United States Patent

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[54] **GOLF GREEN**
19 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** ..... **273/176 H,** 273/195 B, 14/28, 14/17, 14/73
[51] **Int. Cl.** **A63b 67/02**
[50] **Field of Search** 273/176, 182, 195; 14/28

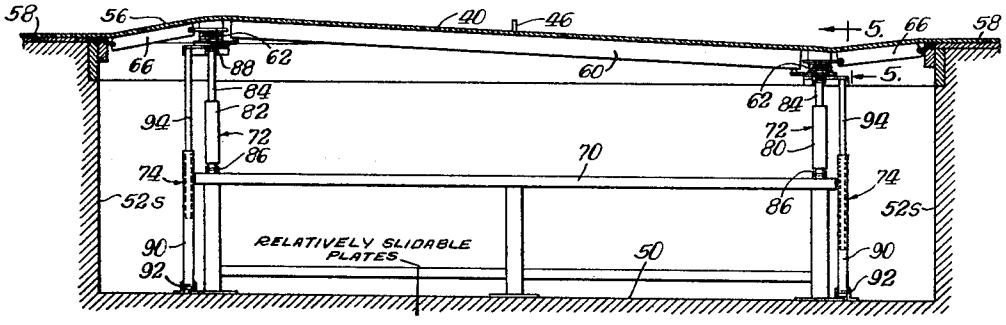
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ABSTRACT: A contourable green for use in a golf game including a platform of sufficient rigidity to support one or more golfers and yet of sufficient flexibility to be distorted to a plurality of nonplanar forms. The platform includes an upper putting surface with a golf cup therein supported by two elongated flexible beams with a plurality of flexibly connected rigid crossbeams supported thereon. The beams comprise at least two abutting flexible plates adjacent a flexible walled partially restrained tube, whereby fluid pressure may be applied to the tube for rigidification of the beams. Apron members provide a pivotal connection between the platform supporting means and the floor. Included are at least two jacks secured to the underside of the platform at spaced locations for changing the contour thereof and stabilizers to prevent swaying movement of the platform. A selectively operable control for the jacks includes a cam surface with associated sensors whereby the jacks may be operated to distort the platform thereby providing a rolling, contoured putting surface.



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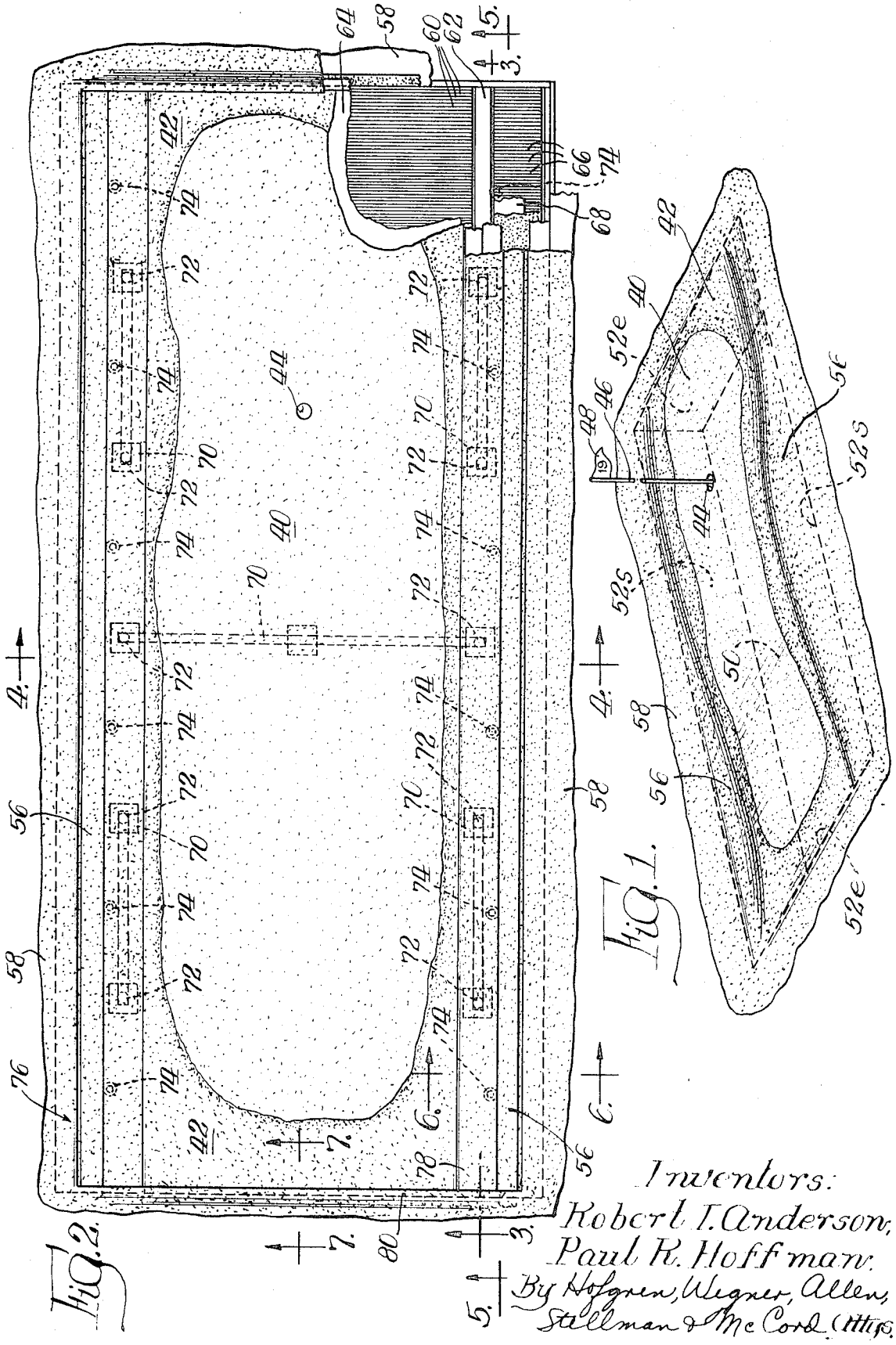


FIG. 2.

