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Bell

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(54) **GOLF SWING TRAINING DEVICE**

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(51) **Int. Cl.**
A63B 69/36 (2006.01)

(52) **U.S. Cl.** **473/220**; 473/409

(58) **Field of Classification Search** 473/220–227, 473/257, 266, 268, 422, 409
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,082,282 A * 1/1992 Hernberg 473/220
5,665,006 A * 9/1997 Pellegrini 473/220
5,692,966 A * 12/1997 Wash 473/221
6,488,592 B1 * 12/2002 Boatner 473/220

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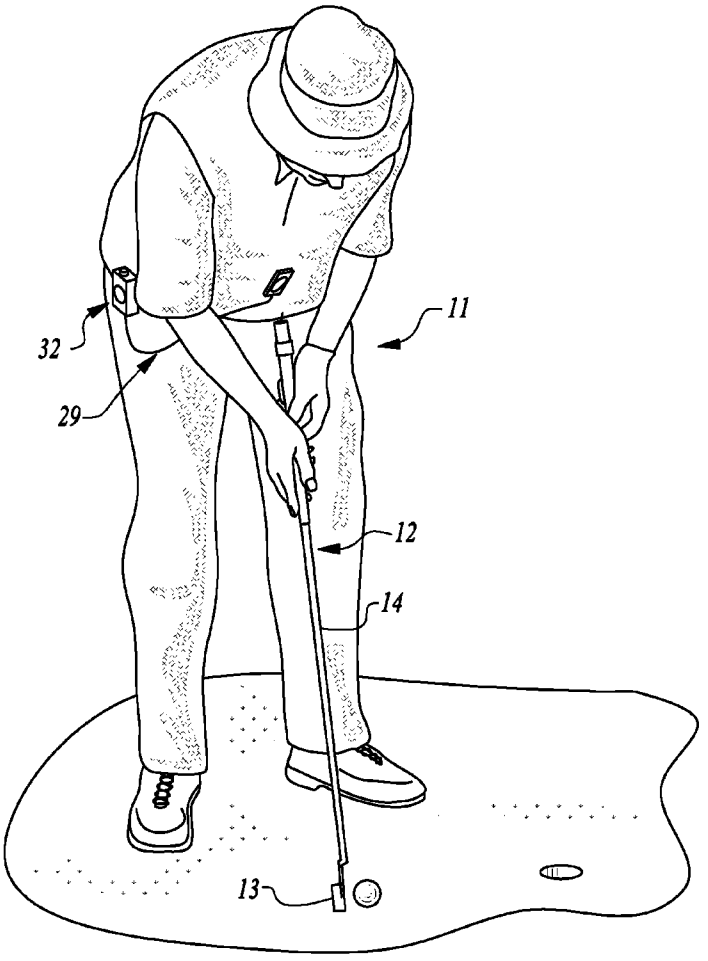
(57) **ABSTRACT**

A golf swing training device comprising an illuminator mounted on the shaft of a golf club and a detector assembly including a light sensor strategically located around the stomach region of the golfer. The illuminator provides a relatively narrow beam of light wave energy, preferably along an axis that is generally coincident with the longitudinal axis of the club. The illuminator may be pulse modulated, to provide a frequency encoded light output. The detector assembly detects the light output from the illuminator, and produces a buzzing sound or a vibrating sensation, to alert the golfer that the club is following a correct path and position through the golf swing. The detector assembly may include optical filtering and signal conditioning to reduce the effects of ambient light. With such sensory feedback, the golfer develops muscle training for a consistent and correct swing pattern.

