Nov. 2, 1965 M. CARTER 3,215,436

OPEN-CELLED STRETCHABLE PUTTING SURFACE AND ASSOCIATED STRETCH MEASURING MEANS

Filed April 3, 1962 2 Sheets-Sheet 1

FIG. 2

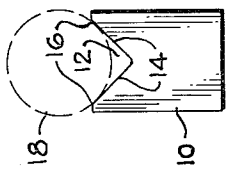


FIG. 1

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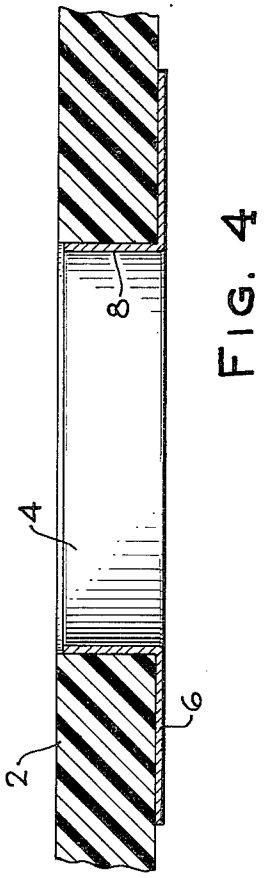


FIG. 4

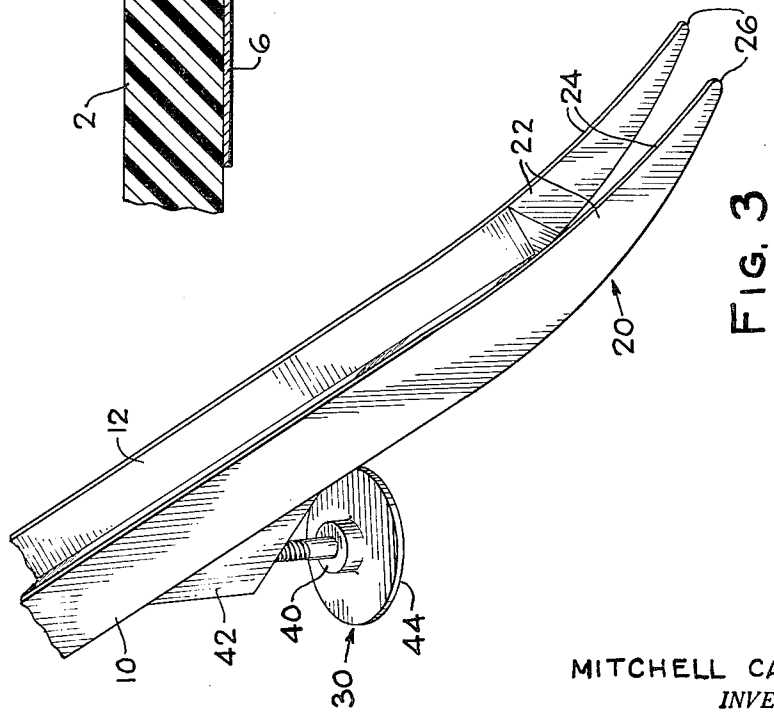


FIG. 3

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3,215,436

OPEN-CELLED STRETCHABLE PUTTING SURFACE AND ASSOCIATED STRETCH MEASURING MEANS

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Filed Apr. 3, 1962, Ser. No. 184,750
2 Claims. (Cl. 273—176)

This invention relates to artificial or synthetic putting greens adapted for use by golfers in practicing putting or when playing golf, and is directed particularly to constructions which may be varied to create conditions corresponding to those of either a "fast" green or a "slow" green or putting greens having some intermediate characteristics.

Numerous types of synethetic putting greens have been constructed heretofore but their characteristics have seldom, if ever, served to duplicate those encountered in actual play on a golf sourse. In fact, there has never before been any standard or means by which the "fastness" or "coefficient of putting friction" of either a natural or synthetic putting green could be determined or measured. The terms "fast" and "slow" have, therefore, been purely relative terms representing the current opinion of each individual player. It also is well known that the different greens on a golf course vary one from another and even the same green will vary from day to day, or even from hour to hour, so as to be either "fast," "medium" or "slow" depending upon the length and condition of the grass and whether the grass is wet or dry. The synthetic putting greens of the prior art have not been capable of variation to simulate such varying conditions or to permit practice or play under any and all of the conditions actually encountered in play on the usual grass green of a golf course.