FIG. 1.

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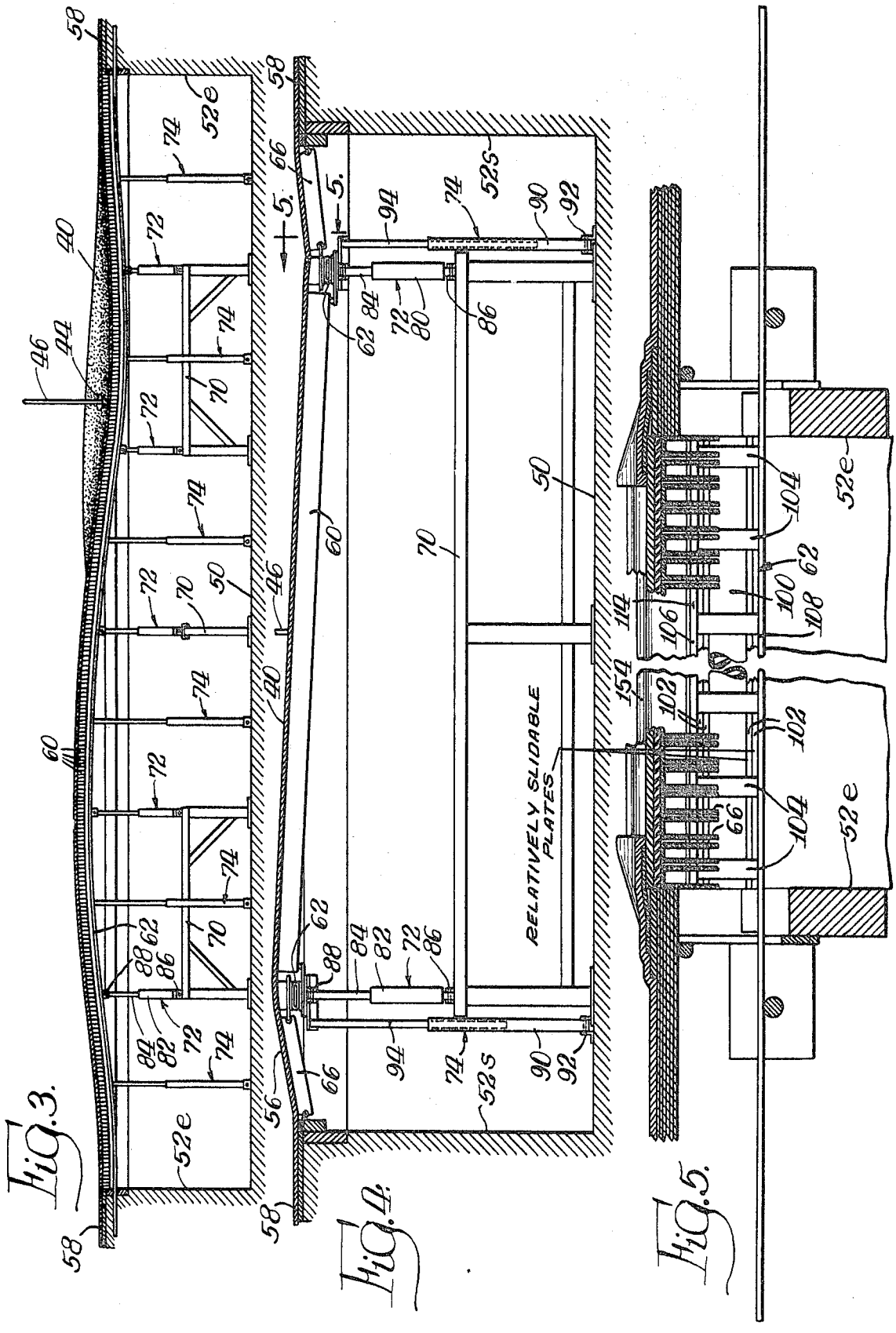


FIG. 3.

FIG. 4.

FIG. 5.

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FIG. 6.

FIG. 7.

FIG. 8.

FIG. 11.

FIG. 12.

FIG. 9.

FIG. 10.

GOLF GREEN

In the last few years, many proposals have been made for indoor golf games wherein a golfer may take a full swing at a free-flying ball and play a simulated golf course from tee to green through a plurality of holes. Some such games have been sufficiently practical such that they have actually been commercialized. Of course, the commercial success of such an indoor golf game depends almost entirely upon the degree of realism provided. That is to say, an indoor golf game that utilizes equipment that closely simulates the conditions on an outdoor golf course will enjoy a greater degree of success than a game that does not provide a realistic simulation. Of the indoor golf games known to be commercialized, one very detracting factor from the realism provided thereby lies in the inability to provide a suitable green surface that closely simulates the green on a natural course.

It is, therefore, the principal object of the invention to provide a new and improved golf green that is particularly well suited for use in indoor golf games.

More particularly, it is an object of the invention to provide a golf green that very closely simulates an outdoor golf green and that may be used indoors where space requirements are comparatively limited.

Another object of the invention is the provision of a golf green of a husky construction such that it may support a plurality of golfers while being of such a size as to fit within a suitable building and which includes means for selectively altering the contour of the green to follow the contour of a natural golf green at differing radial positions thereon relative to the hole.

Yet another object is the provision of a golf green such as that mentioned in the preceding paragraph wherein the contour of the golf green may be selectively altered to provide the contour of each of several differing natural greens on a golf course.