20 Claims, 3 Drawing Sheets



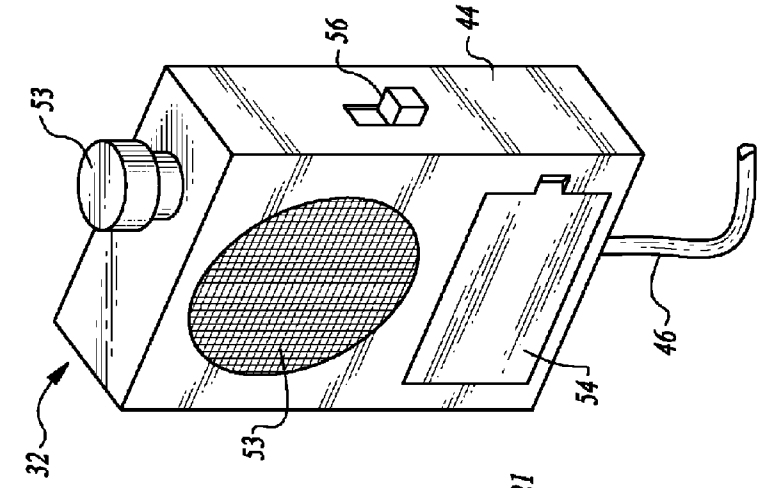


Fig. 3

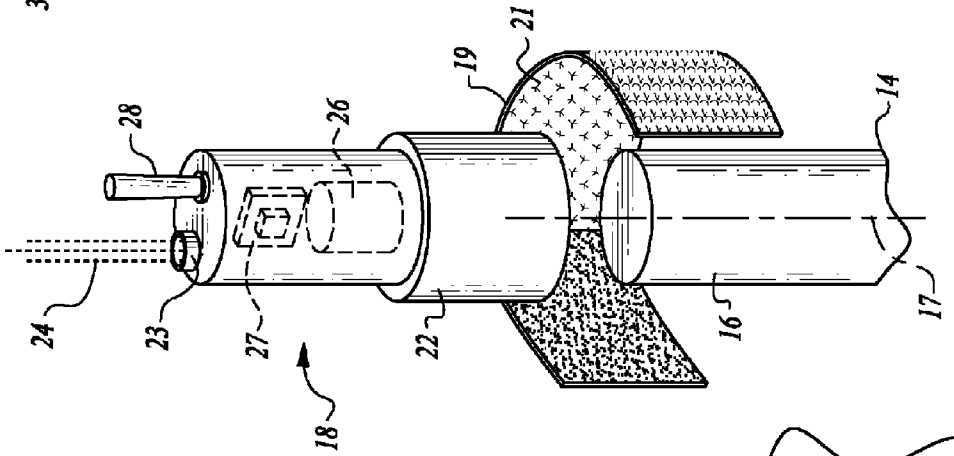


Fig. 2

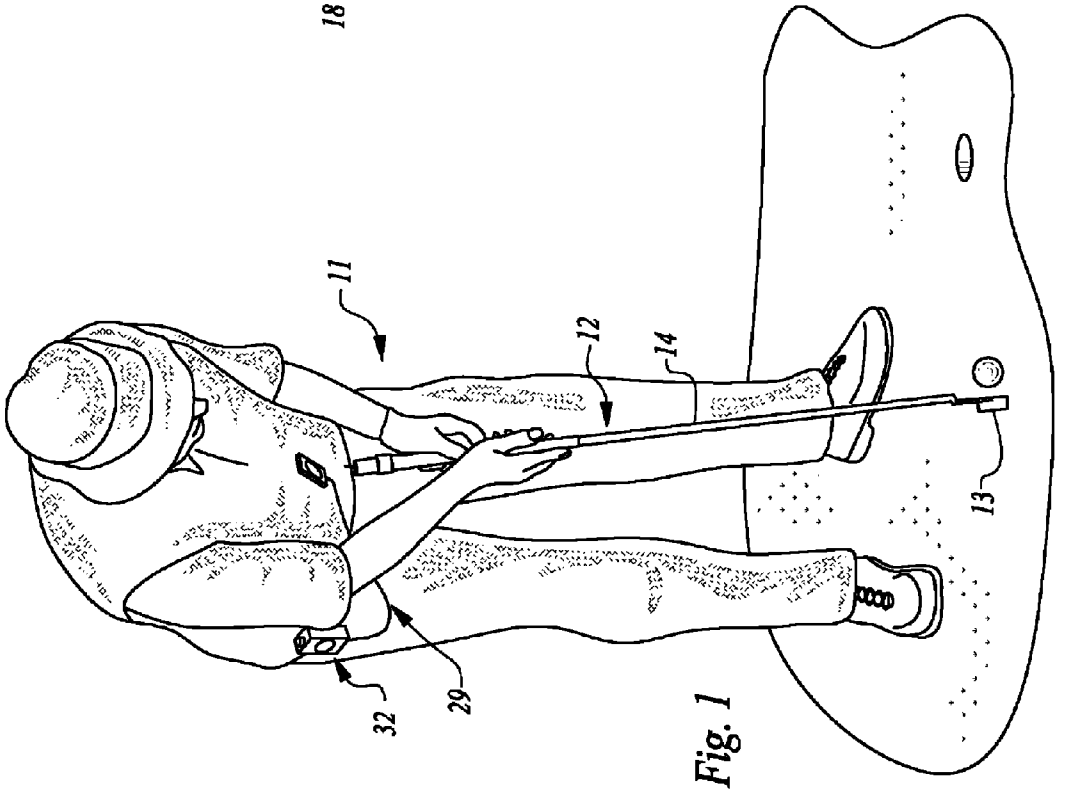


Fig. 1

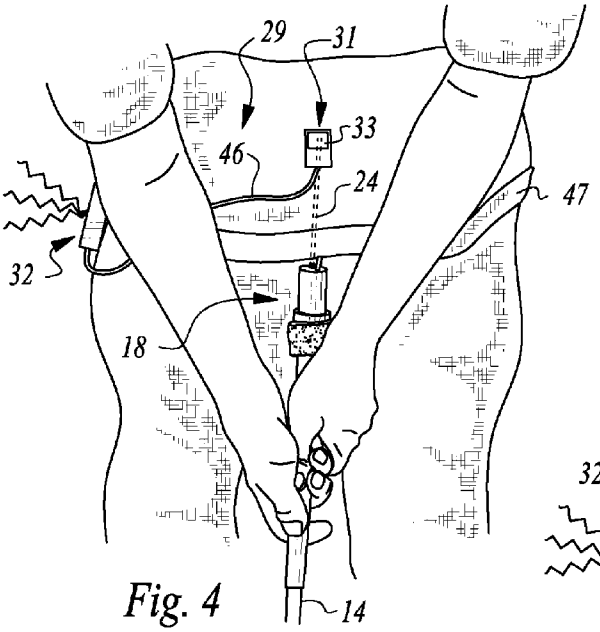


Fig. 4

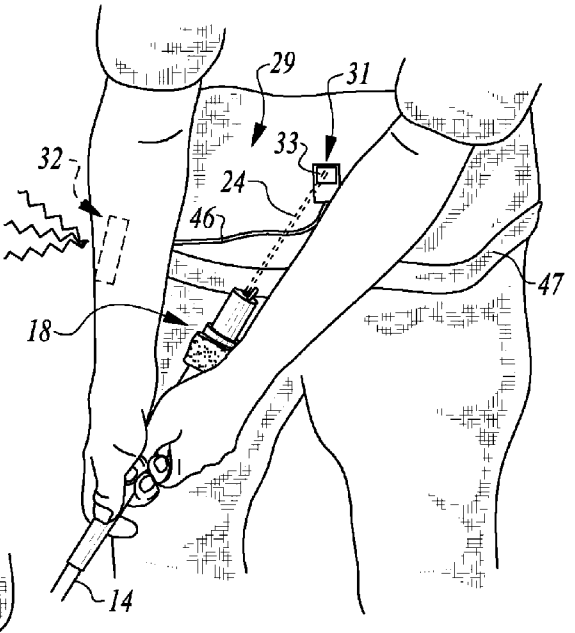


Fig. 5

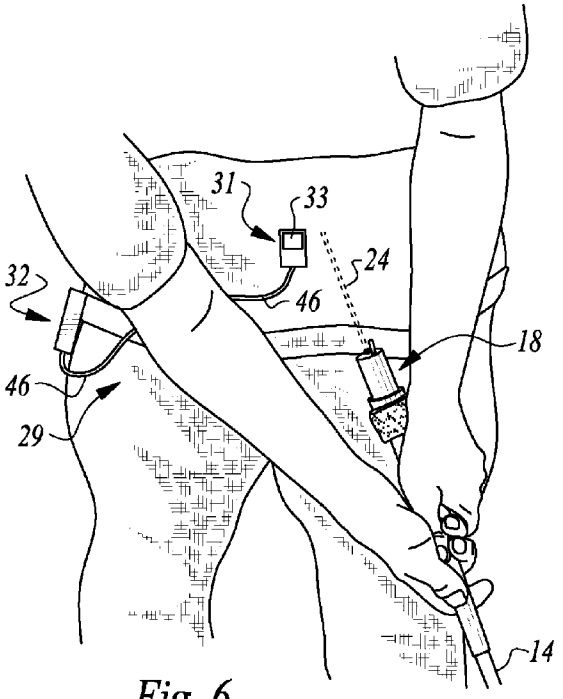


Fig. 6

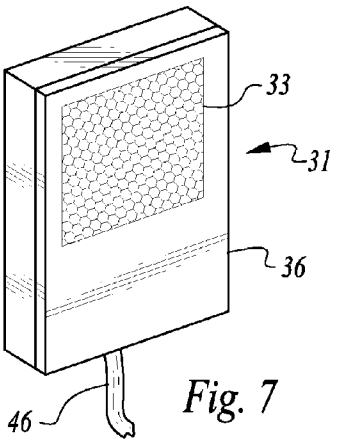


