May 19, 1970 J. VINICKI 3,513,062

SYNTHETIC TURF SURFACE

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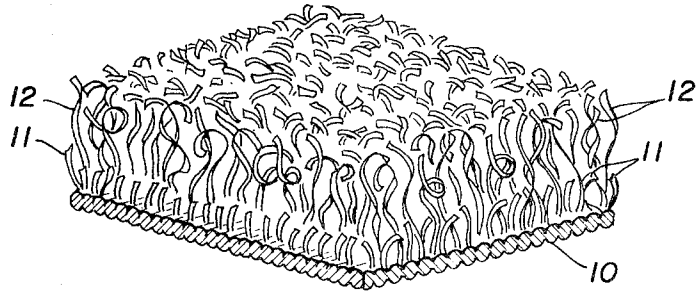


FIG. 1.

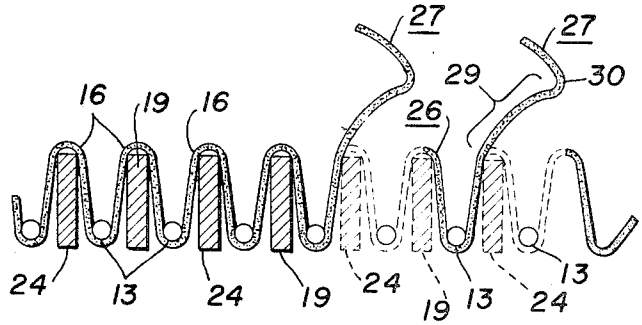


FIG. 2.

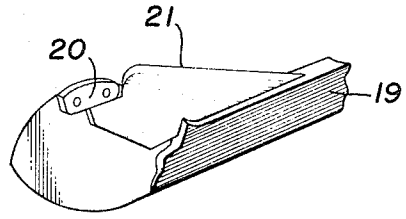


FIG. 3.

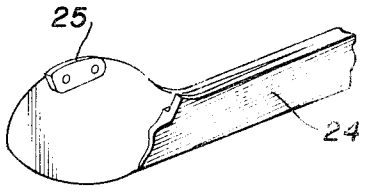


FIG. 4.

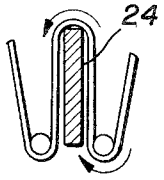


FIG. 5.

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SYNTHETIC TURF SURFACE

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Continuation-in-part of application Ser. No. 695,189, Jan. 2, 1968. This application May 14, 1968, Ser. No. 728,983

Int. Cl. D03d 27/00

U.S. Cl. 161—21 9 Claims

ABSTRACT OF THE DISCLOSURE

A synthetic turf is disclosed which is particularly useful as a golf green. The turf is a woven fabric having cut thermoplastic monofilament ribbons extending from a base. At least 20% of the ribbons are of one length and at least 20% of the ribbons are at least twice as long. The longer ribbons have a curved portion and intermingle with each other over a substantial surface area of the turf to give the appearance and feel of natural grass.

The method of making the same comprises fabricating a carpet structure having a backing from which extends a plurality of courses of loops of a synthetic filament, the loops being positioned in rows extending transverse to the courses. A first row of loops is severed near the tips thereof and a second row of loops adjacent to the first row is pulled to remove from the backing that portion of each filament extending to the point of severing in the first row. The severing and pulling steps are repeated sequentially along the carpet to transform it from a loop to a cut pile carpet.

This application is a continuation-in-part of application Ser. No. 695,189, filed Jan. 2, 1968.

It is known to make simulated-grass carpeting or synthetic turf for recreational uses such as golf greens, etc. Conventionally, these simulated turf surfaces include a backing from which extends a plurality of filaments simulating grass. One of the biggest objections to known materials of this type is that ball roll on such a surface is not always true. For example, a golf ball stroked on such a surface will deviate or drift from a straight line path as it slows to a stop unless it is stroked along a line parallel to the warp direction. This is, of course, undesirable since the golfer cannot depend upon the ball to travel along a straight line.

In addition, existing simulated turf surfaces do not decelerate golf balls at the same rate as natural turf. Generally, conventional synthetic turf is only ½ to ⅓ as effective as natural turf in decelerating a golf ball. In other words a golf ball stroked with a given force, will travel 2 to 3 times as far on conventional simulated turf surfaces as it will on natural turf. This is another disadvantage of conventional synthetic turf. With these problems in mind, one of the objects of this invention is to provide a novel and improved synthetic turf.

Another object of this invention is to provide a simulated turf or grass recreational surface which does not have a tendency to deflect a rolling ball from a straight line path.

A further object of this invention is to provide a simulated-grass recreational surface having the appearance of natural grass.

Still another object of this invention is to provide a synthetic turf having ball deceleration characteristics similar to natural turf.

A further object of this invention is to provide a simulated-grass recreational surface which has a backing from which extends a plurality of synthetic filaments in ribbon form, portions of the synthetic filaments having a molecular orientation which varies from one side of the filament to the other.