A still further object of the invention is the provision of a golf green such as that mentioned above including a flexible putting surface, a support means for the putting surface that is sufficiently rigid to support one or more golfers and yet sufficiently flexible so that it may be distorted when a significant force is applied thereto to change the contour of the putting surface, a plurality of spaced means connected to the support means for moving the support means to cause the distortion thereof, each of the moving means being independently operable of the others so as to cause differing movement of different points of the support means to provide differing contours, and a control means for the moving means including a programming means and a means responsive to the programming means for controlling the moving means in accordance with the conditions of the programming means.

Another object is the provision of a contourable green including at least two spaced beams, a platform of sufficient rigidity to support a golfer and that is somewhat flexible such that its shape may be distorted to provide a desired contour, a putting surface on the platform, at least one mechanism associated with each of the beams for moving the respective beam to cause movement and distortion of the platform and control means for operating the mechanism.

A further object is the provision of a golf green such as that mentioned in any of the preceding paragraphs additionally including a stabilizing means for the platform or supporting surface and including a first means secured to the platform for movement therewith and a second means for engaging the first means to permit up and down movement thereof while precluding side to side movement thereof to thereby prevent swaying movement of the green when it is supporting a golfer.

Other objects and advantages of the invention will become apparent from the following specification taken in conjunction with the following drawings in which:

FIG. 1 is a perspective view of one form of a green made according to the invention;

FIG. 2 is a plan view of the embodiment illustrated in FIG. 1 with portions thereof broken away;

FIG. 3 is a vertical section taken approximately along the line 3–3 of FIG. 2;

FIG. 4 is a vertical section taken approximately along the line 4–4 of FIG. 2;

FIG. 5 is an enlarged fragmentary vertical section taken approximately along the line 5–5 of FIG. 2;

FIG. 6 is a fragmentary vertical section taken approximately along the line 6–6 of FIG. 2;

FIG. 7 is a fragmentary vertical section taken approximately along the line 7–7 of FIG. 2;

FIG. 8 is a schematic of a hydraulic system for changing the contour of the embodiment of the green shown in the preceding figures;

FIG. 9 is a perspective view of a programming cam;

FIG. 10 is a side elevation with parts shown in section of a programming device utilizing the cam of FIG. 9;

FIG. 11 is a horizontal section taken approximately along the line 11–11 of FIG. 10; and

FIG. 12 is an electrical schematic of a control system for the hydraulic system shown in FIG. 8.

One exemplary embodiment of a contourable green made in accordance with the teachings of the invention may be seen in perspective in FIG. 1. The green includes a surface **40** which is formed of suitable sheets of matlike material such as carpeting or the like to simulate the putting surface on a green. Surrounding the surface **40** is a second surface area **42** made of suitable carpeting or the like that serves as the fringe area surrounding a green. Preferably, the carpeting forming the surfaces **40** and **42** is green with the carpeting forming the surface **40** being of a slightly lighter shade of green than the carpeting forming the surface **42** to provide an aesthetic appearance similar to that normally observed on a golf course.

Near one end of the green surface **40**, there is placed a golf cup **44** in which a conventional flag stick **46** bearing a pennant **48** may be received.

The green surface **40** and the fringe **42** are disposed above a pit having a floor **50** and end and sidewalls **52E** and **52S**, respectively. By means of a supporting structure and mechanism to be described hereinafter, the contour of the green surface **40** and the fringe surface **42** may be selectively changed, the supporting structure and mechanism being located within the pit and mounted on the floor **50**. The end walls **52E** support the ends of the fringe surface **42** while the sidewalls **52S** are spaced significantly from the sides of the fringe surface **42**. Interposed between the sides of the fringe surface **42** and the upper ends of the walls **52S** is a flexible apron surface **56** which accommodates movement of the green surface **40** and the fringe surface **42** relative to the floor **50** of the pit and flooring **58** surrounding the walls **52** of the pit. Preferably, the apron surface **56** is covered with a green carpet of the same color as the fringe surface **42** and the flooring **58** is similarly covered.

FIG. 2 is a plan view of the form of the green illustrated in FIG. 1 and has portions thereof broken away to illustrate the supporting structure for the green surface **40**, the fringe surface **42** and the apron surface **56**. A plurality of rigid crossmembers **60** such as common wood 2_X6 beams are laid side-by-side with their shortest dimension in a horizontal plane and are supported by elongated flexible beams **62**. The upper surface of the crossmembers **60** is covered by a foam rubber pad **64** which, in turn, is covered by the carpeting forming the surfaces **40** and **42**.

Apron members **66** have one end thereof supported by beams **62** and the other end supported on the upper edge of the sidewalls **52S** of the pit. Portions of the supper surface of the apron members **66** are also covered by a foam pad **68** which, in turn, is covered by the apron surface **56**.

A plurality of support frames are mounted on the floor **50** of the pit and support 10 jacks **72**. The jacks **72** may be divided into two groups of five each, each group being placed adjacent one of the sidewalls **52S** and associated with one of the beams

62. Each jack 72 is spaced with respect to the other jacks 72 in the same group directly beneath the corresponding beam 62.

Twelve stabilizers 74 are mounted on the floor 50 of the pit and are connected to the beams 62. The stabilizers 74 are in two groups of six and are symmetrically disposed with respect to the group of five jacks 72 adjacent the corresponding sidewall 52S. The stabilizers 74 permit a small amount of shifting movement of the green in a direction parallel to its length while precluding such shifting movement in a direction transverse to its length as will be described in greater detail hereinafter.

In order to provide a substantially continuous surface between the carpeting on the flooring 58, the carpeting comprising the apron surface 56 and the carpeting of the fringe surface 42, first border means 76 are provided between the flooring 58 and the apron 56. Second border means 78 are provided between the apron surface 56 and the fringe surface 42 while third border means 80 are provided between the flooring 58 and the fringe surface 42.

