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Hagaman

[11] **3,776,555**

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[54] **GOLF CLUB SWING TRAINING APPARATUS**

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[52] **U.S. Cl.** ..... **273/186 R,** 35/29 A

[51] **Int. Cl.** **A63b 69/36**

[58] **Field of Search** 273/186, 183, 191, 273/192, 35; 35/29

[56] **References Cited**

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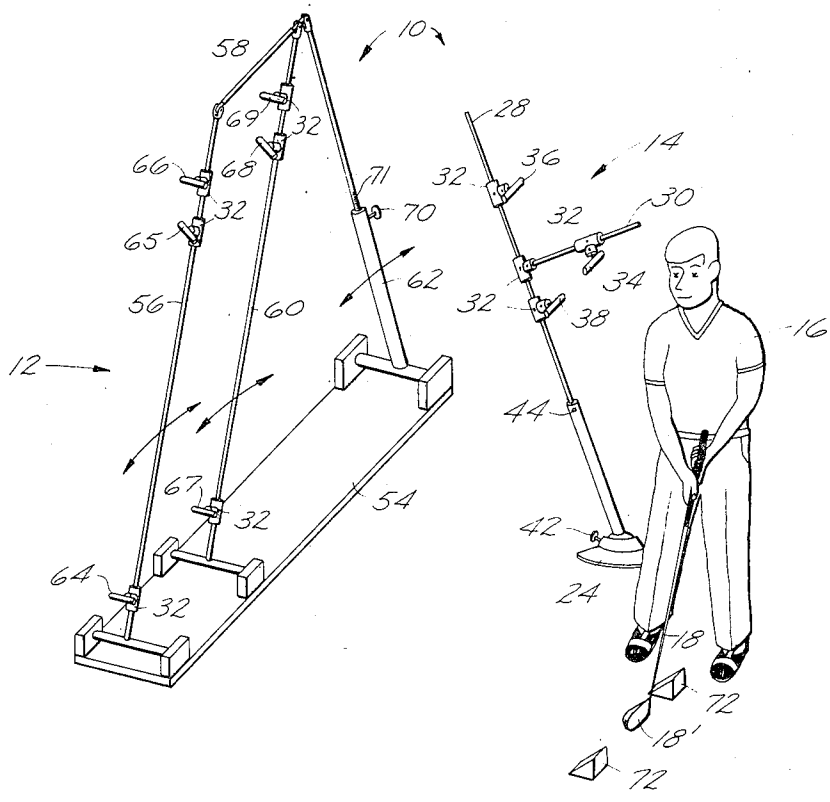
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Primary Examiner—George J. Marlo
Attorney—Joseph H. Heard

[57] **ABSTRACT**

First and second arrays of photoelectric units respectively delineate the vertically inclined plane and the arcuate paths traveled by the clubhead during a full golf swing, and through associated electrical circuitry cause actuation of signaling devices upon the performance of an improper swing by the golfer. The signaling devices give immediate audible notification of an error in a golf swing, and also indicate the approximate location of the error or errors. The photoelectric units are physically spaced from the golfer so as to not impede his natural swing, and are adjustably movable and selectively energizible so as to readily permit use of the apparatus by golfers who differ in size and/or in other physical characteristics, and so as to permit, if desired, the use of progressive teaching techniques.

18 Claims, 5 Drawing Figures



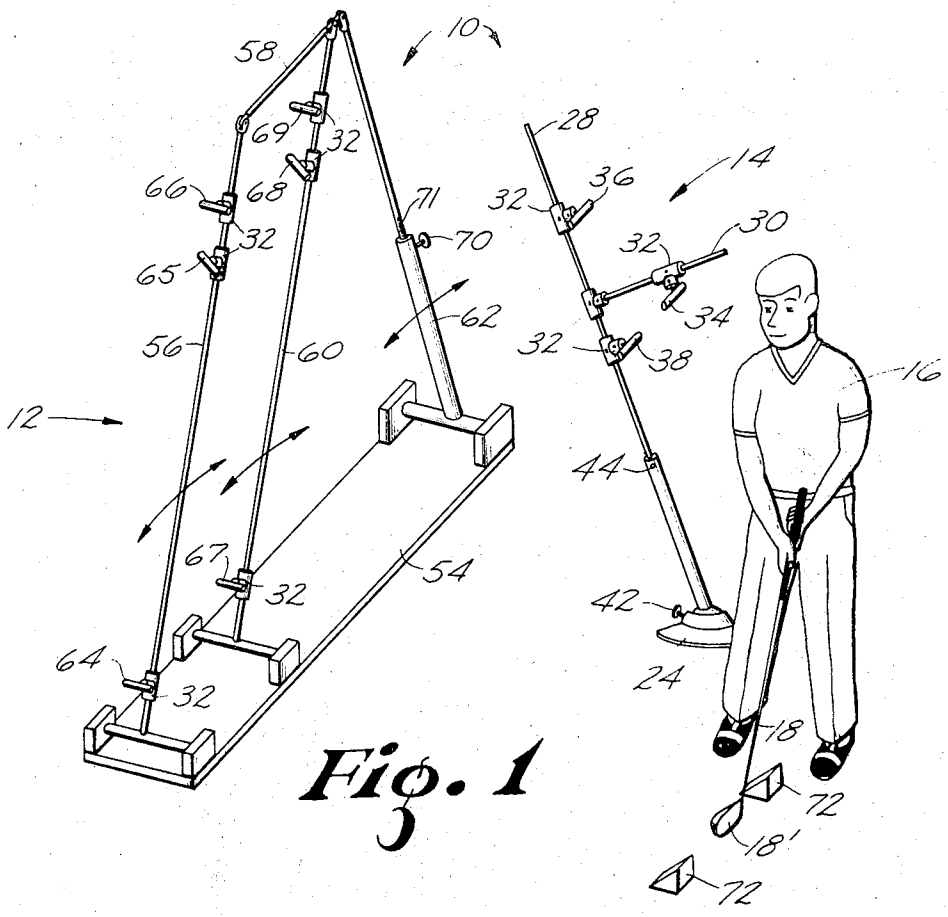

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65
62
56
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12
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24
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72
18'