In accordance with the present invention, these objections and limitations of prior art synthetic putting greens are overcome and constructions are provided which may be varied to enable one to practice putting or to play under all of the conditions encountered in normal play on a golf course. The present invention also serves to provide a definite and specific standard of measurement by which the characteristics of either synthetic or grass putting greens may be established and compared.

These advantages of the present invention are attained by providing a sheet or playing surface which is formed of material having predetermined physical properties falling within specific ranges and characterized by a coefficient of putting friction falling within a specific range as determined by an instrument which will serve to provide an accurate measurement of the coefficient of putting friction of a putting green.

In accordance with the present invention, the sheet or playing surface is capable of being stretched or otherwise altered to a greater or less extent so as to alter the characteristics of the putting surface and change the properties of the surface over which the ball will roll in putting practice. The material employed is preferably cellular or porous in nature and is flexible and elastic in character. Upon stretching such material, the yielding characteristics thereof are varied and the cells or pores therein are elongated or changed in shape so that the coefficient of putting friction or resistance to the movement of a ball thereover can be changed to correspond to the conditions presented by either a "fast" green, a "slow" green or a green having various intermediate characteristics. In the alternative or in addition, the synthetic putting green may be provided with upper and lower surfaces possessing different coefficients of putting friction and the green may simply be turned over or may be both turned over and stretched to present different and desired coefficients of putting friction.

Moreover, the flexible nature of the material permits it to be placed on an irregular lawn, sand pile or other surface for practicing the putting of side hill shots or shots over an undulating surface of a fast or slow golf green. In fact, synthetic putting greens embodying the present invention may be applied over existing grass putting greens which are in a poor or rough condition or when it is desired to provide either uniform or specifically varied conditions in a green for tournament play or for variety and interest. The changes in character of a putting green thus afforded, provide for infinite variation in the type of shot being practiced or played so as to render practice putting or playing of a course much more interesting and instructive than has been possible heretofore.

Accordingly, the principal object of the present invention is to provide a synthetic putting green which possesses characteristics closely approaching those actually encountered on a golf course.

A further object of the invention is to provide a synthetic putting green which is variable to alter the properties thereof and to simulate the conditions of a slow, medium or fast green.

Another object of the invention is to determine the properties and establish standards for grass putting greens and to provide synthetic putting greens possessing properties conforming to such standards.

A specific object of the invention is to provide a synthetic putting green formed of cellular or porous material which is flexible and elastic and capable of being altered to vary the characteristics of the playing surface thereof.

These and other objects and features of the present invention will appear from the following description thereof wherein reference is made to the figures of the accompanying drawings.

In the drawings:

FIG. 1 is a perspective illustrating a typical form of synthetic putting green and standardizing means therefor embodying my invention;

FIG. 2 is an enlarged end view of the standardizing means shown in FIG. 1;

FIG. 3 is a perspective illustrating the foot of the standardizing device of FIG. 2; and

FIG. 4 is an enlarged sectional view through the synthetic putting green illustrated in FIG. 1.

In that form of the invention chosen for purposes of illustration in the drawings, the synthetic putting green embodies a sheet of flexible and elastic material which may have any suitable area desired up to that of a full-sized conventional putting green. The sheet presents a smooth upper surface **2** over which a golf ball may roll. A "cup" **4** may be positioned in or on the surface of the sheet **2** and may be located in the center or in any other desired location in the sheet. As shown in FIG. 4, the "cup" **4** is in the form of a circular opening within the sheet **2** and is reinforced about its edges by means of a sheet of relatively inelastic material **6** which is secured to the lower surface thereof about the "cup" or opening **4**. The inelastic sheet **6** may be formed of canvas, heavy paper, thin sheet metal or any other material desired to prevent distortion of the cup when the sheet **2** is stretched. In this way, the opening **4** serves to provide a cup which will have the same characteristics as the ordinary metal cup inserted in the surface of a conventional grass green on a golf course.