Fig. 7

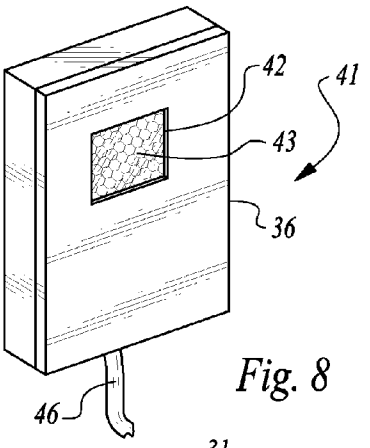


Fig. 8

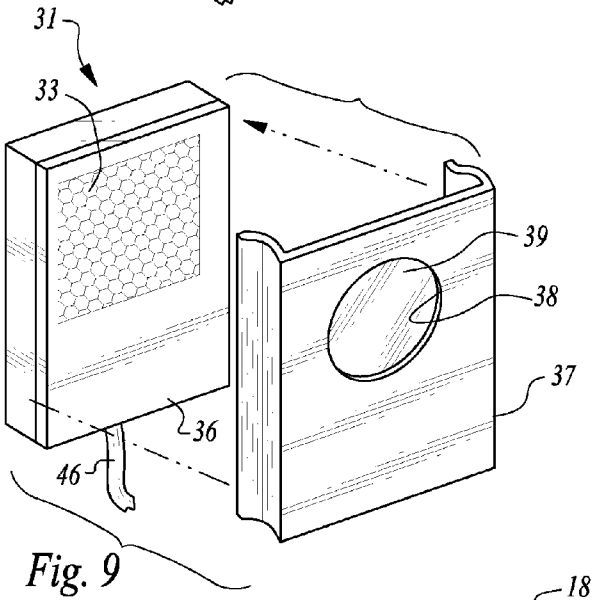


Fig. 9

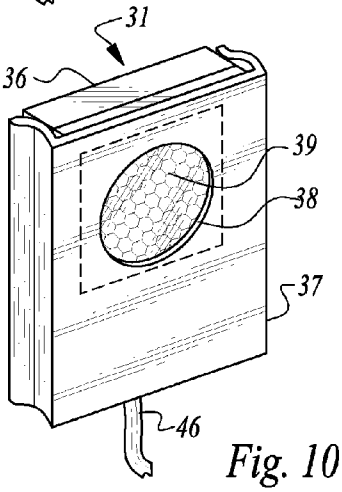


Fig. 10

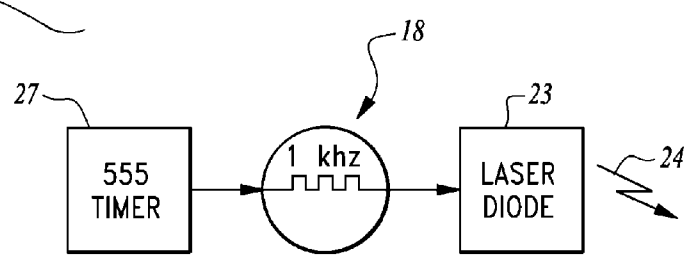


Fig. 11

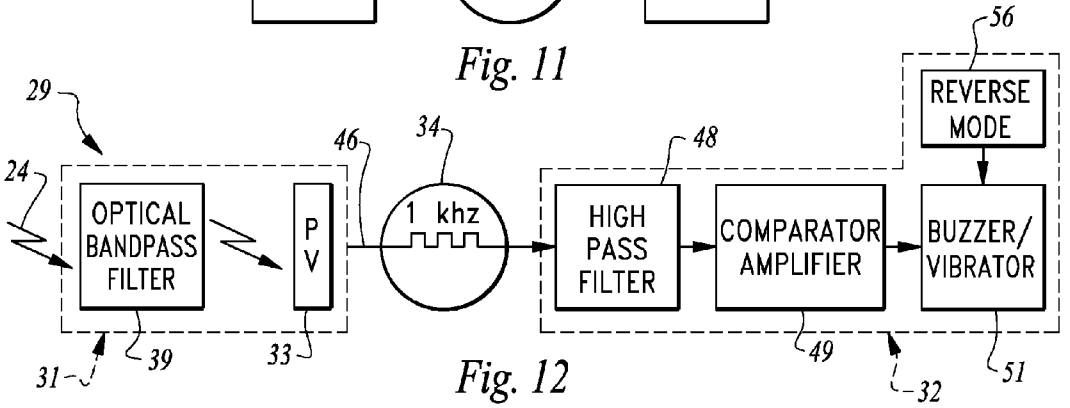


Fig. 12

GOLF SWING TRAINING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to improvements in devices for training golfers how to swing a golf club accurately and consistently. More specifically, the invention pertains to an illuminator mounted on the end of a golf club shaft and a detector assembly worn on the golfer, which together provide a perceptible signal to the golfer, confirming that the club has been maintained in the proper orientation through each swing.