Fig. 1

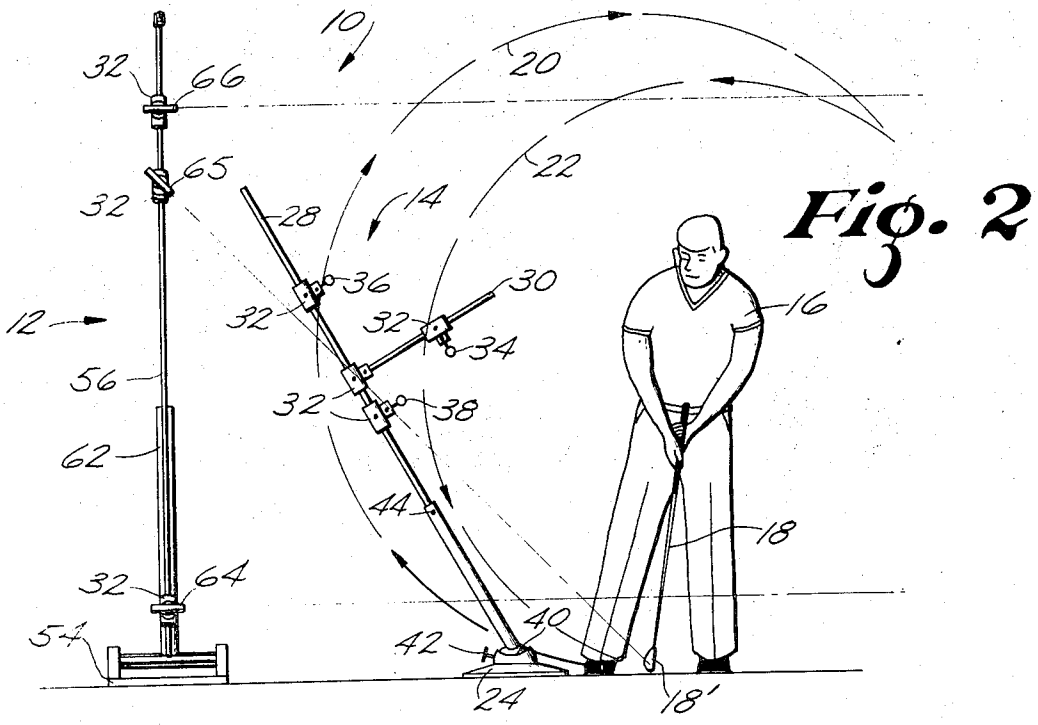
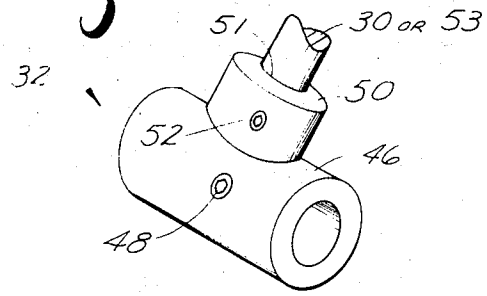

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34
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16
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62
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Fig. 2