There has never before been any standard of measurement of any testing means by which the fastness or putting characteristics of a putting green could be accurately determined or compared with those of any other putting green or surface. Therefore, in order to produce a synthetic putting green which would possess characteristics comparable to those of a grass putting green, it was nec-

essary to create a testing and measuring device in order to establish the putting characteristic or the coefficient of putting friction which were possessed by any natural green and by greens which differed in their action by reason of differences in the length of the grass, wetness of the green, direction of cut or "grain" of the grass, and other variables encountered in actual play of a golf green.

The testing device illustrated in the drawings was, therefore, invented and has been found to produce results which can be measured accurately and consistently under all conditions of usage on both grass putting greens and synthetic putting greens. This device embodies an elongated track **10** which presents a channel **12** on its upper surface which is V-shaped in cross section, with the sides **14** of the channel extending at an angle of 90° with respect to each other and spaced 1¼ inches apart at their edges **16** where the sides are engaged by a standard golf ball **18** placed on the track. The lower end **20** of the track is formed with spaced parallel extensions **22** which are also spaced 1¼ inches apart and provided with a curved shaped upper surface **24** tapering to the points **26**. The surfaces **24** have a radius of curvature of 1.5 feet and extend through an arc of 25° from the lower end **20** of the track **10**.

The track **10** is arranged in an inclined position and accurately located with respect to the surface of the putting green by means of the tripod support **28** and the adjustable foot **30**. The tripod is preferably formed with a central column **32** pivotably secured to the track **10** by an adjustable connection **34** and slidable vertically with respect to the tripod support **28**. A thumb screw **36** serves to hold the column **32** and track **10** in the desired elevated position. For test purposes, the track **10** is inclined at an angle of 30° with respect to the horizontal. A spirit level **38** having a base positioned at such a 30° angle may be placed on the track **10** to assure accurate positioning and inclination of the track. The curved lower end **20** is adjusted with respect to the surface of the green or length of grass by the foot **40** which is threaded into a holder **42** on the lower surface of the track **10** and provided with a relatively large lower padded surface **44**. For test purposes, the foot **40** is adjusted so that the maximum distance of travel will be attained when a standard golf ball is placed in a known position on the track and released to roll over the surface of the putting green. Ordinarily, two or three adjustments of the foot **40** will serve to establish the correct position for any green.

In order to assure travel of the ball in a predetermined direction or over a specific path from the lower end of the track **10**, the upper end of the track may be moved laterally. In this way, the track may be aimed at the cup **4** or toward any other desired point with the assurance that under the same conditions of testing the ball will always travel over the same path and to substantially the same point on the green. In fact, the average results obtained under any given condition of the green have been found to be remarkably consistent as demonstrated by thousands of tests which have been conducted with the testing device described above.

For test purposes, the track **10** is graduated in tenths of a foot from the tip **26** of the extension **22** of the track. Then when a standard golf ball is released from a position eight feet up the track from the tip **26** while the track is inclined at an angle of 30°, it is said to have a "Force" of "80." Since the "Force" will differ with the inclination of the track, the inclination of 30° has been adopted as standard in all of the tests hereafter referred to. Similarly, the "Force" may be varied by releasing the ball from different positions on the track but the "Force" of "80" has been adopted as standard in all tests referred to below since this "Force" has been found in practice to be a satisfactory one to use under widely varying conditions of grass and synthetic putting greens.