2. Description of the Prior Art

Light sources have previously been used in various aspects of training devices intended to improve a golfer's swing. For example, in U.S. Pat. No. 5,082,282, issued to Hernberg, a Dual Light Source Golf Swing Trainer is shown. A first light source is provided on the club head directed downwardly, and a second light source is mounted on the upper end of the club shaft. A Detachable Golf Swing Training Device Using Two Light Beams is disclosed in U.S. Pat. No. 5,467,991, granted to White IV et al. The device of the '991 Patent is mounted along the club shaft, intermediate the club head and the grip, and illuminates in opposite directions. FIG. **4** shows how the illuminator directed toward the grip end of the shaft illuminates the ideal path for the club to follow during a swing.

A Golf Swing Training Device is shown in U.S. Pat. No. 5,665,006, issued to Pellegrini. This device is mounted on the upper end of the golf club shaft, and illuminates in a direction away from the head of the club. FIG. **3**, in particular, shows the manner in which the illuminating beam assists the golfer in training to undertake a proper swing of the club. U.S. Pat. No. 5,655,973, granted to McPherson, Jr., teaches a Laser Golf Training Device. As shown in FIG. 1 of the '973 Patent, at the upper end of the backswing, the laser illuminator casts a light path on the ground which intersects the ideal path for the head of the club through the remainder of the swing.

Yet other devices have used both a light source and a light detector, as components in a golf training device. More particularly, in U.S. Pat. No. 5,692,966, issued to Wash, an illumination source and a light detector are located on the face of a golf putter alignment device, and a mirror or reflector is located on the face of the putter head. A Sporting Club Swing Trainer is illustrated in Patent Application Publication US 2009/0082122, filed by Kellogg. The golf club shaft end includes a light projector that sweeps a moving light beam along a path parallel to the face of the club. A light beam receiver is provided, including two rows of light detectors arranged in spaced relation. Electronic circuitry compares the output of the detectors, and determines whether an angular offset exists, as the light beam passes over the detectors. Lastly, in U.S. Pat. No. 6,458,038, granted to Lin, a Golf Putting Indication Device is shown, employing an illuminator on the club head, a light sensing unit including a plurality of photocells, and a display unit including a plurality of corresponding light emitting diodes.

SUMMARY OF THE INVENTION

The present invention comprises a golf swing training device having as one component thereof, an illuminator mounted preferably on the upper end of the shaft of a golf club. The illuminator is of compact design, including a laser diode and associated drive circuitry to pulse modulate or encode the light beam outputted by the diode. The laser diode is positioned so its narrow light beam is directed away from the club head, while having an orientation which is generally coincident with the longitudinal axis of the club shaft.

The other component is a detector assembly worn by the golfer. The detector assembly includes a light sensor strategically located around the stomach region of the golfer. The light sensor may comprise a photovoltaic cell or panel of relatively small size. The effective size and configuration of the cell may be varied through the use of differently configured external shrouds, fitted over the case holding the cell. This feature varies the size of the target for the illuminator, depending upon the expertise of the golfer.

The detector assembly also includes a transducer, which is electrically interconnected to the output of the light sensor. The transducer and the sensor may be located in the same housing, or they may be physically separated. If the units are separated, the transducer is preferably located on the belt of the golfer, and interconnected to the light sensor by a small wire.

The transducer produces a buzzing sound or a vibrating sensation, whenever the light sensor detects the light beam outputted from the illuminator. This buzz or vibration alerts the golfer that the club is following a correct path and position through the course of the golf swing. With such sensory feedback, the golfer develops muscle training for a consistent and correct swing pattern.

The operation of the transducer may be reversed, producing a buzzing sound or a vibratory sensation in the absence of a detected light beam. This is effected by simply flipping a switch on the transducer housing.