Fig. 3



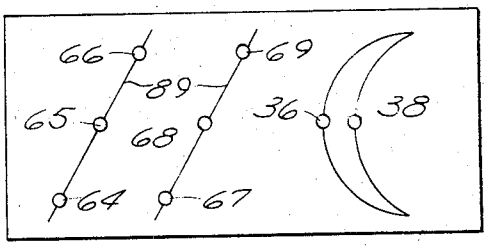


Fig. 4

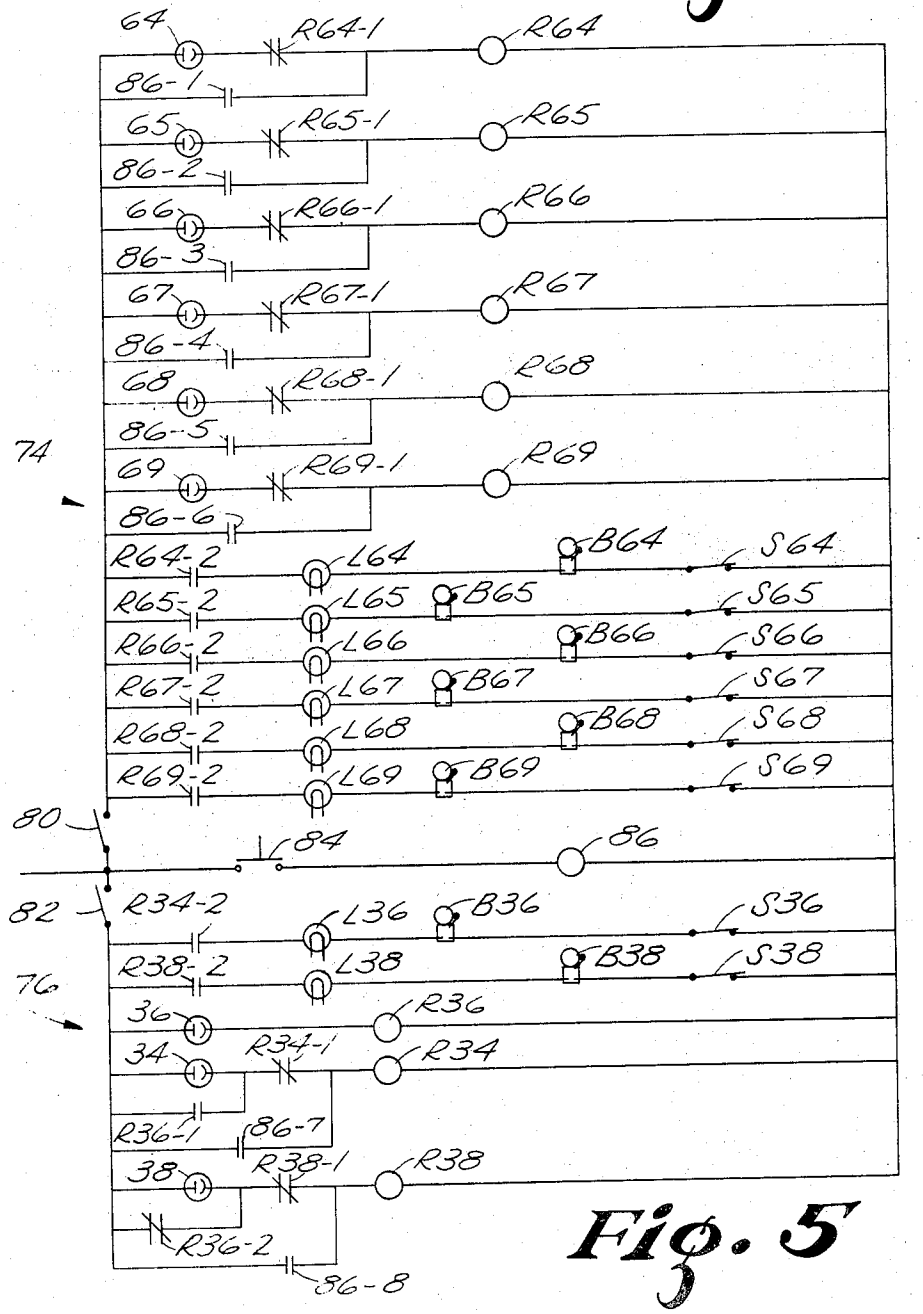


Fig. 5

GOLF CLUB SWING TRAINING APPARATUS

BACKGROUND OF THE INVENTION

This invention pertains to golf teaching apparatus, and more particularly to an improved apparatus for rapidly teaching a golfer both the proper plane and arcs of a full golf swing.

During a full golf swing the head of a golf club is moved through a vertically inclined plane first upwardly and then downwardly along arcuate paths of travel which extend between elevations adjacent the feet and the head of the golfer. The upstroke and the initial part of the downstroke of the club are quite important as they are subject to control by the golfer and are largely determinative of the nature of the remainder of the golf swing. As the clubhead passes into the terminal part of the downstroke and approaches the "hitting zone," its velocity is such that the same behaves much like a free-flying missile, over which the golfer has little or no control.

For any particular golfer, the arcuate paths of travel described by the clubhead during the upstroke and downstroke of a proper golf swing will have definite radial boundaries and will lie entirely between a pair of closely spaced imaginary planes extending in substantially parallel relationship to each other at a predetermined angle relative to the vertical. Various types of mechanical guiding devices have heretofore been devised for teaching golfers the aforesaid swing plane and/or arcs: See e.g., U. S. Pats. Nos. 1,399,761, 1,854,392, 1,960,787, 3,339,927, 3,415,523 and 3,583,707. Such mechanical devices have not met with complete success, for a variety of reasons. Some of the devices have failed to recognize that the arcuate paths of travel described by the clubhead, although merging with one another at their opposite extremities, have different radii intermediate their length due to the golfer's differing wrist-action during the upstroke and downstroke. Other of the devices prohibit departure of the club from the desired plane of travel in one forward or rearward direction only, and ignore possible departures in the other direction. Most of the devices are quite cumbersome and difficult to adjust: ease of adjustment is quite important since golfer's of course vary radially in size and other physical characteristics (e.g., left versus right handed). Finally, and perhaps most importantly, all of the mechanical guiding devices necessarily impose some type of physical constraint upon the golfer, either directly or through contact with some portion of the golf club. This is not only mentally distacting to the golfer, but moreover tends to create a highly undesirably aftereffect. That is, the golfer's muscles and reflexes become so conditioned to the presence of the guiding device that after the same is no longer present and the golfer makes a swing under actual playing conditions, such swing tends to depart from the proper path of movement in the direction or directions in which the restraint was previously imposed.