In order to express the coefficient of putting friction of any green in its simplest, yet most accurate and mathematical, terms for comparision with other greens, the "Force" has been divided by the distance which the ball is found to roll. Therefore, the term "coefficient of putting friction" as used in this description is referred to as

$$\text{COPF} = \frac{\text{Force}}{\text{Distance}}$$

and in the tests described

$$\text{COPF} = \frac{80}{\text{Distance}}$$

After extended testing and when using the golfers' terms, it is found that grass putting greens have the following characteristics:

Term	Force	Distance	COPF
"Very slow"	80	17.5 to 19 ft.	4.57 to 4.21.
"Slow"	80	19.0 to 20.5 ft.	4.21 to 3.90.
"Medium slow"	80	20.5 to 22.0 ft.	3.90 to 3.64.
"Medium"	80	22.0 to 23.5 ft.	3.64 to 3.40.
"Medium fast"	80	23.5 to 25.0 ft.	3.40 to 3.20.
"Fast"	80	25.0 to 26.5 ft.	3.20 to 3.02.
"Very fast"	80	26.5 to 28.0 ft.	3.02 to 2.86.

Thus, in general it may be said that conventional grass putting greens will ordinarily be found to have a COPF not less than about 2.50 and not more than about 5.0. The greens are usually found to have a COPF in the range of about 3 to 4. All tests are conducted in the absence of wind.

Having determined the characteristics of grass putting greens as indicated above, it was anticipated that there would be little difficulty in locating synthetic materials which would have a COPF in the range of from about 3 to 4. However, this did not prove to be the case. In particular, no material was found or known to any of the many manufacturers contacted which could be varied to change the COPF over a substantial range of values as, for example, a range of from 2.5 to 5.0 or even from 3 to 4. Thus, it was soon found that carpeting or textile materials having a nap simulating grass, whether made of woven or felted fibers, tended to have too low a COPF and did not permit any significant variation in their properties. On the other hand, solid sheet materials such as rubber and plasticized resinous or plastic materials which were sufficiently soft and flexible did not possess sufficient resiliency or tensile strength to permit material stretching or variation in its COPF. Moreover, such solid sheet materials are very heavy and expensive when produced in thicknesses sufficient for use in a synthetic putting green.

Cellular materials such as sponge rubber were tested extensively, but it was found that their properties varied greatly. Thus, for example, those cellular materials, such as foam rubber and other foamed synthetic plastics in which most of the cells are closed or sealed within the body of the sheet do not possess adequate yielding properties under the weight of a golf ball since the ball is not heavy enough to compress the gas or air within the cells appreciably. Moreover, changes in temperature resulted in uncontrollable variations in the properties of the sheet as the entrapped gases expanded and contracted within the closed cells.

Those cellular synthetic plastic materials which are porous and elastic were found to offer the greatest promise, but even then, it was discovered that the size of the pores or openings in the surface of the sheet, the compressibility of the sheet, its flexibility, and even the manner in which it was produced, have a great influence on its properties and its suitability for use as a synthetic putting green. As a result, it was necessary to produce a novel material having new and unique physical properties in order to provide a synthetic putting green possessing characteristics comparable to those of the grass putting greens found on a golf course.

The composition and physical properties of the material of which the synthetic putting green is formed are found to be critical. Thus, extensive tests have demonstrated that the size of the pores in the sheet and its resiliency or indentation properties must be closely controlled in order to impart a surface condition to the sheet which will afford the desired speed, COPF or resistance to movement of a golf ball.

In practice, it is found that there should be an average of at least 5 and not more than about 15 pores or cells to the linear inch in the upper or playing surface of the sheet. However, the cells need not be uniform in size and some cells may be less than 1/15 inch in cross section, but no exposed cells should be more than about ¼ inch in diameter. These cells should be open cells and, if necessary, any skin or other smooth surface or closed cells formed on the surface of the sheet in molding, casting or forming the sheet should be cut off or broken by calendering, working or other treatment of the sheet. In actual practice, it is found that best results are attained when there is an average of from 5 to 9 open cells to the linear inch in the upper or playing surface of the sheet.

The "Indentation" or "Compression" characteristics of the sheet material suitable for use in producing a synthetic putting green are best stated in terms of the ASTM standards of March 1960—"D1564–59T" wherein the results are stated in terms of pounds per 50 square inches required for 25% indentation. This is also known as "RMA values."

It is found in practice that the RMA value may vary from about 5 to 15 pounds per 50 square inches. However, in general, the RMA value should be lower when the cells in the sheet material are smaller and higher when the cells are larger. Thus, for example, a suitable sheet having an RMA value of 5 pounds and an average cell size of 15 to the inch will generally have essentially the same COPF as a similar sheet of material having an RMA value of 15 pounds and an average cell size of 5 to the inch.