Other objects and advantages of the invention will become apparent when the following detailed description is read in conjunction with the appended drawing, in which—

FIG. 1 is a perspective view of a swatch of the synthetic turf or recreational surface of the present invention,

FIG. 2 is an enlarged cross-sectional view showing the manner in which the looped pile is cut and pulled out of the backing layer to provide a cut pile carpet,

FIG. 3 is an enlarged view of a conventional wire used in a carpet loom showing the knife utilized to cut the looped pile,

FIG. 4 is a perspective view of a carpet loom wire with the cutting blade removed, and

FIG. 5 is an enlarged cross-sectional view showing the manner in which the pile filaments are pulled across the sharp corners of the wire as the wire is withdrawn from the row of loops.

In accordance with the present invention there is provided a synthetic turf having a backing and a plurality of synthetic thermoplastic monofilaments extending therefrom. The filaments extend from the backing in at least two lengths. One of said lengths extends from the backing a distance which is at least twice the distance of the other length. This longer length has a curved portion. For convenience, the short length will be referred to as a first length and the long length will be referred to as a second length. At least 20 percent of the extending monofilaments are composed of the first length and at least 20 percent are composed of the second length. It is preferred that each length comprise half of the extending filaments but this proportion may vary within the prescribed limits. It has been found that at least 20 percent of the monofilaments must be of the second, or longer, length in order that the curved portions thereof intermingle with each other over a substantial surface area of the turf to give the appearance and feel of natural grass.

One embodiment of the process of the present invention contemplates making a simulated-grass recreational surface or synthetic turf by weaving a loop pile carpet structure, the loops of said carpet structure being made of a synthetic monofilament having a flat, ribbon-like configuration. A first row of loops is cut near the tips thereof and then tension is applied to an adjacent row of filaments to pull out the cut ends out of the backing layer. These two steps are repeated alternately along the carpet to provide a cut pile carpet having pile filaments of two different lengths.

Referring now in detail to the drawing, in FIG. 1 there is shown a simulated-grass recreational surface comprising a backing **10**, from which extend a plurality of synthetic monofilaments in two lengths, **11** and **12**, with length **12** extending at least twice the distance of length **11**. The monofilaments of length **12** also have a curved portion. The backing layer **10** is a woven structure which can be fabricated on a carpet loom in such a manner that picks **13** hold filament loops **16** in an upright position. For clarity the warp threads are omitted from the drawing. This type of carpet weaving is conventionally done on a Wilton or Velvet loom.

The filaments making up the loops **16** are extruded synthetic thermoplastic monofilaments in ribbon form and have a denier of at least 300 and preferably within the range of 300 to 1200, a width in the range of 0.01–0.3" and a thickness in the range of 0.001–0.003". The filaments, which are generally flat and ribbon-like to simulate natural grass and possess suitable bending properties, may be pigmented green to simulate the color of grass. Other colors may be used for special effects.

By "ribbon" is meant an extruded thermoplastic monofilament having a substantially rectangular cross-section.

Among the thermoplastic compositions which may be used for making the ribbon are nylon, polypropylene, acrylic, polyester (e.g. polyethylene terephthalate), etc. Of these, nylon is preferred.

The monofilament ribbons run along the backing layer in courses as shown in FIG. 2 with the loops **16** being arranged in rows perpendicular to the courses. At the stage of the fabrication the recreational surface has the construction and configuration of a woven loop pile carpet.

The wires used in the weaving of this recreational surface are those conventionally used in the making of cut pile woven carpets with the exception that the knives utilized for cutting the loops are removed, from e.g., half of the wires (i.e., every other wire). FIG. 3 shows the conventional wire **19** which has an enlarged head **20** and a cutting blade **21**. When the wire **19** is pulled along the row of loops to remove it therefrom, the blade **21** will sever each loop at or near the tip thereof to convert the carpet from a loop pile carpet to a cut pile carpet.

FIG. 4 shows a wire **24** having an enlarged head **25** but no cutting blade **21**. The purpose of this wire **24** will be explained hereinafter.

The wires **19** and **24** are used alternately in fabricating the recreational surface. In other words, if it is desired, as preferred, to make a turf with 50 percent long length and 50 percent short length monofilaments, as the carpet is woven each wire **19** will be positioned between two wires **24** and each wire **24** will be positioned between two wires **19**. A number of these wires are utilized in weaving the carpet and as each new loop **16** is formed the wire most remote from the loop is pulled out of its row of loops in a well known manner.

The first row of loops is formed on one of the wires **19** with a blade **21** while the second row of loops is formed on one of the wires **24** without a cutting blade. When the wire **19** in the first row of loops is withdrawn the blade **21** severs the row of loops near the tips thereof. Then when the wire **24** (without a blade) is withdrawn from the next row of loops the enlarged head **25** applies tension to the loops in this row to pull out of the backing layer that portion of each of the filaments extending to the cut made in the first row of loops. The third wire, which has a blade **21**, is then withdrawn and the blade **21** severs the loops in this row at the tips thereof. Then when the fourth wire which has no blade is withdrawn, it pulls out that portion of each of the filaments extending to the cut in the preceding row. These steps of severing and pulling are repeated sequentially on the successive rows of loops.