The detector assembly may also include optical filtering for the light sensor, and signal conditioning circuitry in the transducer. Both of these features are provided to enhance the overall signal to noise ratio of the system, thereby reducing the effects of ambient light.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a golfer practicing putting, with the illuminator mounted on the upper end of the club shaft and the detector assembly being worn by the golfer;

FIG. **2** is a fragmentary exploded perspective view of the upper end of the club shaft, showing the illuminator and a connector band;

FIG. **3** is a perspective view of the transducer component of the detector assembly;

FIG. **4** is a front elevational view of a golfer preparing to take a swing of the putter, establishing the proper orientation for the club;

FIG. **5** is a view as in FIG. **4**, but with the putter at the end of the backswing position while remaining in the proper orientation;

FIG. **6** is a view as in FIG. **4**, but with the putter at the forward end of the stroke with the putter now in a misaligned orientation with respect to the light sensor of the detector assembly;

FIG. **7** is a perspective view of a typical light sensor, including a standard size photovoltaic cell imbedded in its face;

FIG. **8** is a perspective view of an alternative form of the light sensor, fitted with a substantially smaller photovoltaic cell for more experienced golfers;

FIG. **9** is a perspective view of the light sensor shown in FIG. **7**, being fitted with a circular target shroud to modify the size and configuration of the exposed portion of the cell;

FIG. **10** is a view of the light sensor of FIG. **9**, with the target shroud secured in place;

FIG. **11** is a functional block diagram of the illuminator; and,

FIG. **12** is a functional block diagram of the detector assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The golf swing training device **11** disclosed herein is used in connection with a golf club, namely, a putter **12**. Putter **12** includes a head **13**, and a shaft **14** having an upper end **16**. Putter **12** also has a longitudinal axis **17**, shown in FIG. **2**. Although the device **11** is primarily intended for use with training golfers in the use of putters, it may also be used with other golf clubs, where the stroke is similar to that of a putter.

An illuminator **18** is mounted on the upper end **16** of the shaft **14** by any convenient means. For example, a strip **19** of hook and loop material having an inner adhesive side **21** provides a simple and inexpensive means of attachment. One advantage of this arrangement is that the illuminator **18** can easily be removed either for service or to return the putter **12** to an unmodified condition. Lower coupler section **22** of illuminator **18** could also be screwed over the upper end **16** of shaft **14**, provided both structures are provided with complementary threads (not shown). Or, coupler section **22** could simply be adhesively attached over upper end **16**.

Illuminator **18** preferably includes a laser diode **23**, producing a beam **24** of light wave energy. The 3 mw laser diode **23** provides an intense, collimated output anywhere within the general range of 640 nm to 760 nm. This red color frequency range is selected because it can readily be seen by the golfer during the day or night, and it can also be detected by many different light sensors. A laser diode also provides the advantage of having low power consumption, a desirable attribute for use in illuminator **18**, a battery powered device. However, an LED or other source of light wave energy providing sufficient intensity at an appropriate light wave frequency may also be substituted.

Laser diode **23** is powered by a battery **26**, providing low voltage DC to a driver **27**. A switch **28** enables the golfer to turn illuminator **18** on and off as desired. Driver **27** is a conventional and inexpensive 555 timer, providing a stable current output at an AC frequency of approximately 1 khz, effective to pulse encode the beam **24** produced by laser diode **23**. This frequency is not critical, but it is high enough to provide a light wave source which can be differentiated from the DC frequency of ambient light. This frequency of 1 khz is also low enough to minimize charge/discharge losses caused by capacitive reactance in the laser diode drive circuit.

As is evident from FIG. **2**, beam **24** is directed away from the shaft **14** of putter **12**, along a path which is generally coincident with and parallel to, the longitudinal axis **17** of the shaft **14**. Laser diode **23** could also be located so that beam **24** is directly coincident with longitudinal axis **17**, but for purposes of practicing the invention, it is only necessary that the beam **24** be generally coincident with and parallel to that axis. This direction and orientation for beam **24** ensures that the axis of putter **12** will be accurately projected onto the golfer so it can be detected and the golfer appropriately alerted.

For that purpose, a detector assembly **29** is provided, including a light sensor **31** and a transducer **32**. Light sensor **31** includes a polycrystalline photovoltaic cell **33**, selected for its ability to generate an AC square wave output **34** responsive to the beam **24**, even in the presence of high levels of ambient light produced by the sun. Cell **33** also has the characteristic of being relatively large in size, on the order of 1" square, for practical use in the present application.

Light sensor **31** also includes a housing **36** to secure cell **33** and to provide a convenient means for attaching sensor **31** to the clothing of the golfer. Typically, the light sensor **31** is worn by the golfer during the training session, being strategically located around the stomach region of the golfer to define a target for the beam **24**. During a putting stroke, it is generally advantageous for consistency and accuracy in the shot, to maintain the longitudinal axis **17** of the putter **12** directed toward the stomach of the golfer. Each golfer can experiment to find a particular location for light sensor **31**, for example somewhere between the belt region to the upper stomach region, which is optimum for his putter and unique style of golfing. In any event, housing **36** may be attached to the clothing of the golfer by any convenient means including hook and loop strips, clips, or pins. (not shown).