The connection of the jacks 72 between the frames 70 and the beams 62 may be best seen in FIGS. 3 and 4. Each jack 72 is comprised of a conventional double-acting hydraulic cylinder 82 having a piston rod 84. The lower end of each cylinder 82 is pivotally connected at 86 to a corresponding one of the frames 70. The pivotal axis of the connection 86 is in a direction transverse to the length of the green. The upper end of the piston rod 84 is pivotally connected as at 88 to the underside of the corresponding beam 62. Again, the pivotal axis of the connection 88 is transverse to the length of the green.

One contour effect achieved by operation of the jacks 72 may be seen in FIGS. 3 and 4. The various jacks 72 in each group of five may be operated to have their piston rods 84 extended from the cylinders 82 varying distances. As illustrated in FIGS. 3, the leftmost jack 72 is partially extended while the second jack 72 from the left is fully extended. The third jack from the left is extended slightly more than the leftmost jack 72 while the fourth and fifth jacks 72 from the left are extended only a small amount or not at all. As a result, a golfer standing at the left-hand edge of the green and looking toward the cup 44 will be faced with a putt that will be initially uphill changing to downhill as the distance to the cup 44 is decreased. At a point just pass the cup 44, the slope reverses itself to again present an uphill characteristic.

As best illustrated in FIG. 4, the green may be contoured to provide a "break" to one side or the other, the specific break illustrated being from left to right. In order to achieve a contour providing such breaks, the jack 72 of one group of five jacks is extended while the corresponding jack 72 in the other group of five jacks is withdrawn. Of course, it is possible to provide a contour where a putt may initially break from left to right and subsequently break from right to left. This is achieved by operating one set of corresponding jacks in the two groups of five jacks to assume a position such as that shown in FIG. 4 while operating another set of corresponding jacks in the two groups of five to assume a position opposite that shown in FIG. 4.

FIGS. 3 and 4 also illustrate the construction of the stabilizers 74. It will be appreciated that operation of the jacks 72 to provide a contoured surface in the manner described previously will cause various points on the beams 62 intermediate the ends thereof to shift slightly in a direction parallel to the length of the green. However, it is not desirable to permit shifting of the beams 62 in a direction transverse to the length of the green, and the stabilizers 74 are utilized to permit shifting of the former type while precluding movement of the latter type. Each stabilizer 74 is comprised of a tube 90 which may be formed of relatively heavy pipe and has its lower end secured by a pivotal connection 92 to the floor 50 of the pit. The pivotal axis of the connection 92 is transverse to the length of the green. Telescopingly received in the tube 90 is a stiff rod or pipe 94 which has its upper end secured to the underside of the corresponding beam 62. The rod 94 is freely slidable within the tube 90 to accommodate extension of the jacks 72. The interconnection between the tube 90 and the beam 62 provided by the rod 94 precludes movement of the beam 62 relative to the floor 50 to which the tube 90 is secured in any direction other than a direction transverse to the pivotal axis of the connection 92. That is, only up and down movement and movement of the beam 62 relative to the floor 50 in a direction parallel to the length of the green is permitted. As a result of this construction, the green will not sway when walked upon by a golfer.

The specific construction of the beams 62 is best seen in FIGS. 5 and 6. As stated previously, the beams 62 are flexible and may be distorted by the jacks 72 to provide the various contours discussed previously. Each beam 62 must additionally provide sufficient rigidity to maintain a desired contour once the contour has been set by the jacks 72. The beam construction to be described possesses the attributes of rigidity when required and flexibility when required.

Each beam 62 includes a flexible hydraulic hose 100 capable of withstanding substantial hydraulic pressure. The hose 100 is sandwiched between two groups of elongated flexible plates 102, formed of any suitable material and extending the length of the green as viewed in FIG. 3, each group being comprised of two or more such plates 102. Spaced at relatively close intervals, are metallic bands 104 which surround the hose 100 and the two groups of plates 102.

When it is desired to cause the green to assume a new contour, hydraulic pressure within the hose 100 is released and the jacks 72 are operated as required. Movement of the jack 72, in turn, causes movement of the beams 62; and as a result, the abutting plates 102 slide relative to each other. When the desired contour has been set by the jacks 72 to rigidify the beam 62, hydraulic pressure is again applied to the hose 100. This, in turn, causes abutting ones of the plate 102 to be frictionally forced together due to the confining function provided by the bands 104 and the pressure applied to the plates 102 by the hydraulic hose 100. The frictional interlock between abutting ones of the plates 102 is sufficiently great to preclude slipping movement of a plate 102 relative to the abutting plate 102 even when a significant load is placed on the beam 62 as, for example, when one or more golfers walk onto the green surface 40 and, in effect, the assemblage comprised of the hose 100, the plates 102 and the bands 104 is a one-piece rigid beam. The jack 72 may then be placed in an inactive position, the beams 62 being sufficiently rigid at this point to support the green surface 40 and a number of golfers standing thereon. Swaying of the beams 62 in such a position is precluded by the operation of the stabilizers 74 in the manner previously mentioned.

As best seen in FIG. 6, a first plate 106 is placed on the upper end of one of the plates 102 while a second plate 108 is placed under the lowermost one of the plates 102. The plates 106 and 108 have a significantly greater width than the plates 102 and may be maintained in the position indicated by means of bolts, not shown.

The plate 108 has a side 110 extending inwardly towards the center of the green and mounts a wear strip 112 on which the beams 60 rest. The arrangement between the wear strip 112 and the beams 60 is such that some sliding movement therebetween is permitted. The connection also provides the support of the beams 60 on the flexible beams 62 for movement of the former with the latter when a contour is being set by the jacks 72. The pivotal connection 88 between the piston rod 84 of each jack 72 is made directly to the underside of the plate 108.

