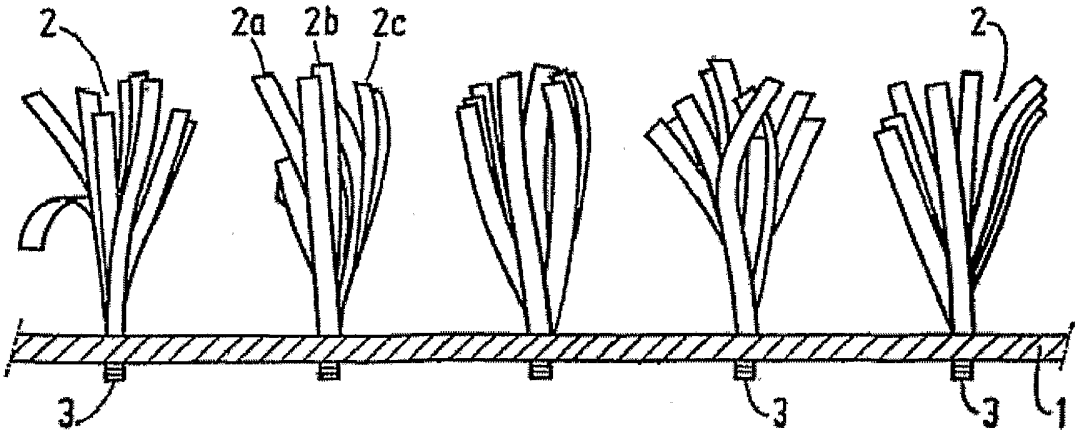


Fig. 6

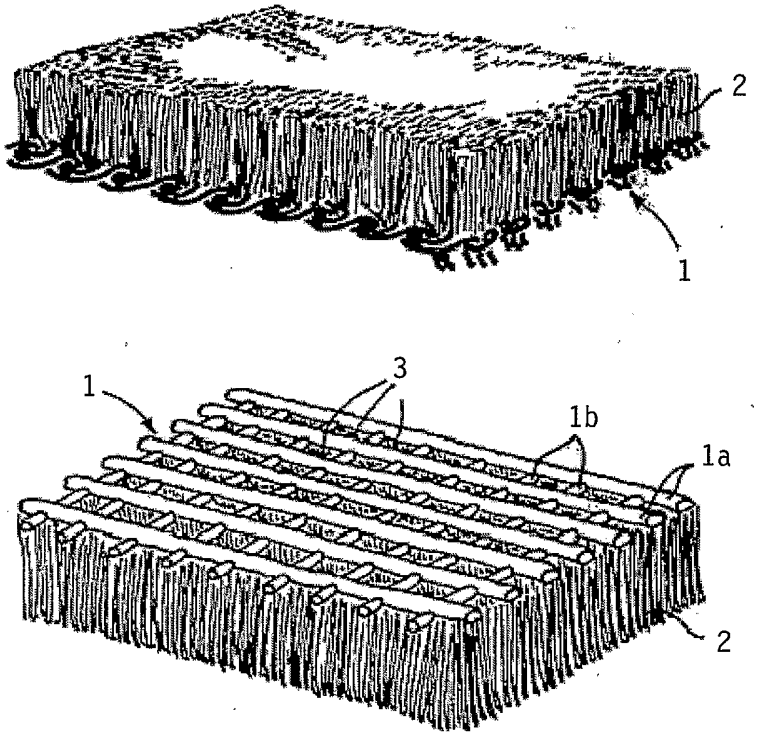


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. E01C13/08

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)
E01C D01D

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 4 176 150 A (BROMLEY, JAMES E ET AL) 27 November 1979 (1979-11-27) the whole document	1-11
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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