Housing **36** also provides a structure for a detachable shroud **37**, providing a number of additional features. After a golfer has achieved a certain level of expertise and skill, it may be desirable to reduce the effective size of the target provided for the illuminator **18**. For that purpose, shroud **37** including a circular cutout **38** may be clipped over the housing **36**. The shroud **37** thereby reduces the exposed area of cell **33**, and changes the target from a square configuration to a circular configuration. (See, FIGS. **9** and **10**). It is apparent that the size and configuration of the cutout can be varied, depending upon the needs of the golfer.

In addition to the feature of varying the target size and configuration, an optical bandpass filter **39** may be included in circular cutout **38** to provide another operational feature. The light wave transmission characteristics of optical bandpass filter **39** are selected to pass light wave energy produced by the illuminator **18**, and to absorb ambient light wave energy produced by the sun. The optical bandpass filter **39** will increase the signal to noise ratio of the system, and therefore the reliability of the operation of the transducer **32**.

Yet another light sensor **41**, is shown in FIG. **8**. In this construction, the housing **36** is the same size as that previously described, but the photovoltaic cell **42** is substantially smaller than cell **33**. This arrangement, presenting a much smaller target for illuminator **18**, would be appropriate for an advanced golfer. In addition, an optical bandpass filter **43** is directly affixed over the exposed portion of photovoltaic cell **42**, making the aforementioned shroud unnecessary.

Transducer **32** preferably includes a housing **44** to confine and protect its various components. If transducer **32** is mounted on the golfer in a position remote from the light sensor **31**, as shown in the drawings, a small cable **46** is provided to interconnect the two units and deliver the square wave output **34** of the cell **33** to the transducer **32**. Typically, housing **44** would be secured by clip or clamp to the golfer's belt **47**. Alternatively, light sensor **31** and transducer **32** may be mounted in a common housing (not shown), worn by the golfer in the proper position for the light sensor.

As its first internal component, transducer **32** includes a high pass filter **48**. High pass filter **48** has a low frequency cutoff of 100 hz, and provides 6 db of loss for all signals below that frequency. This filter has proven effective in removing all ambient light DC output from the photovoltaic cell **33**. The output of high pass filter **48** is then fed to amplifier means **49**, to increase the amplitude of the detected square wave signal. A common and very high gain LM339 comparator chip was selected for amplifier means **49**, to clean up and amplify the weak square wave signal outputted from high pass filter **48**. The output of amplifier means **49** is effective to drive a either a buzzer or a vibrator **51**.

If a buzzer is employed, the aural output passes through grill **52** in housing **44**. If a vibrator is used in transducer **32**, the

vibrator is mechanically coupled to the housing **44**. As shown in FIG. **3**, housing **44** also includes an on-off push button switch **53** to turn the transducer **32** on or off. A battery door **54** is also provided, to allow convenient access for battery replacement.

In operation, the transducer **32** produces a buzzing sound or a vibrating sensation, whenever the light sensor **31** detects the light beam **24** outputted from the illuminator **18**. This buzz or vibration alerts the golfer that the club is following a correct path and position through the course of the golf swing. With such sensory feedback, the golfer develops muscle training for a consistent and correct swing pattern. This operation is depicted in FIGS. **4-6**. As can be seen in FIGS. **4** and **5**, the golfer has maintained the correct position of the club from the beginning of the swing up to and including the end of the backstroke. However, in FIG. **6**, it is evident that the beam **24** has strayed from the target presented by the light sensor **31**, indicating an incorrect position for the golfer's hands and arms as they are holding the shaft **14**. By the time the club has reached the position shown in FIG. **6**, the buzzing sound or vibrating sensation will have ceased, indicating to the golfer that correction is needed. Once correction of the position of the club throughout the entire stroke has been made, the golfer will experience continuous sensory feedback of that fact.

In the event the golfer learns better through a reverse sensory feedback, a reverse mode switch **56** is also provided on the side of housing **44**. When reverse mode switch is activated, it is effective to reverse the operation of the transducer **32** so that it produces a buzzing sound or a vibratory sensation in the absence of a detected light beam **24**.

Irrespective of the mode of operation, the buzz or vibration or the lack thereof, communicates to the golfer that the club is following a correct path and position through the course of the golf swing. With such sensory feedback, the golfer develops muscle training for a consistent and correct swing pattern.