The upper plate 106 has a side 114 which projects outwardly from the center of the green toward the adjacent sidewall 52S and serves to provide a pivotal and slidable connection between the beam 62 and the apron member 66. As best seen in FIG. 5, each apron member 66 is formed from an inverted U-shaped channel. At one end of each U-shaped apron member 66 and formed in the legs thereof is a bulb-shaped slot 116 in which the end 114 of the plate 106 is

received. At the other end of each U-shaped apron member **66** and formed in the legs thereof is a curved slot **118** which provides a portion of a pivotal connection between the apron member **66** and the upper edge of the sidewall **52S**. A cleat **120** is mounted on the upper edge of each sidewall **52S** and sandwiches a bracket **122** between the under surface of the flooring **58**. The bracket **122** has a curved end **124** which is received in the slot **118**. As a result of the construction just described, the flexible beam **62** may be moved by the corresponding jack **72** and the pivotal, slidable connection provided by the end **114** and the plate **106** and the bulb-shaped slot **116** in the apron member provides a flexible connection between the apron member and the beam and the former will follow movement of the beam. The pivotal connection formed by the slot **118** and the end **124** of the bracket **112** maintains the apron member **66** in close adjacency with the sidewall **52S** regardless of the movement of the flexible beam **62** to thereby provide a continuous surface between the flooring **58** and the beam **60** supporting the green surface **40**.

From the foregoing, it will be apparent that when the green is caused to assume a contour that is anything but perfectly flat, the upper surface of adjacent ones of the beams **60** will be disposed in differing planes. Since the beams **60** merely rest on the wear strip **112** (FIG. **6**), it will be apparent that a means is required to maintain orientation of the beams **60** with respect to each other. Such a means is shown in FIG. **7** and comprises a stringer rod disposed in aligned apertures **132** in adjacent beams. Surrounding the stringer rod **130** at the interface between adjacent ones of the beams **60** are spacing washers **134**.

In actuality, a plurality of the stringer rods **130** are used. The length of each such stringer rod is equal to approximately six times the width of the beam **60** plus five—seven times the width of a spacing washer **134**. The stringer rods **130** are disposed in a staggered relation in a generally horizontal plane such that certain ones of the stringer rods **130** are disposed closer to the center of the green than the remainder of the rods **130**. The staggered relation is shown in part by the staggered relation of the apertures **132** as seen in FIG. **6**. Furthermore, the ends of the stringer rods **130** are overlapped in the following manner. The first stringer rod **130** at an end of the green is disposed through apertures **132** in the first through sixth beams **60**. The second rod stringer **130** is disposed in another set of the apertures **132** and engages the fourth through 10 beams **60**. The third stringer rod is disposed in a set of apertures **132** corresponding to the apertures **132** in which the first stringer rod **130** is disposed and is in contact with the eighth through 14 beams **60**, etc. As a result of the just described construction, adjacent ones of the beams **60** are maintained in the desired orientation with respect to each other but are free to move slightly with respect to other beams **60** engaging the same stringer rod **130** to provide a substantially continuous platform surface. Any discontinuities present between the upper surfaces of adjacent ones of the beams **60** are small and are effectively eliminated by the thickness of the foam rubber pad **64** and the thickness of the carpeting forming the green surface **40**.

As mentioned previously, the fringe surface **42**, the apron surface **56** and the carpeting covering the flooring **58** are formed of discrete pieces of material to facilitate relative movement during the contouring of the green while preventing undue stress on the carpeting forming the surfaces. The ends of the carpeting forming the surfaces are covered by the border means **76**, **78** and **80** mentioned in conjunction with the description of FIG. **2**. Turning now to FIG. **6**, the construction of the border means **76** and **78** may be seen. The first border means **76** are comprised of a resilient metal plate **140** and a continuation **142** of the carpeting **144** covering the flooring **58**. The resilient plate **140** is secured to the flooring **58** at the edge thereof overlying the cleat **120** and is formed to engage a portion **146** of the apron surface **56** and to hold the latter firmly against the upper surface of the apron **66** through all positions of movement of the latter. The continuation **142** of the carpeting **144** is adhered to the upper surface of the plate **140** and at its end, includes a downturned portion **148** which snugly abuts the surface of the carpeting forming the apron surface **56**. However, if desired, the downturned portion **148** may be tucked under the plate **140**.

The second border means **78** is formed of a layer of carpeting **150** adhered to the upper surface of a resilient plate **152**. The resilient plate has its center secured by means not shown to the upper surface of a U-shaped channel **154** which, in turn, is secured to the upper surface of the plate **106**. It will be recalled that the plate **106** is secured to the beams **62**. The ends of the resilient plate **152** overlie both the apron members **66** and the beams **60** and the inherent resilience of the plate **152** is such as to cause the latter to follow the movement of the beams **60** and/or the apron members **66** through all positions of movement of each.

In order to secure the innermost end of the apron surface **56** to the apron members **66**, the end of the plate **152** overlying the apron members **66** bears against the upper surface of the carpeting forming the apron surface **56** to clamp the latter against the foam pad **68** thereunder to hold the two firmly against the upper surface of the apron members **66**. The other end of the plate **152** bears against the upper surface of the fringe surface **42** to clamp the latter firmly against the upper surface of the beams **60**. It will be noted that the extent of the foam pad **64** is not as great as the extent of the fringe surface **42** and is held in place only by the fringe surface **42** which, in turn, is held in place by the resilient plate **152**.

