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FLOCKED GOLF GREEN

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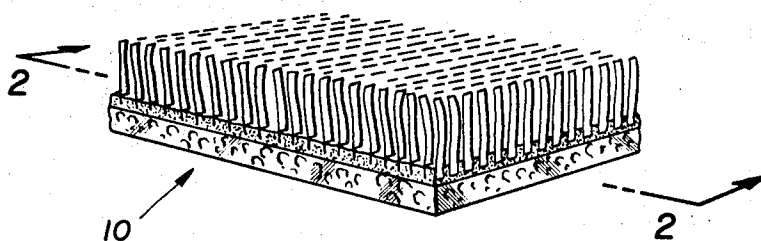


FIG. 1.

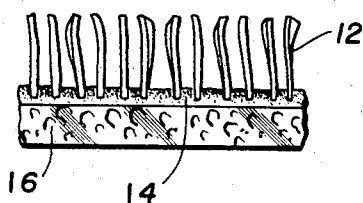


FIG. 2.



FIG. 3.



FIG. 4.

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FLOCKED GOLF GREEN

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10 Claims

ABSTRACT OF THE DISCLOSURE

Synthetic golf green products are made by a mechanical or an electrostatic flocking process using pigmented, thermoplastic ribbon on a synthetic adhesive backing or on fabrics constructed from natural fibers. The resulting product has the advantages of exhibiting true putting and chipping characteristics because of the non-directional pile and resiliency of the synthetic green.

BACKGROUND OF THE INVENTION

(A) Field of the invention

This invention pertains to a man-made, golf-green product that is made by projecting or spraying short lengths of pigmented, synthetic fiber onto a suitable endless, moving backing. A layer of a suitable adhesive is applied to the backing before the solid, particulate material is impacted so as to coat and bond the ribbon to the backing simultaneously. The method by which the product of this invention is made is known as flocking.

(B) Description of prior art

A considerable commercial interest has developed in synthetic or man-made turfs. The classical example of a good synthetic turf has been disclosed in patent application S.N. 526,007 filed Dec. 28, 1965, now U.S. Pat. No. 3,332,828 which has been used for many athletic activities such as baseball, football and soccer. This product is made by weaving nylon ribbon onto a polyester or an acrylic backing and coating said backing with a polyvinyl chloride foam. The synthetic turf described above is outstanding for practically all athletic events because the height and density of the pile and the cell size and thickness of the foam can be adjusted to give ball responses similar to natural turf.

Different problems which relate to putting and ball rebound have been encountered in the use of such synthetic turfs when used as golf greens. Putting characteristics have been found to be altered considerably in speed and direction as a result of the direction of pile lay. If a golf ball is stroked against (in the opposite direction of) the pile there is an abnormal reduction in the velocity of the ball and, by contrast, there is an abnormally slow deceleration of the ball when stroked with (in the direction of) the pile lay, resulting in an abnormally high ball velocity.

Similarly, there is a pronounced change in direction of the ball when stroked at various angles to the pile lay resulting in untrue and highly variable putting characteristics. The change in direction that a rolling ball undergoes is known as deceleration deviation and is defined as the angle, in degrees, that is formed by the points at which the accelerating force is removed and at which the ball comes to rest. When putting golf balls on conventional, experimental synthetic turfs it has been found that deceleration deviations encountered were up to 25°, depending on the particular angle from the pile lay direction. Another measured parameter that is used to characterize the dynamic responses of synthetic turf is known as deceleration modulus and is defined as the distance required for a ball to come to rest from the point at which it had a velocity of 0.3 mile/hour.

Putting activities carried out under conditions similar to those described above have proved marked changes in deceleration moduli occur again, as a function of pile lay direction. It can be seen intuitively that stroking the ball with the pile lay will result in a much "faster" green whereas stroking the ball against the pile lay will result in a much "slower" green when compared to natural greens. Similarly, a ball putted at intermediate angles will result in a range of deceleration moduli, which is undesirable. In actual measurement on conventional synthetic turf, deceleration moduli have been known to vary from 100 percent to 50 percent of the value observed on natural golf greens, depending on the direction of pile lay.

In attempting to solve the above described problems on conventional synthetic turf it has been found that pile height played an important role. A reduction in pile height tended to reduce deceleration deviation to a suitable level, however, this resulted in a much higher deceleration modulus and a much faster green, as compared to natural turf. For example, higher forces are needed to bend the ribbon tips in very short pile heights to the extent that a golf ball tends to skid across the surface on the blade tips rather than roll on bent ribbons. Conversely, increases in pile height have been found to reduce the deceleration modulus to a suitable level, but increase deceleration deviation so that a change in pile height alone will not produce the desired deceleration moduli and deviations.