As shown in the drawing the synthetic turf product has approximately 50 percent short length and 50 percent long length ribbon making up the pile, that is, every other loop is cut. It is to be understood, however, that this is only a preferred method of making the product of the invention. It is of course possible to vary the sequence to provide for more or for less of the longer filaments.

It can readily be seen that the cutting and pulling operations performed successively along the carpet as described hereinabove result in a synthetic turf having a cut pile of two different lengths. The length of the shorter cut pile filaments **26** will be substantially equal in length of the looped pile **16** prior to the cutting. The length of the longer cut pile filaments **27** will be (measured along the filament) approximately two to three times the length of the shorter filament **26**. While the shorter filament **26** will have a fairly straight configuration, the longer filament **27** will have a configuration similar to that shown in FIG. 2. Each of the longer filaments **27** has a curved portion **29** and a fairly sharp bend or elbow **30**. The bend or elbow **30** is caused by deformation of the filament **27** which is caused as tension is applied to the filament **27** as it is held by the pick **13**.

The curved portion **29** is a result of pulling the filament **27** under tension over the sharp edges of the wire **24**. The wire **24** is thin and has relative sharp corners. As the enlarged head **25** passes through the loop it applies tension to the filament **27** which, as it pulls out of the backing layer, is drawn across the sharp edges of the head **25** under tension. This effects a change in the molecular orientation of the side of the filament **27** in contact with the sharp edges of the wire **24**. Since the molecular orientation on one side of the filament is different from that on the other side, the filament will tend to bend or curl as illustrated in FIG. 2.

It is not quite understood why but a golf ball stroked across this surface travels along a straight line with no deviation therefrom as the ball comes to a stop. Perhaps it is because the longer filaments **27**, while retaining basically the configuration shown in FIG. 2, tend to assume random positions (rather than the orderly positions shown in FIG. 2) so that the same resistance is offered to the ball regardless of its direction of travel relative to the warp of the fabric. Of course, if this fabric is utilized on a slope the force of gravity will have some effect on the direction of ball travel. However, this direction of travel will not be influenced or changed because of the nature of the surface **12**.

A further advantage of this synthetic turf is that the ball deceleration rate on this turf is very similar to that of natural turf. On conventional synthetic turf a golf ball will roll several times as far, when impelled by a given force, as it will on natural turf. This undesirable characteristic is overcome in the present invention.

It is of course within the purview of the present invention to construct a synthetic turf wherein the filament loops **16** are composed of a plurality of monofilament ribbons, for example, prior to being woven into the backing, a plurality, say six, ribbons are grouped together and thereafter, this group is woven into the backing. In some cases, this is even preferred since when these loops are cut, the several ends of the short length tend to flair out from each other, and likewise, when pulled from the backing, the ends of the long length separate causing more intermingling thus producing a closer resemblance to natural grass.

It is to be understood that the embodiment disclosed herein merely illustrates the invention and that numerous other embodiments can be contemplated without departing from the spirit and scope of the invention.

What is claimed is:

1. A simulated grass-like woven product comprising a warp and fill backing layer, and a plurality of synthetic thermoplastic cut pile monofilament ribbons anchored in the backing layer and extending therefrom, said ribbons having a denier in the range of 300 to 1200 and a width at least three times greater than its thickness, at least 20 percent of said monofilament ribbons extending a first length and at least 20 percent of said monofilament ribbons extending a second length which is at least twice as great as said first length, said longer monofilament ribbons having along at least a portion of the length thereof a molecular orientation which varies from one value on one side of said monofilament ribbon to another value on the other side of said monofilament ribbon to thereby impart a curl to each monofilament ribbon.

2. The product as defined in claim **1** wherein said longer monofilament ribbons intermingle with each other over a substantial area of said product.

3. The product of claim **1** wherein the longer ribbons include a curved portion connected to an elbow shaped bend which terminates at a cut end.

4. The product as defined in claim **1** wherein the thermoplastic is nylon.

5. The product as defined in claim **1** wherein the thermoplastic is polypropylene.

6. The product as defined in claim **1** wherein the thermoplastic is polyester.

7. The product as defined in claim **1** wherein the ther-

moplastic monofilament is nylon in the form of a ribbon having a substantially rectangular cross-section.

8. The product as defined in claim 1 wherein the thermoplastic monofilament is polypropylene in the form of a ribbon having a substantially rectangular cross-section.

9. The product as defined in claim 1 wherein the thermoplastic monofilament is polyethylene terephthalate in the form of a ribbon having a substantially rectangular cross-section.

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