Turning now to FIG. **7**, the construction of the third border means **80** may be seen. A mounting plate **160** is secured by means not shown to the edge of the flooring **58** adjacent end walls **52E** of the pit. The upper surface of the mounting plate in turn mounts a resilient plate **162**, the under surface of which bears against the carpeting forming the fringe surface **42** which, in turn, bears against the foam rubber pad **64** to hold the two against the upper surface of the beams **60**. The plate **162** is covered by a continuation **164** of the carpeting **144** covering the flooring **58**, and, of course, the continuation **164** of the carpeting **144** is adhered to the upper surface of the plate **162**.

a control system for changing and maintaining the contour of the green is illustrated in FIGS. **8—12**, inclusive. FIG. **8** schematically illustrates the hydraulic portion of the control system for operating the jack **72** and the pressurizing the hydraulic hoses **100** forming parts of the flexible beams **62**. The hydraulic system includes a pump **170** and a tank or reservoir **172** associated therewith in a conventional manner. The output from the pump **170** is led to a port of a three-way valve **174** having a solenoid pilot **176**. Similarly, the tank **172** is connected to a port on the three-way valve **174**. The output of the valve **174** is connected directly to the hydraulic hoses **100**. The arrangement is such that when the solenoid pilot **176** is actuated, the valve **174** will permit communication between the hydraulic hoses **100** and the pump **70** while when the pilot **176** is deenergized, there will be fluid communication between the tank **172** and and hydraulic hoses **100**. In terms of the result produced by this construction, energization of the pilot **176** will cause pressurization of the hydraulic hoses **100** to rigidify the flexible beams **62** while deenergization of the pilot **176** will render the beams **62** flexible such that their shape may be changed by action of the jacks **72**.

The pump **170** and tank **172** also form a part of the control system for the jacks **72**. Since the construction of the control system for each of the jacks **72** is identical only one will be described, it being understood that there are 10 such systems in all. Both the pump **170** and the tank **172** are in fluid communication with various ports of a conventional double piloted four-way valve **178**. Outlet ports of the valve **178** are connected respectively to the upper end and to the lower end of the double-acting hydraulic cylinder **82** comprising the jack **72**. Additionally, a pilot-operated check or holding valve **180** is interposed in the line between the lower end of the cylinder **82** and the four-way valve **178**. The holding valve **180** also has

a connection for its pilot to the line between the four-way valve **178** and the upper end of the cylinder **82**.

As mentioned above, the four-way valve **178** is double piloted and accordingly includes a first solenoid pilot **182** and a second solenoid pilot **184**. The overall arrangement is such that when the first pilot **182** is actuated, fluid communication between the pump **170** and the upper end of the cylinder **82** is made and the piston rod **84** of the jack will descend within the cylinder **82**. Additionally, pressure will be applied to the pilot of the check valve **180** thereby opening the latter to permit fluid on the underside of the piston to flow backwardly through the four-way valve **178** to the tank **172**. When the second pilot **184** is energized, fluid communication is established from the pump **170** through the holding valve **180** to the lower end of the cylinder **82** to force the piston rod **84** thereof upwardly. Simultaneously, fluid communication is established between the tank **172** and the upper end of the cylinder **82** to preclude a pressure buildup therein. When neither of the pilots **182** or **184** are energized, the nature of the valve **178** is such as to preclude fluid communication between the pump **170** and either end of the cylinder **82**. At such a time, the force of gravity will prevent upward movement of the piston within the cylinder **82** while the action of the holding valve **180** will preclude the piston from descending therein.

Turning now to FIG. **9**, there is seen a control cam **186** for providing the system with contour information. The cam **186** is generally circular and includes an aperture **188** in the center thereof which receives a shaft as will be seen. A cam surface **190** of the cam **186** is contoured to simulate the putting surface of a natural green. The aperture **188**, which is located at the center of the cam **186**, is also located at the point at which the cup or hole on a natural green would be located. Thus, the cam **186** may be said to comprise a miniature green.

Turning now to FIG. **10**, the cam **186** is shown in section and a shaft **192** is disposed in the aperture **188** thereof. A suitable key **194** is used to lock the cam **186** to the shaft **192** for rotation therewith. The lower end of the shaft **192** is mounted in a suitable bearing **196** which, in turn, is secured in any suitable manner to a bracket **198**. The bracket **198** includes an upper portion mounting a similar bearing **200** for journaling the upper end of the shaft **192**. The upper extremity of the shaft **192** includes a manually operable knob **202** which may have a pointer associated therewith for cooperation with a scale (not shown).

Mounted above the cam **186** by means of ears **204** on the bracket **198** are 10 potentiometers, generally designated **206**, each having a corresponding actuator **208** that is spring urged downwardly to ride on the cam surface the pit, of the cam **186**. In other words, the actuators **208** are cam followers that follow the cam surface **190** of the cam **186**.

As best seen in FIG. **11**, the actuators **208** are disposed with respect to each other and with respect to the center of the greenlike upper cam surface **190** of the cam **186** on which the position of the shaft **192** is representative of the hole or cup of the green, in a manner identical to the disposition of the jacks **72** with respect to each other and the cup **44** on the green surface **40**. Each actuator **208** controls its corresponding potentiometer **206** to move the wiper thereof thereby shifting the ratio of resistance on either side of the variable tap port provided by the wiper in a manner proportional to its degree of extent which, of course, is proportional to the contour of the upper surface **190** of the cam **186**. Thus, a distinct signal may be produced for each of the jacks **72** to control the degree of extent thereof.

Turning now to FIG. **12**, a means for utilizing such a signal and controlling the hydraulic system for each jack **72** is schematically indicated. Since the control for the hydraulic system for each jack **72** is identical, only one will be described, it being understood that there are ten such means. The end taps of the potentiometer **206** are connected across a source of DC power **210**, and a second potentiometer **212** is similarly connected to the DC power source **210**. The wiper of the potentiometer **212** is moved in response to movement of the piston rod **84** of each double-acting hydraulic cylinder comprising a jack **72** by means of any suitable mechanical connection such that the wiper position of the potentiometer **212** is dependent upon the degree of extent of its corresponding jack **72**. The arrangement is that of a conventional DC bridge circuit with the potentiometer **206** providing the control signal while the potentiometer **212** provides a suitable feedback signal. The error signal from the bridge is taken from the wipers of the potentiometers **206** and **212** and fed through the coil **214** of a micropositioner. The coil **214** operates a blade **216** which is interposed between a first contact **218** and a second contact **220**. The contact **218** is connected to the solenoid pilot **182** of the four-way valve **178** and then to one side of a source of power **222** while the contact **220** is connected to the solenoid pilot **184** of the valve **178** and then to the source of power **222**. The blade **216** is connected through a relay coil **224** and then to the opposite side of the source of power **222**.