The sheets of material used may vary in thickness from about ⅛ inch to about 1 inch, but are preferably about ½ to ¾ inch in thickness.

The elasticity of the sheet material may vary somewhat, but it is preferably capable of being stretched both longitudinally and transversely up to 35% with complete recovery. When so stretched, the cells on the surface of the sheet which are engaged by the ball are elongated in the direction of stretch so that they present more nearly parallel edges held under tension and positioned closer together than when the sheet is unstretched. As a result, the frictional resistance to travel of the ball over the surface of the sheet is decreased and a condition simulating that of a "fast" green is presented.

Thus, the characteristics of a typical and preferred synthetic putting green embodying the present invention may be summarized as comprising a sheet of green cellular plastic material from about ⅛ to 1 inch thick and having from about 5 to 15 open cells per linear inch in the surface of the sheet. The sheet should have "Indentation or Compression" characteristics in the range of about 5 to 15 pounds and be sufficiently elastic to be elongated in either direction up to 35% with complete recovery. The COPF of such a sheet of material should range from about 2.5 to 5.0 and a standard golf ball should roll a distance of about 15 to 30 feet over the level surface of such a sheet under a "Force" of 80 when tested as described above.

Ordinarily, the material will have a density of from about 1.5 to 3.0 pounds per cubic foot. The material may contain plasticizers, softening agents or the like or it may be treated to impart the desired softness, resiliency or other properties required thereto. The material preferably is dyed or contains a pigment to give it a green color corresponding to that of a green golf course.

In order to produce sheets of material having these properties, it is preferable to form the sheets of a foamed or cellular composition containing polyurethane, polyethers or polyesters or blends, mixtures or copolymers thereof including plastic materials such as polyvinyl, polystyrene and polyisocyanate compositions together with alkyd resin materials, polyalkylene glycols and the like. Typical compositions of this character are described in U.S. Patents Nos. 2,965,584 and 2,999,823. However, other foamed or cellular plastic materials including foamed neoprene or other synthetic rubber type compositions may be used if desired.

A typical composition and method adapted for use in accordance with the present invention employs polyester compositions purchased from Thiokol Chemical Corporation and designated A220, Part A and Part B, together with a suitable catalyst, which compositions and cataylst are understood to be of the character set forth in U.S. Pattent No. 2,965,584.

In employing these materials, the catalyst was mixed into a "master batch" containing approximately 400 parts by weight of isopropyl alcohol, 70 parts by weight of the catalyst, 20 parts by weight of triethylamine and 90 parts by weight of castor oil. 567 parts of master batch were mixed with 80 parts of a green coloring agent and added to 3000 parts of A220, Part A. This mixture was blended with an equal amount of the A220, Part B in a mixing head by means of positive displacement pumps at the rate of about 1680 grams per minute. The opertion was carried out at a temperature of about 70° F. The speed of the motor on the mixing head was adjusted to afford the optimum mixing effect so as to produce a product having the desired cell size.

The mixture, in liquid form, was poured into a slow moving mold 3 feet wide and 6 inches deep. The exothermic heat generated during foaming of the mix raises the temperature of the foam from about 70° F. to 190° F. in about 2½ minutes. When the liquid mixture is placed in the mold to a depth of about ¼ inch, it expands to produce a foam which is about 6 inches in thickness. As soon as the foam is gelled or set and before the "bun" has cooled or shrunk or the cells have communicated, it is passed between rollers under pressure to rupture or explode the membranes of the cells whereby the cells are caused to communicate and form an open porous structure.

The bun thus produced is then sliced on a standard slicing machine to the desired thickness which in a typical example will be ½ inch. After such a sliced sheet has aged for 24 hours or more, it may be tested. In a typical sheet the average cell size will be approximately 6 per linear inch, the Indentation or Compression by ASTM standards will be about 8 pounds. The product will weigh from about 2.3 pounds per cubic foot and have an elongation of approximately 35% from which it will recover fully. Of course, the longer the sheet of material remains in a stretched condition, the longer it will require to recover fully.