The detection by photoelectric means of various characteristics of a golf swing or putting stroke has also heretofore been proposed: See e.g., U. S. Pats. Nos. 2,571,974, 2,825,569, 3,009,704, 3,020,049, 3,173,348, 3,194,563 and 3,513,707. Many of the prior devices have not been concerned with the detection of the proper arcs and plane of a full golf swing, but rather have dealt with such diverse matters as the "open" or "closed" condition of the club face, the putting stroke, etc. Of the other photoelectric devices heretofore proposed, most are intended for practice or amusement, rather than teaching, purposes. Their detecting activities are concentrated upon that portion of the golf swing which transpires as the clubhead passes through or beyond the "hitting zone," for the purpose of determining at that time the velocity and/or trajectory of the clubhead or a golf ball (real or imaginary) struck thereby. As previously noted herein, the detection of errors in the aforesaid portion of a golf swing is of little if any benefit from an instructional viewpoint since at such time the clubhead is not controllable by the golfer and its then-trajectory has already been determined by the preceding portion of the swing. The preceding errors causing an improper trajectory of the clubhead within the hitting zone are best detected only indirectly, and then only some time after they actually transpire and without identification of their location. This is contrary to correct instructional or teaching, as opposed to practice or amusement, procedure. For proper instructional or teaching purposes, it is highly desirable that the basic or causitive errors in the golf swing be detected. It is also highly important that the golfer be given substantially immediate notification of such errors as they occur, rather than at some later point in time. Finally, it is also highly desirable that the golfer be notified of at least the approximate location of the error in his swing.

SUMMARY OF THE INVENTION

With the foregoing in mind the present invention provides an improved apparatus for teaching a golfer the proper characteristics of a full golf swing, which apparatus satisfies the needs and is free from the deficiencies hereinbefore noted. The apparatus includes first and second photoelectric means which respectively delineate boundaries of the plane and the arcuate paths of travel traversed by the clubhead during a proper golf swing, and which through associated electrical circuitry actuate signaling means upon each detection of an error in the swing. The signaling means immediately notifies the golfer of the fact that he is then in the process of making an error in his swing, and also indicates the nature and the approximate location of his departure or departures from the path of a proper swing. All components of the apparatus are spaced from and are out of contact with the golfer, so as to not detract mentally or physically from his optimum performance during either the teaching process or thereafter during actual play.

In a preferred embodiment of the apparatus, the photoelectric units thereof are mounted for convenient multidirectional positional adjustment and are capable of selective utilization. This permits ready use of the apparatus by golfers of different sizes and other varying physical characteristics (e.g., left-handed versus right-handed). It also permits the use, if desired, of progressive teaching techniques. In the latter connection, for instance, the apparatus may be used to first teach a golfer only the proper plane of a full golf swing, and thereafter used to teach the golfer only the proper arcs of such swing. Alternatively, the golfer may be first taught the proper arcs and then the proper plane of the swing, or may be taught both at the same time.

DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will be in part apparent and in part pointed out hereinafter in the following description of an illustrative embodiment thereof, which should be read in conjunction with the accompanying drawing, in which:

FIGS. 1 and 2 are respective front perspective and front elevational views of a golfer employing teaching apparatus embodying the invention, which apparatus includes first and second photoelectric means respectively shown in side and front elevation in FIG. 2;

FIG. 3 is an enlarged perspective view of one of the mounting brackets of the photoelectric means shown in FIG. 1;

FIG. 4 is a front elevational view of an error-indicator board forming part of the apparatus; and

FIG. 5 is a schematic representation of the electrical circuitry of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, that part of the teaching apparatus **10** which is shown in FIGS. **1** and **2** generally includes first and second photoelectric means **12, 14** which are adapted to be positioned in spaced relationship to a golfer **16** for the purpose of respectively delineating the vertically-inclined plane and the arcuate paths of travel traversed by the head **18'** of a golf club **18** when golfer **16** properly executes a full golf swing. The arcuate paths described by clubhead **18'** during the upstroke and downstroke of a properly executed swing by golfer **16** are indicated in FIG. **2** by the broken lines **20, 22,** respectively. Such arcuate paths extend in a vertical direction between elevations adjacent the feet and the head of golfer **16,** and merge with each other at their opposite extremities. Intermediate such extremities, however, paths **20, 22** have different radii and are therefore laterally spaced from each other, since during a properly executed swing the upstroke wrist-action of golfer **16** is not the same as his downstroke wrist-action.

The photoelectric means **14** which delineates boundaries of arcuate paths **20, 22** generally comprises a floor-supported base **24,** adjustable frame means including rod-like members **28,30** and bracket members **32,** and an array of generally cylindrical photoelectric units **34,36** and **38.** Rod **28** is connected at its lower end to base **24** by a universal joint **40,** for angular positional adjustment relative to the vertical, and is telescopically adjustable so as to permit its effective length to be varied. Releasable set screws or levers **42,44** are respectively carried by base **24** and rod **28** for securing the latter in a desired position of adjustment. At spaced locations along its length, rod **28** supports three of the brackets **32,** which are all of identical construction. As is better shown in FIG. **3,** each bracket **32** comprises a collar portion **46** which encircles rod **28** and is releasably clamped thereto by a set screw **48.** Upon loosening of its set screw **48,** each bracket **32** may be slid along rod **28,** and/or pivoted about its axis, to adjust the bracket's position as desired. A boss **50** formed integrally with collar **46** of each bracket **32** has a bore **51** extending therethrough, and a set screw **52** associated therewith. One end portion of rod **30** extends into bore **51** of the center bracket **32** carried by rod **28,** and is releasably secured therein by set screw **52** of such bracket. The opposite end portion of rod **30** is encircled by the collar **46** of a fourth bracket **32.** Photoelectric unit **34** is mounted upon a rod or pin **53** adjustably and releasably secured within bore **51** of such fourth bracket by the bracket's set screw **52.** Photoelectric units **36,38** are similarly releasably carried by respective ones of the end-most two brackets **32** upon rod **28.**