The overall arrangement is such that when the cam **186** is rotated by manipulation of the knob **202**, the resulting movement of the wiper of the potentiometer **206** will cause an imbalance in the DC bridge. As a result, current will flow through the coil **214** of the micropositioner in a direction dependent upon the polarity of the imbalance caused. If the nature of the imbalance if such as to cause current to flow from the wiper of the potentiometer **206** to the wiper of the potentiometer **212**, energization of the coil **214** will cause the blade **218** to close a circuit through the contact **218** to energize the pilot **182**. As a result, the four-way valve **178** will be appropriately actuated and fluid will be admitted to the underside of the piston of the hydraulic cylinder comprising the jack **72** to cause the jack **72** to extend itself. As the jack **72** extends, the wiper of the potentiometer **212** will be moved by the jack **72** until the bridge is again balanced. When the bridge is balanced, current will cease to flow through the coil **214** and the blade **216** will return to a normally open position.

Were the imbalance caused by rotation of the cam **186** to be of the opposite polarity of that just described, the blade **216** would have closed a circuit through the contact **220** to energize the pilot solenoid **184** to ultimately cause the piston of the cylinder comprising the jack **72** to descent until the wiper of the potentiometer **212** had been moved to a sufficient distance to rebalance the bridge.

From the foregoing description of the circuitry, it will be apparent that whenever the blade **216** completes a circuit through either a contact **218** or **220**, the coil **224** will be energized. Associated with the coil **224** is a set of normally closed contacts **226** which are connected in series with the pilot **176** of the three-way valve **174** and across the source of power **222**. Thus, whenever the coil **224** is energized in response to an imbalance in the bridge circuit, the contacts **226** will be opened to deenergize the solenoid pilot **176** of the three-way valve **174** to thereby relax the pressure in the hydraulic hoses **100** to cause the beam **62** to revert to a flexible state wherein it may be moved by the jacks **72**. When the bridge is balanced, which corresponds to a jack **72** reaching its programmed extension to provide a desired contour, the coil **224** will be deenergized and the contacts **226** will close to energize the pilot **176** thereby causing the three-way valve **174** to admit fluid under pressure to the hydraulic hoses **100** and rigidify the beams **62**.

Since it is essential that the beams **62** remain in a flexible state until all of the jacks **72** have reached their programmed extension, the power applied to the four-way valve pilots associated with all of the jacks **72** is taken from the junction of the blade **216** and the coil **224** rather than directly from the source of power **222**. Thus, if the bridge circuits associated with nine of the jacks are balanced but the 10 circuit remains unbalanced, the coil **224** will remain energized to preclude the pressurization of the hydraulic hoses **100** and thus, the rigidification of the beams **62**.

Once all of the jacks have attained their programmed extent, it will be apparent that they will be maintained in such a

position by operation of their corresponding holding valves **180**. Similarly, the beams **62** will be rigidified due to the deenergization of the coil **224** and the resultant energization of the pilot **176** associated with the three-way valve **174**.

From the foregoing, it will be apparent that by mere manipulation of the knob **202** the cam **186** may be rotated to simultaneously program each of the jacks **72** and cause the green to achieve a desired contoured configuration. When the green is used in conjunction with an indoor golf game, it will be apparent that the cam **186** could be used to provide 18 different green contours. A suitable index could be associated with the knob **202** and numbered in terms of holes such that each 20° of rotation of the shaft **192** would correspond to the changing of the contour of the green from one hole to the next hole. Alternatively, if the indoor golf game is such as to provide the golfer with information relative to the position on the green at which his ball stopped, as for example, the 6 o'clock position, the knob **202** may be manipulated to rotate the cam **186** such that the actuators **208** for the potentiometers **206** sense the contour of the cam surface **190** at the 6 o'clock position thereof. When such a method is sued, it may be desirable to provide a plurality of interchangeable cams **186** having differing upper surfaces **190**, each corresponding to a different hole on a golf course, or a plurality of the structures shown in FIG. **10**, one for each hole on a golf course, may be provided with suitable switch means for selectively connecting a desired one of the structures into the bridge circuit illustrated in FIG. **12**.

While we have shown and described certain embodiments of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A contourable green for use in a golf game comprising: a flexible putting surface including a cup therein for reception of a golf ball; means providing a support for said surface that is sufficiently rigid to support at least one golfer and sufficiently flexible so as to be distorted whereby the contour of said putting surface may be changed; a plurality of means spaced from one another and connected to said support means for moving said support means, each of said plurality of moving means being individually operable independently of the other of said moving means whereby different ones of said moving means may be operated to cause differing movement of differing points of said support means to cause distortion of the latter; and control means for said plurality of moving means comprising programming means for simultaneously providing information relative to a predetermined operation for each of said plurality of moving means, and means responsive to said programming means for individually operating each of said plurality of moving means in accordance with the information provided by said programming means.

2. The invention of claim **1** wherein said support means comprise at least two elongated flexible beams and a plurality of rigid crossmembers supported by said beams and movable therewith.

3. The invention of claim **2** wherein said crossmembers are formed of a material such as wood.

4. The invention of claim **1** wherein each of said plurality of moving means comprises a jack having a member reciprocal in two directions connected to said support means and means for moving said member in said two directions.

5. The invention of claim **1** wherein said programming means comprises means for providing information relative to a predetermined amount of movement of said support means by each of said moving means and feedback means associated with each of said moving means for providing information relative to the amount of actual movement of said support means caused thereby, means for comparing said information relative to a predetermined amount of movement and said information relative to the amount of actual movement and means responsive to said comparing means for causing operation of each of said moving means when there is a difference between the information relative to a predetermined amount of movement and the information relative to the amount of actual movement.