On testing the ½ inch sheets thus produced with a "Force" of 80, the sheet was found to have the following properties:

Sheet	Length of putt	COPF
Unstretched	19.2	4.06
Elongated 5%	20.1	3.98
Elongated 10%	21.1	3.80
Elongated 20%	23.0	3.44
Elongated 30%	25.0	3.20
Elongated 35%	25.9	3.09

It is thus apparent that the product produced as described above may be employed as a synthetic putting green capable of being varied to produce effects varying from those of a fast green to a slow green by simply varying the amount of elongation or stretching of the sheet produced.

Instead of producing the sheets as described above, it is possible to use various foamed compositions which result in the formation of polyester or polyether foams which are relatively hard and stiff when produced. Such foamed plastic compositions may be given a treatment in order to impart the necessary flexibility and resilience thereto for use in accordance with the present invention. For this purpose, a substantially rigid foamed polyurethane sheet may be treated with a strong caustic alkali solution at temperatures of from about room temperature to 400° F. for from a minute or two up to several hours. In the alternative, the material may be treated with ethylene glycol or polyethylene glycol at temperatures of from about 200 to 400° F. In some instances, both treatments may be used. The softening of the foamed material takes place more rapidly at elevated temperatures and when ethylene glycol or polyethylene glycol is used, care should be taken to avoid the use of temperatures above the flash point of the softening agent. As a practical matter, the polyethylene glycols having a flash point above 300° F. are preferred when such agents are used.

In any event, after a sheet has been softened in such a way, it is washed thoroughly with water to remove the softening agent and for this purpose, it is preferably boiled in water. This is particularly important when caustic alkali is used since the softening of the material will continue if all alkali is not removed from the sheet.

In some instances, relatively stiff but elastic expanded plastic materials may simply be worked on a calender or rubber mill to develop the desired softness and flexibility therein.

When the material of which the sheet is formed is cast, or expanded in a mold, it generally will have a skin or surface portion which is at least partially sealed or contains closed or semi-closed cells or cells which are much finer than desired for use in accordance with the present invention. It is then desirable to remove such a skin or surface portion or to break it down by calendering or otherwise. In practice, a block of foamed material several inches in thickness is sometimes first produced. If the foamed material is of a composition or character which renders it too stiff or inelastic for use in accordance with the present invention, it may be treated as above described to impart the desired elasticity and resiliency thereto. Thereafter, the block may be cut into sheets of the desired thickness so that at least one surface, and in most cases, both surfaces of each sheet, are cut surfaces presenting the desired open cell characteristics required in accordance with the present invention. If preferred, the block may be cut into sheets while still relatively stiff or rigid and the cut sheets may thereafter be given a softening treatment.

When the synthetic putting greens of the present invention are produced by slicing a "bun" or block of foamed plastic material, it has been discovered that it is possible to impart different putting characteristics to the opposite surfaces of the sheet by employing different cutting or slicing devices. Thus, for example, when the sheet or block of foamed material is cut with a very sharp knife of the conventional type employed in cutting foamed plastic materials, the surface of the sheet thus produced will correspond to that of a fast green, whereas if the block or bun of foamed plastic material is sliced with a relatively dull knife or cutting element, the surface of the sheet produced will have the properties of a relatively slower green. In a typical case, one surface of the sheet may be formed by a saw having from 16 to 24 teeth to the inch whereas the opposite surface of the sheet may be formed by a saw having from about 4 to 12 teeth to the inch. In this way, it is possible to produce synthetic putting greens having different roughness or putting characteristics on the opposite surface thereof corresponding to a fast or a slow green. When so produced, the synthetic putting green does not need to be stretched in order to vary the putting characteristics thereof but may simply be turned over so as to use the opposite face of the sheet of material.

The latter method for varying the putting characteristics of the sheet by altering the surface characteristics thereof is particularly adapted for use in those synthetic putting greens which may be employed in the home or other locations where the percent of elongation of the sheet is not readily controlled to vary the putting characteristics. In the alternative, such sheets having opposite surfaces presenting different putting characteristics may be employed on practice putting greens of a golf course or on regular greens employed in tournament play in order to present predetermined and uniform putting characteristics to each player while varying the putting characteristics from hole to hole on the putting green or golf course.