What is claimed is:

1. A golf swing training device for use with a golf club, comprising:

a. an illuminator mounted on an upper end of the shaft of the golf club, said illuminator producing a beam of light wave energy directed away from the golf club along a path which is generally coincident with a longitudinal axis of the club shaft; and,

b. a detector assembly including a light sensor and a transducer, said light sensor being sensitive to said beam produced by said illuminator and outputting an electrical signal in response thereto, said light sensor being worn by the golfer and strategically located around the stomach region of the golfer to define a target, said transducer being electrically interconnected to said light sensor and producing either a buzzing sound or a vibrating sensation whenever said beam strikes the target presented by said light sensor, whereby the buzz or vibration alerts the golfer that the club is following a correct path and position through the course of a golf swing.

2. A device as in claim **1** in which said light sensor includes a photovoltaic cell.

3. A device as in claim **2** further including a housing and a shroud fitted over said housing, selectively covering a portion of said photovoltaic cell and effectively reducing the size of said cell as a target for said illuminator.

4. A device as in claim **1** in which said light sensor includes a housing, and further including an optical bandpass filter fitted over said housing interposed between said illuminator and said light sensor, the transmission characteristics of said optical bandpass filter being selected to pass light wave energy produced by said illuminator and to absorb ambient light wave energy.

5. A device as in claim **1** in which said illuminator includes a laser diode and a timer to pulse encode the output of said diode.

6. A device as in claim **5** in which said transducer includes amplifier means to increase the amplitude of said electrical signal.

7. A device as in claim **1** further including a switch interconnected to said transducer, said switch being effective to reverse the operation of said transducer so that it produces a buzzing sound or a vibratory sensation in the absence of a detected light beam.

8. A device as in claim **1** in which an optical bandpass filter is located over said light sensor interposed between said illuminator and said light sensor, the transmission characteristics of said filter being selected to pass light wave energy produced by said illuminator and to absorb ambient light wave energy.

9. A device as in claim **1** in which said transducer includes amplifier means to increase the amplitude of said electrical signal.

10. A device as in claim **9** in which said amplifier means is a comparator.

11. A golf swing training device for use with a golf club, comprising:

a. an illuminator mounted on an upper end of the shaft of the golf club, said illuminator producing a beam of light wave energy directed away from the golf club along a path which is generally coincident with the longitudinal axis of the club shaft, said illuminator including a laser diode and means to pulse encode said beam produced by said laser diode; and,

b. a detector assembly including a light sensor and a transducer, said light sensor being sensitive to said beam produced by said illuminator and outputting an electrical signal in response thereto, said light sensor being worn by the golfer and strategically located around the stomach region of the golfer to define a target, said transducer including amplifier means electrically interconnected to said light sensor to process said electrical signal, said amplifier means having an output interconnected either to a buzzer or a vibrator, whereby the buzz or vibration produced thereby alerts the golfer that the club is following a correct path and position through the course of a golf swing.

12. A device as in claim **11** in which said light sensor includes a photovoltaic cell.

13. A device as in claim **11** in which said amplifier means comprises a comparator.

14. A device as in claim **11** in which an optical bandpass filter is located over said light sensor interposed between said illuminator and said light sensor, the transmission characteristics of said filter being selected to pass light wave energy produced by said illuminator and to absorb ambient light wave energy.

15. A method for training a golfer, comprising the steps of:

a. providing a putter, said putter having an illuminator mounted on an upper end of the shaft of said putter, said illuminator producing a beam of light wave energy directed away from said putter along a path which is generally coincident with a longitudinal axis of said putter's shaft, said illuminator including a laser diode and means to pulse encode said beam produced by said laser diode

b. providing a detector assembly including a light sensor and a transducer, said light sensor being sensitive to said beam produced by said illuminator and outputting an electrical signal in response thereto, said light sensor being worn by the golfer and strategically located around the stomach region of the golfer to define a target, said transducer including amplifier means electrically interconnected to said light sensor to process said electrical signal, said amplifier means having an output interconnected either to a buzzer or a vibrator; and

c. producing either a buzz or a vibration, thereby alerting the golfer that the club is following a correct path and position through the course of a putting stroke, providing said beam remains directed upon said light sensor, during the course of said putting stroke.

16. A method as in claim **15** further including the step of providing an optical bandpass filter located over said light sensor, the transmission characteristics of said filter being selected to pass light wave energy produced by said illuminator and to absorb ambient light wave energy.

17. A method as in claim **15** in which said light sensor includes a photovoltaic cell.

18. A method as in claim **15** in which said amplifier means comprises a comparator.

19. A method as in claim **15** in which said light sensor and said transducer are physically separated, said transducer worn by the golfer in a location removed from the stomach region of the golfer and being interconnected to said light sensor by means of a wire.

20. A method as in claim **19** in which said removed location is on the belt or trousers of the golfer.

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