6. The invention of claim **1** wherein said programming means includes a cam having an undulating cam surface for producing contours corresponding to those on a green.

7. A contourable green comprising: at least two beams spaced from each other, comprising at least two elongated flexible plates mounted in abutment with each other for selective slidable movement relative to each other along their longitudinal axes; means for frictionally locking said plates against each other to rigidify the flexible beam formed thereby; means providing a platform of sufficient rigidity to support a golfer and being somewhat flexible such that its shape may be distorted to provide a desired contour, said platform being supported on said beams to be movable therewith; means on said platform providing a putting surface, a cup associated with said putting surface for receiving a golf ball propelled thereacross; at least one mechanism associated with each of said beams for moving the respective beam to cause movement of said platform, each said mechanism being operable independently of the other whereby said beams may be moved different amounts to cause distortion of said platform whereby said putting surface may be contoured; and control means for operating said mechanisms.

8. A contourable green comprising: at least two beams spaced from each other; means providing a platform of sufficient rigidity to support a golfer and being somewhat flexible such that its shape may be distorted to provide a desired contour, said platform providing means comprising a plurality of closely spaced rigid members spanning said beams and flexibly connected to each other, said platform being supported on said beams to be movable therewith; means on said platform providing a putting surface, a cup associated with said putting surface for receiving a golf ball propelled thereacross; at least one mechanism associated with each of said beams for moving the respective beam to cause movement of said platform, each said mechanism being operable independently of the other whereby said beams may be moved different amounts to cause distortion of said platform whereby said putting surface may be contoured; and control means for operating said mechanisms.

9. A contourable surface comprising: means providing a relatively rigid surface that is adapted to be distorted by moving differing parts thereof unequal distances; at least one beam supporting said surface, said beam comprising at least two abutting flexible plates adjacent a flexible walled tube and restraining means at least partially surrounding said plates and said tube; and means for applying fluid pressure within said tube to cause rigidification of said beam to thereby maintain said surface in a desired configuration.

10. The invention of claim **9** further including means for moving differing parts of said surface unequal amounts, means responsive to initiation of operation of said moving means for releasing fluid pressure within said tube; and means responsive to the cessation of operation of said moving means for causing said fluid pressure applying means to apply fluid pressure within said tube.

11. A contourable green for a golf game comprising: means providing a platform of sufficient rigidity to support at least one golfer and of sufficient flexibility such that it may be distorted to simulate undulations in a green; means providing a putting surface on said platform providing means; a plurality of means for moving said platform-providing means differing amounts to distort the latter; and stabilizing means for said platform including first means secured to said platform for movement therewith and second means for engaging said first means for permitting up and down movement thereof while effectively precluding side-to-side movement thereof thereby preventing swaying movement of said platform providing means when it is supporting a golfer.

12. The invention of claim 11 wherein said platform providing means is supported by at least one beam, said first means comprising a rigid rod connected to said beam and said second means comprising a rigid tube pivotally connected to a stationary member, said rod being telescopingly and slidably received in said tube so that when said platform is distorted, said rod may slide within said tube to permit up and down movement of said platform and yet will form an unbendable structure to effectively preclude side-to-side movement of said platform.

13. A contourable green for use in a golf game and capable of supporting a plurality of golfers comprising: a base-supporting surface, at least two spaced elongated beams mounted for generally independent up and down movement, means mounting said beams in an elevated position relative to said base supporting surface, at least one moving means associated with each of said beams for moving the associated beam, a distortable platform comprising a plurality of rigid crossmembers generally transverse to and supported by said beams, a plurality of stringers running generally parallel to said beams and flexibly interconnecting said crossmembers to permit relative movement between said crossmembers, and a sheet of material having an upper putting surface supported by said crossmembers, and ball-receiving means associated with said putting surface.

14. The contourable green of claim 13 wherein said rigid crossmembers are closely spaced, said stringers comprise aligning rods received in apertures in said crossmembers, and said sheet comprises a carpetlike mat.

15. A contourable green for a golf game comprising: means providing a platform of sufficient rigidity to support one or more golfers and of sufficient flexibility to be distorted to a plurality of nonplanar forms; means providing a floor spaced from at least a part of said platform providing means; apron means flexibly interconnecting said platform providing means and said floor providing means to provide a substantially continuous surface therebetween; a putting surface on said platform providing means and including means for receiving a ball; at least two powered jack means secured to the underside of said platform providing means at spaced locations; and control means for said powered jack means whereby said platform providing means may be selectively distorted.

16. The green of claim 15 wherein said apron-providing means comprises a plurality of closely spaced rigid members having pivotal connections to said platform providing means and to said floor-providing means.

17. The green of claim 16 wherein some of said pivotal connections are additionally slidable connections.

18. A contourable green for a golf game comprising: means providing a platform of sufficient rigidity to support one or more golfers and of sufficient flexibility to be distorted to a plurality of nonplanar forms; a putting surface on said platform providing means and including means for receiving a ball; at least two powered jack means secured to the underside of said platform providing means at spaced locations; control means for said powered jack means whereby said platform providing means may be selectively distorted, said powered jack means being bidirectional to raise or lower said platform providing means; and said control means including means for selecting a desired contour of said surface, means for providing information relative to the selected contour and a means for receiving said information and for automatically, in response thereto, actuating said powered jack means in the proper direction to distort said surface to said selected contour.

19. A contourable green for a golf game comprising: means providing a platform of sufficient rigidity to support one or more golfers and of sufficient flexibility to be distorted to a plurality of nonplanar forms; a putting surface on said platform providing means and including means for receiving a ball; at least two powered jack means secured to the underside of said platform providing means at spaced locations; control means for said powered jack means whereby said platform providing means may be selectively distorted, said control means including a cam having a cam surface configured proportionally to a desired contour of said green; and sensing means associated with said cam surface for operating said powered jack means.