Each of the photoelectric units **34,36,38** is of a commercially-available type adapted when energized to detect interruptions of a light beam projected from and normally reflected back to one end of the unit. In FIGS. **1** and **2** photoelectric means **14** is positioned behind and to the right side of the right-handed golfer **16,** and photoelectric units **34,36, 38** direct their light beams forwardly to any suitable type of reflective surface (not shown), such as a reflective wall or screen, forwardly of golfer **16.** It would be equally satisfactory, however, for photoelectric means **14** to be forwardly of golfer **16** with the light beams directed to a reflective surface rearwardly of him. By suitable adjustment of the appropriate ones of the frame components of photoelectric means **12,** photoelectric unit **36** is so positioned adjacent the head elevation of golfer **16** that its light beam will extend just inside (i.e., radially inwardly of) the upstroke arcuate path of travel **20** of clubhead **18'** when a proper golf swing is executed by the golfer **16,** while photoelectric unit **38** is so positioned that its light beam will extend just outside of the downstroke arcuate path of travel **22** of clubhead **18'** at an elevation below that of unit **36** but still within the controllable part of the downstroke. The remaining photoelectric unit **34** is positioned at an elevation slightly above that of unit **38,** and at a radial location considerably inwardly of both arcs **20** and **22.**

Referring now still to FIGS. **1** and **2,** the other photoelectric means **12** comprises a floor-supported base **54** and frame means including rod-like frame members **56,58,60,** a brace number **62,** and a plurality of bracket members **32** mounting an array of photoelectric units **64–69,** which brackets and photoelectric units may be and preferably are of the same type and construction as those previously described in connection with photoelectric means **14.** Members **56,60** and **62** each extend angularly upwardly from base **54** and are pivotally connected at their lower ends to such base for pivotal adjustment about substantially parallel horizontal axes, as indicated by the arcuate double-headed arrows in FIG. **1.** Member **58** extends between and pivotally interconnects the upper ends of members **56,60,** so as to maintain a substantially parallel relationship between them at all times, and also is pivotally connected at one end to the upper end of brace member **62.** As is shown in FIG. **1,** brace **62** is telescopically adjustable so that its effective length may be varied as desired upon loosening a locking lever **70** carried by it. Adjustment of the effective length of brace **62** varies the vertical inclination of rod members **56,60,** and brace **62** preferably carries suitable indicia **71** to indicate the aforesaid vertical inclination of rod members **56,60** in their different adjustive positions.

Photoelectric unit **64–66** are mounted by brackets **32** at spaced locations along the length of rod member **56,** while photoelectric units **67–69** are similarly mounted by other brackets **32** at spaced locations along the length of rod member **60.** The light beams produced by units **64–66,** when such units are energized, all extend in a common first plane, while the light beams of units

67–69 all extend in a common second plane which is substantially parallel to the aforesaid first plane. Base 54 of photoelectric means 12 is positioned in spaced relationship to the right side of the right-handed golfer 16 shown in FIGS. 1,2, and the vertical inclination of rod members 56,60 is suitably adjusted (by varying the effective length of brace 62) such that the light beams of units 64–66 delineate the forward boundary of the vertically inclined plane of travel of clubhead 18' during its movement along arcuate paths 20,22, while the light beams of units 67–69 delineate the rearward boundary of such plane of travel of the clubhead. Units 64,67 are so positioned (by adjustment, if required, of their brackets 32) as to project their light beams substantially horizontally at an elevation adjacent the golfer's ankles, while units 66,69 are positioned so as to direct their light beams substantially horizontally at an elevation above the head of golfer 16, the beams in each case being directed to any suitable reflective wall, screen, or other surface (not shown) disposed on the opposite side of golfer 16 and in spaced relationship to him. Photoelectric units 65,68 are mounted on upper portions of rods 56,60, respectively, and are so positioned as to direct their light beams angularly downwardly to corresponding ones of a pair of reflective members 72 (shown in FIG. 1 only) mounted on the floor or ground adjacent the "tee" location constituting the target of golfer 16. The reflective surfaces of members 72 are of course suitably inclined as to reflect the light beams of units 65,68 back to the associated ones of such units and away from the eyes of golfer 16.

The electrical circuitry of apparatus 10 is schematically shown in FIG. 5. Such circuitry includes a first primary circuit 74, shown at the upper portion of FIG. 5 and connectable to a suitable source of electrical power by a master switch 80, associated with photoelectric means 12; a second primary circuit 76, shown at the lower portion of FIG. 5 and connectable to the aforesaid power source by a master switch 82; and reset means, operable in association with both of the aforesaid primary circuits and connectable to the power source by a normally open switch 84, in the form of a relay 86 having eight normally open contacts 86-1 through 86-8.

Within the primary circuit 74 associated with photoelectric means 12, there is provided for each photoelectric unit 64–69 (only the photosensative components of which are shown in FIG. 5) thereof a corresponding relay R having a pair of normally open contacts R-1 and R-2, visual signaling means in the form of a lamp L and audible signaling means in the form of a buzzer or bell B, and a normally closed switch S. The foregoing components are identified in FIG. 5 by the foregoing letter designations with the addition of the number of the particular photoelectric unit 64–69 associated therewith.