In order to control the characteristics of the surface of the artificial putting green to simulate a particular type of green on a golf course, the sheet **2** may be provided with one or more tapes or measuring devices **64** which, as shown in FIG. 1, are connected at one end to the cup **4** and extend therefrom beyond the edge of the sheet **2**. These tapes may be marked with legends, "fast," "slow," "normal" or the like to indicate how far the material should be stretched to impart the desired surface condition to the artificial putting green. The edges of the sheet may then be secured in place to hold the sheet suitably stretched by means of adhesive tabs, tapes, weighted members or other securing means as indicated at **66**.

The construction provided is thus capable of many changes and modifications to provide an artificial putting green having any desired characteristics. It may be placed on a lawn, driveway, sand pile, or elsewhere to practice side, hill or irregular surface shots.

It will, thus, be apparent that synthetic putting greens embodying the present invention are capable of many changes and variations in constructon, composition, and usage, and may be of any size or shape desired. It can be adjusted and used in a multitude of ways so as to make practice putting really interesting or to provide a fascinating sport which may be played independently of its teaching or practice value.

In view thereof, it should be understood that the particular embodiments of the invention shown in the drawings and described above are intended to be illustrative only and are not intended to limit the scope of the invention.

I claim:

1. As an article of manufacture, a synthetic putting green, intended to approximate closely any of various putting speed conditions encountered on an actual green, comprising a generally flat, flexible sheet resiliently stretchable in its own plane in at least one direction, with complete recovery, to the extent of at least a 35% increase in its normal dimension as measured in said direction, said sheet being stretchable to any of a multiplicity of selected lengths and having a putting surface of open-cellular structure provided with a target area for a putted golf ball, the cells of said surface offering a frictional resistance to rolling movement of said ball thereupon and lengthening in said direction responsive to selective stretching of the sheet to thereby lower said frictional resistance in correspondingly selective fashion; and measuring means at least a portion of which is retained against movement in respect to the sheet, said measuring means projecting beyond an edge of the sheet and having, on its projecting portion, indicia denoting various degrees of said frictional resistance, said indicia being selectively registrable with said edge of the sheet in response to stretching of the sheet to a correspondingly selected extent.

2. As an article of manufacture, a synthetic putting green, intended to approximate closely any of various putting speed conditions encountered on an actual green,

comprising a generally flat, flexible sheet resiliently stretchable in its own plane in at least one direction, with complete recovery, to the extent of at least a 35% increase in its normal dimension as measured in said direction, said sheet being stretchable to any of a multiplicity of selected lengths and having a putting surface of open-cellular structure provided with a target area for a putted golf ball, the cells of said surface offering a frictional resistance to rolling movement of said ball thereupon and lengthening in said direction responsive to selective stretching of the sheet to thereby lower said frictional resistance in correspondingly selective fashion; and a measuring device of elongated form one end portion of which is retained against movement in respect to the sheet, the other end portion thereof being free of the sheet and projecting beyond an edge thereof, said other end portion of the measuring device having indicia denoting various degrees of said frictional resistance, said indicia being selectively registrable with said edge of the sheet in response to stretching of the sheet to a correspondingly selected extent.

References Cited by the Examiner

UNITED STATES PATENTS

1,772,415	8/30	Carpenter	73—9
2,025,183	12/35	Stayton et al.	273—176
2,225,140	12/40	Walker	73—9
2,961,710	11/60	Stark	264—54
2,965,584	12/60	Elkin	260—2.5
2,993,869	7/61	Maxey et al.	260—2.5
2,999,823	9/61	Dombrow	260—2.5
3,038,726	6/62	Hesidence	273—176
3,079,641	3/63	Knox et al.	264—54

FOREIGN PATENTS

620,248	5/61	Canada.

OTHER REFERENCES

Modern Plastics, April 1959, page 113.

DELBERT B. LOWE, *Primary Examiner.*