Different construction types have been investigated also in an attempt to solve the above mentioned problems. Again, modifications in weaving, tufting and knitting constructions have not been known to result in the desired ball roll characteristics. In each case, the relative ribbon orientation is essentially uniform because of the flat ribbons and therefore resulted in the pile laying preferentially in one direction. Furthermore, it is believed that the above mentioned problems will continue to exist in varying degrees as long as the ribbons remain oriented in a uniform manner.

The discovery has been made however to overcome this problem by randomly orienting the broad surfaces of the ribbons in a flocked construction. When the flocked product of this invention is used as an artificial golf green it was found to overcome the problem of pile lay and resulted in putting characteristics similar to natural turf. Similarly, the problem of ball holding was overcome and quite surprisingly the flocked golf green exhibited ball responses similar to natural turf.

The product of this invention is unique in that it possesses the appearance and the ball response characteristics of natural golf greens and is heretofore unknown. In the past some grass-like products have been made by flocking, however none have utilized a ribbon because of the technological difficulties encountered in flocking ribbons. Serious technological problems were encountered in the preparation of a useful flocked synthetic turf product. In our preliminary attempts to prepare the flocked synthetic turf of this invention we found that unsatisfactory products resulted from conventional practice. These products exhibited a random and excessive "lay-down" of the ribbon and gave the texture and appearance of an uncontrolled, highly irregular surface. The problem was found to be related to the abnormally high ribbon weight as compared to low denier fibers. After considerable efforts this problem was solved by using a suitable adhesive composition that was capable of holding the ribbon in the proper angle and position during the flocking process.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a synthetic turf for use in golf greens. More specifically, it is an object of this invention to provide a synthetic turf that exhibits golf-ball responses similar to natural turf, yet is

economical to produce. Accordingly, this invention comprises a man-made turf product comprised of synthetic ribbons having a denier of about 250 to 750, a width to thickness ratio of about 10, being precision cut to about 0.2 to 0.4 inch in length, flocked onto an endless width of a synthetic foam or other fabric coated with an adhesive such that the product exhibits golf-ball responses similar to those of natural greens.

The mechanism by which the product of this invention gives rise to ball responses essentially the same as those of natural golf greens is not known, however it is believed that random orientation of the pile and variable shock absorption characteristics of the randomly oriented ribbon are the principal factors. This random orientation overcomes the problem of pile lay completely. Furthermore, pile height becomes less critical in the product of this invention since ribbon height and denier can be selectively adjusted to duplicate the "speed" of a natural green. This is accomplished by the use of different ribbon sizes throughout the construction. Either the pile is of different heights such that the lower pile ribbon supports the ball during its roll while the higher pile ribbon succeeds in reducing the speed of the ball or the pile is comprised of two denier sizes whereby the smaller denier tends to slow down the ball. Preferably the higher pile is comprised of the lower denier ribbon than the shorter pile because of the different function of each. In actual tests, these greens can be constructed easily in such a way as to give a deceleration deviation of not more than 2 percent and a deceleration modulus of not more than 5 percent.

The advantage of the product of this invention is that it can be tailored to exhibit the desired golf-ball responses, yet is non-directional, maintenance free, water proof, not dependent on climatic conditions, wear resistant, rot proof, non allergenic, mildew resistant and is economical to produce. Heretofore no such product has been known to exist.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 represents a perspective view of the product of this invention including a foam underlay.

FIG. 2 is a cross-sectional view of a portion of the synthetic golf green of the product shown in FIG. 1, enlarged, illustrating the construction of the preferred embodiment.

FIG. 3 is a cross-sectional view of the product shown in FIG. 2 without the foam backing.

FIG. 4 is similar to FIG. 3 showing an enlarged cross-section of the product utilizing ribbons of two different pile heights in a single construction.

Referring to FIG. 1, the numeral 10 denotes the product of this invention in its preferred form. As more clearly shown in FIG. 2, the ribbons 12 are secured in an adhesive backing 14 which has a foam underlay adhered thereto. Since the product can be used without the foam underlay 14 by the proper selection of a suitable backing adhesive, such an embodiment is illustrated in FIG. 3.

Another embodiment of the invention is shown in FIG. 4 to illustrate the higher ribbons 20 and the shorter ribbons 22 which further improve the grass-like properties of the product. If preferred an underlay as shown in FIG. 2 may be employed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following examples illustrate various embodiments in full detail of the present invention which can be made without departing from the scope set forth herein.

Example I

A preferred embodiment was produced by precision cutting 500 denier, green-pigmented, nylon ribbon, having a cross-section of about 80 by 800 microns into 0.250 inch lengths. The ribbon lengths were mechanically flocked following conventional procedures onto a poly-

vinyl chloride foam about $\frac{3}{16}$ inch thick, which had been coated with a Rhoplex acrylate polymer adhesive which is a self-cross linking acrylic emulsion manufactured by Rohm and Haas Company. The nylon ribbon flock was applied at a density of about 12 oz./sq. yd., and the flocked fabric was heated in an oven for 5 minutes at 260° F. to dry and cure the adhesive. The synthetic flocked product had an appearance resembling closely cropped natural grass turf.