The photosensitive component of each unit 64–69 is disposed in a series subcircuit which further includes its corresponding relay R and contact R-1 of the latter, and to which there is connected a reset circuit including one of the contacts of reset relay 86. The second contact R-2 of the relay R associated with each unit 64–69 is arranged in series in a signaling subcircuit with the lamp L, bell B and switch S associated with the particular unit 64–69. When master switch 80 is closed and photoelectric means 12 is in use, the photosensitive components of photoelectric units 64–69 each normally receive reflected light produced by the associated lamp components (not shown) of such units, and therefore are electrically conductive. The six associated relays R are therefore all energized, and remain so for as long as golfer 16 (FIGS. 1 and 2) continues to execute proper golf swings which do not interrupt the light beams of units 64–69. If, however, golfer 16 causes club 18 to stray from the proper swing plane, one or more of the light beams of photoelectric means 12 will be broken, and a corresponding one or more of lamps L and bells B will be actuated. For example, assuming that during the commencement of an upstroke golfer 16 brings club 18 too far forwardly, the light beam of photoelectric unit 64 will be momentarily interrupted, thereby rendering the photosensitive component of such unit momentarily non-conducitve. This causes deenergization of relay R64 and ensuing opening of its contact R64-1 and closing of its contact R64-2. Closure of contact R64-2 immediately actuates light L64 and bell B64, and the latter gives golfer 16 immediate audible notification of the existance of an error in the swing then being executed by him. Preferably each bell B has a tone or other audio characteristic noticeably different from that of the other bells B.

As shown in FIG. 4, lamps L64–L69 are carried upon an indicator board or panel 88, which is mounted in any suitable manner forwardly of golfer 16 and which bears indicia 89 representative of the forward and rearward boundaries of the swing plane of club 18. The positions of lamps L64–L69 in relation to indica 89 are generally correlated to the positions of units 64–69 relative to the swing plane. By viewing panel 88 and noting the illuminated condition of lamp L64, golfer 16 therefore obtains visual notification of the approximate location of the error in his golf swing. Such visual notification is highly desirable even if, as mentioned above, bells B64–B69 have different tones by which a golfer 16 who is familiar with apparatus 10 may also receive immediate audible notification of the approximate location of the error in his swing. Distinguishing between the different tones of bells B may be difficult for some golfers, particularly those unfamiliar with apparatus 10 or particularly when more than one error is committed during a single golf swing. In the latter connection, if more than the single previously-discussed error is committed during the golf swing, appropriate additional ones of the lamps L and bells B are also actuated. Thus, assuming that club 18 also interrupts the light beam of photoelectric unit 65, lamp L65 and bell B65 will also be actuated. While golfer 16 might not during the golf swing be able to distinguish the respective sounds of bells B64 and B65, he will upon viewing panel 88 observe that lamp 65, as well as lamp 64, is illuminated. This positively notifies golfer 16 that he brought club 18 too far forwardly in an intermediate portion, as well as in the lower portion, of the golf swing.

All lamps L and bells B which have been actuated during a golf swing remain actuated until golfer 16 (or some other person, such as an instructor) momentarily closes reset switch 84. This momentarily energizes reset relay 86, causing closure of its normally opened contacts 86-1 through 86-8 and ensuing reenergization of any previously deenergized ones of the relays R. Assuming in accordance with the foregoing illustration that the deenergized relays are R64 and R65, their reenergization causes contacts R64-1 and R65-1 to again close and contacts R64-2 and R65-2 to again open,

which restores circuit **74** to its original condition of readiness for use.

Opening of master switch **80** entirely removes circuit **74** and photoelectric means **12** from operation. It is also possible to effectively remove only selected ones of photoelectric unit **64–69** from operation, by opening the appropriate ones of the manually operable switches S associated therewith. Such capability permits adjustment of photoelectric means **12** to compensate for a possible peculiarity which might occasionally exist in the swing of a particular golfer **16,** and also permits teaching of only one part of the golf swing at a time, if desired.

The capability for selective non-utilization of desired ones of the photoelectric units is also highly desirable if a modified construction of photoelectric means **12** is employed. In the preferred embodiment of the invention, the light beams of units **65,68** are directed angularly downwardly as shown in FIGS. **1** and **2** and as previously described. Such arrangement permits scanning of larger segments of the golf swing than if the beams extended substantially horizontally, as in the case of the beams of the remaining units, and also permits the detection of errors which might occur in the golf swing at precisely the same elevation as that of the head of golfer **16.** If desired, however, somewhat comparable results could be achieved by adding additional photoelectric units to photoelectric means **12** and directing the light beams of all of the units substantially horizontally to reflective surfaces disposed upon the opposite side of golfer **16.** But in such an arrangement, it would be necessary to either physically reposition or effectively deenergize the particular units whose light beams would intersect the head or upper body portion of the particular golfer **16** then using apparatus **10.** Switches L readily permit effective deenergization of the appropriate ones of such units.

Referring now particularly to the lower portion of FIG. **5,** the electrical circuit **76** associated with photoelectric means **14** includes a plurality of subcircuits within which the photosensitive components of photoelectric units **34,36** and **38** are respectively arranged in series with associated relays **R34,R36** and **R38.** The subcircuits including relays **R34,R38** also respectively include normally closed contacts **R34-1, R38-1** of such relays. Normally open contacts **86-7** and **86-8** of reset relay **86** are arranged in parallel with photoelectric units **34,38,** respectively. Circuit **76** also includes lamps **L36,L38,** buzzers or bells **B36,B38** and switches **S36,S38** arranged in two signaling subcircuits similar in purpose and function to those described above with reference to circuit **74.** Lamps **L36,L38** are also carried upon indicator panel **88** (FIG. **4**), in association with suitable background indica representative of the upstroke and downstroke arcs **20,22** (FIG. **1**) described by clubhead **18'** during a proper golf swing.

Relay **R36** of circuit **76** differs from the other relays R shown in FIG. **5** in that it is of a type which, when deenergized, remains deenergized for a preselected time period. A normally open contact **R36-1** of relay **36** is wired in parallel with photoelectric unit **34** between such unit and normally closed contact **R34-1** of relay **R34.** A normally closed contact **R36-2** of relay **R36** is similarly wired in parallel with photoelectric unit **38** between such unit and normally closed contact **R38-1** of relay **38.** Normally open contacts **R34-2** and **R38-2** of relays **R34** and **R38** are disposed in respective ones of the signaling circuits for photoelectric units **36,38.**

Referring now to FIGS. **2** and **5,** as golfer **16** moves club **18** upwardly during the commencement of a golf swing, the shaft of the club will always first momentarily interrupt the light beam of unit **38.** This produces no alarm signal, however, since continuous energization of relay **R38** is nevertheless maintained through closed contact **R36-2** of relay **36.** If the golf swing is proper and clubhead **18'** is following arcuate path **20** of FIG. **2,** the light beam of unit **36** will next be interrupted. The ensuing deenergization of relay **R36** closes its contact **R36-1** and opens its contact **R36-2,** but the signaling subcircuits are not affected. As the golf swing continues, the light beam of unit **34** is next twice broken by the shaft of club **18,** first as the club completes its upward movement along arcuate path **20** and then as downward movement of the club along path **22** is commenced. This produces no effect since energization of relay **R34** is maintained through then-closed relay contact **R36-1.** If the golf swing continues along a proper course, clubhead **18'** travels during the remaining part of its downward movement along path **22** and therefore passes radially inwardly of the light beam of unit **38,** and does not interrupt such light beam. Following the aforesaid sequence, which requires at most only a few seconds to complete, relay **R36** "times in" once again, whereupon its contact **R36-1** opens and its contact **R36-2** closes. Circuit **76** is then in readiness for the commencement of another golf swing.

If the upstroke portion of a swing is improper, clubhead **18'** will pass radially inwardly of the light beam of photoelectric unit **36** and will not interrupt such light beam. The immediately following interruption of the light beam of unit **34** by club **18** therefore causes deenergization of relay **R34,** since contact **R36-1** of relay **R36** is then still open. The ensuing closure of contact **R34-2** of relay **R34** actuates lamp **L36** and bell **B36,** thereby notifying golfer **16** of the existence and approximate location of an error in the golf swing. Since contact **R34-1** also opened upon deenergization of relay **R34,** such relay remains deenergized and lamp **L36** and bell **B36** remain actuated until reset relay **86** is manually energized, whereupon its contact **86-7** closes.

If the upstroke part of a golf swing is proper but clubhead **18'** travels radially outwardly of arcuate path **22** during the downstroke, the ensuing interruption of light beam of unit **38** causes deenergization of relay **R38** since contact **R36-2** of relay **36** is then open. Closing of relay contact **R38-2** and opening of contact **R38-1** cause lamp **L38** and bell **B38** to be immediately actuated, and to remain actuated until reset relay **86** is energized and its contact **86-8** closes.

It will be appreciated that by adding additional photoelectric units and associated signaling means to photoelectric means **14** and circuit **76,** departures of clubhead **18'** from the arcuate paths **20,22** may be detected at various additional locations along their lengths.

When both master switches **80,82** are closed, both circuits **74,76** and photoelectric means **12,14** are in simultaneous operation. Apparatus **10** may therefore be employed to teach a golfer **16** all aspects of a proper golf swing simultaneously, or may be employed in a progressive manner to teach the golfer only a desired part or parts of the swing before progressing to other parts of it. Such progressive teaching techniques have been found particularly beneficial in building and/or

maintaining the self-confidence of a novice possessing little or no previous golfing experience.

The use of another important progressive teaching techniuqe is possible by reason of the adjustability of photoelectric means **14**. Two of the most common errors committed by a student-golfer **16** are failure to "reach out" far enough during the upstroke for clubhead **18'** to following arcuate path **20** (FIG. 2), and for failure of golfer **16** to maintain his wrists in a "cocked" condition sufficiently long during the downstroke for clubhead **18'** to then follow arcuate path **22.** Overcoming these common errors becomes progressively more difficult as the speed of the golf swings increases, since the difference in the radii of arcuate paths **20,22** during any one golf swing is directly related to the speed of such swing. When golfer **16** is a novice, therefore, photoelectric means **14** may first be employed to teach him the proper arcuate paths of a relatively slow golf swing, by adjusting photoelectric units **36,38** toward each other along rod **29.** Thereafter, as the skill of golfer **16** increases and his golf swings become progressively faster, units **36,38** may be moved progressively farther apart. The same progressive-teaching technique may also be successfully employed to markedly improve the golf swings of experienced golfers.

It will thus be seen that there has been provided an improved golf teaching apparatus realizing the benefits and possessing the advantages hereinbefore noted. Although a preferred embodiment of the invention has been shown and described, it is to be understood that this was for purposes of illustration only, and not for purposes of limitation, the scope of the invention being in accordance with the following claims.

That which is claimed is:

1. Apparatus for teaching a golfer the full golf swing of a golf club comprising:

first photoelectric detector means for delineating and for detecting departures from the vertically inclined plane traversed by the clubhead during a proper golf swing;

second photoelectric detector means for delineating and for detecting radial departures from the arcuate paths of travel traversed by the clubhead during a proper golf swing;

and circuit means operatively associated with said first and second photoelectric detector means and including signaling means actuable thereby in response to the detection of an error in the golf swing of the golfer.

2. Apparatus as in claim **1,** wherein said first photoelectric means includes a plurality of photoelectric units arranged in an array extending between elevations adjacent the feet and the head of the golfer and adapted to delineate and detect departures from both front and rear boundaries of said plane of a proper golf swing, and adjustable frame means mounting said array of said photoelectric units for adjustment of the inclination thereof relative to the vertical.