The flocked product of this example was subjected to the previously noted ball response tests. In these tests it was found that the deceleration deviation did not exceed 2 percent in any direction, which is well within the desired limits and the deceleration modulus was not more than 5 percent of the natural green tested. The mechanism by which such outstanding improvements were achieved is not known fully at this time; however, it is believed that the random manner in which the flat ribbon flock is applied to the adhesive is primarily responsible for imparting non-directional, natural turf-like characteristics to the product.

Example II

The method of Example I was repeated using a 1/1 (wt.) blend of 300 and 500 denier nylon ribbon having a width to thickness ratio of about 10, both types of ribbons being precision cut to 0.375 inch flock. The fibers were mechanically flocked, using conventional procedures, onto a woven jute backing which had been precoated with a base coat of the adhesive to fill the interstices of the weave and provide a level base for the application of the final adhesive and flock. The adhesive employed was an aqueous solution of Rhoplex acrylate polymer thickened with 8 percent methyl cellulose. The flock was applied at a density of about 14 oz./sq. yd. to produce a synthetic turf-like surface.

Tests indicated that this surface was slightly slower with regard to ball roll than the product of Example I. This is contributed by the blend of 300 denier ribbon pile.

Example III

The method of Example I was repeated using a 1/1 (wt.) blend of 300 denier nylon ribbon having a width to thickness ratio of about 10, precision cut to 0.375 inch and 500 denier nylon ribbon having a width to thickness ratio of about 10, precision cut to 0.250 inch. The fibers were mechanically flocked, using conventional procedures onto a $\frac{3}{16}$ inch polyvinyl chloride foam which had been coated with a Rhoplex acrylate polymer adhesive. The flock was applied at a density of about 13 oz./sq. yd. and the product was cured for 5-6 minutes at about 260° F. in an oven.

The product closely resembled natural golf greens in appearance and golf ball responses. The deceleration deviation was less than 2 percent and had a deceleration modulus comparable to that of most natural golf greens.

Example IV

A series of experiments was conducted to optimize the mechanical flocking conditions when using an adhesive marketed by Verona Dyestuffs comprised of Verona Acroflux LUS acrylic polymer emulsion containing 15 percent Verona Acrafix LDU catalyst. The Acroflux LUS is a viscous synthetic resin which is cross-linked by the Acrofix LDU catalyst. A woven jute backing fabric was precoated with the adhesive and dried to fill the interstices of the weave. A top coat of the adhesive was then applied and one sample flocked immediately while other samples were allowed to dry for 5, 10 and 15 minutes intervals at 80° C. It was found that the samples flocked immediately and after 5 minutes drying time had excessive amounts of flock bonded in a horizontal position rather than standing erect on the base surface. The samples flocked after 10 and 15 minutes drying time had a proportion of the desirable perpendicular fibers, but the

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10 minutes drying time was preferred since it provided better adhesion of the flock.

Example V

A synthetic turf-like surface covering was produced by electro-statically flocking 500 denier nylon ribbon which was precision cut to 0.20 inch. The flock was applied at a density of 15 oz./sq. yd. to a woven cotton duck backing fabric which had been coated with an acrylic polymer adhesive. After drying the flocked fabric had a uniformly erect pile and the fibers were securely attached to the backing fabric.

While in the foregoing specification the invention has been set forth in considerable detail for the purpose of making an adequate disclosure thereof, it will be apparent to those skilled in the art that numerous changes may be made without departing from the principles of the invention. Accordingly, there is no intent to limit the invention beyond the scope of the appended claims.

What is claimed is:

1. A flocked product suitable for use as a synthetic golf green and having a substantially uniform deceleration modulus, said product having a surface composed of cut-pile thermoplastic ribbons vertically held in an adhesive backing, said ribbons being characterized by a width to thickness ratio of about 10 to 1 and a denier of about 250 to 750 and being randomly dispersed in said backing to provide a substantially non-directional response to an object rolled across said surface.

2. The product of claim 1 in which the amount of directional drift is less than 2 percent in any direction.

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3. The product of claim 1 further characterized by a mixture of two groups of ribbons having different lengths to provide a high-low pile.

4. The product of claim 1 in which the ribbons are extruded from a pigmented thermoplastic composition.

5. The products of claim 4 in which the ribbons are nylon.

6. The product of claim 4 in which the ribbons are polypropylene.

7. The product of claim 1 further characterized by a resilient material adhered to the adhesive backing.

8. The product of claim 2 in which the ribbons are nylon.

9. The product of claim 2 in which the ribbons are polypropylene.

10. The product of claim 1 wherein the ribbons have a length of between about 0.2 and 0.4 inch.

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