3. Apparatus as in claim **1,** wherein each said photoelectric means includes a base spaced from the golfer, a plurality of photoelectric units, and frame means carried by said base and mounting said photoelectric units for multidirectional adjustive movement relative to said base.

4. Apparatus as in claim **3,** wherein said frame means of said first photoelectric means includes a pair of elongate and generally parallel frame members each pivotally connected adjacent a lower end thereof to said base and each extending upwardly from said base for pivotal adjustment of the angulation thereof relative to the vertical, and a brace member for releasably securing said frame members in desired positions of pivotal adjustment relative to the vertical.

5. Apparatus as in claim **4,** wherein one of said frame members mounts a plurality of said photoelectric units at spaced locations along the length thereof for delineating a forward boundary of said vertically inclined plane of a proper golf swing, and the other of said frame members mounts another plurality of said photoelectric units at spaced locations along the length thereof for delineating a rearward boundary of said vertically inclined plane.

6. Apparatus as in claim **5,** wherein said frame means of said first photoelectric means further includes a plurality of bracket members carried by said frame members and adjustably movable longitudinally thereof, and wherein said photoelectric units of said first photoelectric means are mounted upon said frame members by said bracket members.

7. Apparatus as in claim **1,** wherein said signaling means includes audible signaling means for substantially immediately notifying the golfer of his commission of an error in a golf swing, and visual signaling means for indicating the nature and the approximate location of each such error.

8. Apparatus as in claim **1,** wherein said circuit means includes a first circuit operatively associated with said first photoelectric means, a second circuit operatively associated with said second photoelectric means, and manually operable switch means for permitting selective activation and deactivation of either of said circuits independently of the other of said circuits.

9. In an apparatus for teaching a golfer the full golf swing of a golf club, the improvement comprising:

photoelectric detector means for delineating and for detecting departures from the arcuate paths of travel traversed by the clubhead during the upstroke and downstroke of a proper golf swing, said photoelectric means including at least a first photoelectric unit for determining whether the radius of curvature of the arcuate path traversed by the clubhead during the upstroke of a golf swing is sufficiently large, and at least a second photoelectric unit for determining whether the radius of curvature of the arcuate path traversed by the clubhead during the downstroke is sufficiently small;

and circuit means operatively associated with said photoelectric means and including signaling means actuable thereby in response to the detection of an error in the golf swing of the golfer.

10. Apparatus as in claim **9,** wherein said first photoelectric unit detects the interruption of a light beam normally broken by the golf club during the upstroke of a proper golf swing, and said second photoelectric means detects the interruption of a light beam normally not broken by the golf club during the downstroke of a proper golf swing, and wherein said photoelectric means further includes a third photoelectric unit for detecting the interruption of a light beam normally broken during either a proper or an improper golf swing by the golfer.

11. Apparatus as in claim **10,** wherein said photoelectric means further includes adjustable frame means

mounting at least said first and second photoelectric units for adjustive movement of their radial positions relative to the golfer.

12. Apparatus as in claim **10,** wherein said signaling means includes upstroke-error signaling means actuable during the upstroke of a golf swing upon detection by said third photoelectric unit of interruption of the light beam associated therewith in the absence of prior detection by said first photoelectric unit of interruption of its associated light beam.

13. Apparatus as in claim **12,** wherein said signaling means further includes downstroke-error signaling means actuable during the downstroke of golf swing upon detection by said second photoelectric unit of interruption of the light beam associated therewith following prior detection by said first photoelectric unit of interruption of its associated light beam.

14. Apparatus as in claim **13,** wherein said upstroke-error and said downstroke-error signaling means each include an audible signaling member and a visual signaling member, and wherein said apparatus further includes a display panel mounting said visual signaling members thereon in an array correlated to the upstroke and downstroke arcuate paths of travel of the clubhead during a proper golf swing.

15. In an apparatus for teaching a golfer the full golf swing of a golf club, the improvement comprising:

photoelectric detector means for delineating and for detecting departures from both the forward and rearward boundaries of the vertically inclined plane traversed by the clubhead during a proper golf swing, said photoelectric means including a first pair of horizontally spaced photoelectric units for detecting departures of the clubhead from said plane at an elevation adjacent the feet of the golfer, a second pair of horizontally spaced photoelectric units for detecting departures of the clubhead from said plane at an elevation adjacent the head of the golfer, and a third pair of horizontally spaced photoelectric units for detecting departures of the clubhead from said plane at an elevation intermediate the aforesaid elevations;

and circuit means operatively associated with said photoelectric means and including signaling means actuable thereby in response to the detection of an error in the golf swing of the golfer.

16. Apparatus as in claim **15,** wherein said photoelectric means further includes a movable base positioned during use of said apparatus in spaced relationship to the golfer, and frame means carried by said base and mounting said photoelectric units for multidirectional adjustive movement relative to said base.

17. Apparatus as in claim **16,** wherein said frame means includes a pair of elongate and generally parallel frame members each pivotally connected adjacent a lower end thereof to said base and each extending upwardly from said base for pivotal adjustment of the angulation thereof relative to the vertical, and a brace member for releasably securing said frame members in desired positions of pivotal adjustment relative to the vertical, said photoelectric units being carried by said frame members at spaced locations along the lengths thereof.

18. Apparatus as in claim **15,** wherein said signaling means includes an audible signaling member and a visual signaling member for each of said photoelectric units, and display means mounting said visual signaling members in an array correlated to the forward and rearward boundaries of and to different elevations upon the vertically inclined plane traversed by the clubhead during a proper golf swing.

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