GOLF SWING PRACTICE SIMULATOR

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ABSTRACT

A practice golf swing device which permits the swinger of a golf club to hit a variable height replica golf ball that is fixedly attached to a universally pivoting arm (swivel arm) that moves in direct proportion to the swing path and speed of the golf club. The motion thus initiated in the swivel arm may be measured at the base of the arm (knuckle ball) using an optical/digital sensing output as disclosed in U.S. Pat. Nos. 5,288,993 and 5,703,356 with this measurement being computed so as to numerically or graphically depict the movement. This graphical depiction may be viewed as a pictorial view of a golf ball in flight along the path that would be expected had the ball been struck by a golf ball with the same force and direction that is imparted to the replica golf ball, which is attached to the pivot arm of the device. The apparatus has a self-zeroing capability that provides an identical "at rest" position prior to impact. Thus, the only force that can affect the measured movement of the arm and the replica golf ball is the force applied directly to the ball at the point in time of impact.
FIGURE 7

LOGIC DIAGRAM
GOLF SWING PRACTICE SIMULATOR

INCORPORATION BY REFERENCE

[0001] Applicant(s) hereby incorporate herein by reference, any and all U.S. patents, U.S. patent applications, and other documents and printed matter cited or referred to in this application.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates generally to practice equipment in the field of golf and more particularly to measuring, predicting and simulating golf ball trajectory and force of impact in a simple stationary equipment.

[0004] 2. Description of Related Art

[0005] The following art defines the present state of this field:

[0006] Kimrot et al. U.S. Pat. No. 6,424,407, defines a method for determining the relative motion of a surface with respect to a measurement device comprising: illuminating the surface with incident illumination; detecting illumination reflected from the surface to form at least one detected signal; and determining the amount of relative motion parallel to the surface from said at least one detected signal, characterized in that said determining includes correcting for the effects of relative motion perpendicular to the surface.

[0007] Toner U.S. Pat. No. 4,767,121: A golf simulating apparatus capable of simulating play on a golf course and/or a driving range. A pivoted mounted resilient ball member (38) is arranged to be impacted with the head of a golf club when the club is swung by the player. Special sensors are associated with the ball member (38) to sense its velocity and any lateral deviation from a fixed plane of movement (Y-Y) thereby to provide signals representing a probable distance and direction of ball travel. These signals are applied to the input ports of a computer (80) which is programmed to provide output signals to a monitor (20) so that it displays a simulated golf course or driving range, with the simulated path of ball travel and/or landing position being displayed on the golf course or driving range. The program provides the golf course or driving range with selected hazards (water, sand, trees etc.). Provision is made for counting and displaying the number of strokes, for averaging distances, assessing penalties and the like thereby to provide a simulation of conditions likely to be encountered during actual play of a game of golf.

[0008] Chen, et al. U.S. Pat. No. 4,429,880: A game simulator device permits the golfer to view a specific golf course or portion thereof on a television monitor and is provided with additional information relating to the ball and its position in relation to the hole. The golfer then hits the ball in the normal manner, which ball is fixedly retained on a joystick apparatus, whereby in striking the ball the joystick transmits signals to a computer which generates graphic data relative to a golf course and converts the signal input to graphic display information relative to the new position or lie of the ball in relation to the hole on the golf course. The golf ball is mounted so that when struck, first and second signals for each of four degrees of movement are transmitted to the computer and correlated with the golf course data input. The device in one embodiment utilizes a video disc whereby the course layout is pictorially viewed on a television monitor in addition to graphic information, and the computer determines the pictorial scene to be displayed depending upon the location of the golf ball after being struck by the golfer. The device is useful to simulate other ball games, such as billiards, pool or croquet.

[0009] Onozuka, et al. U.S. Pat. No. 4,958,836: In a golf simulator having a housing in which a display and a reproducing device are accommodated, and an arm to the distal end of which a ball is secured, the golf simulator comprises a bed plate which supports a horizontal shaft; a swingable bed rotatable on the horizontal shaft and having another shaft which makes a right angle with the horizontal shaft, and to which the proximal end of the arm is rotatably secured; and drive means for driving the swingable bed so as to enable the shaft of the swingable bed to be selectively in either of a first state in which the shaft inclines with respect to the vertical line and toward approaching to the front side of the housing, and a second state in which the shaft inclines with respect to the vertical line and in the reverse of inclination under the first state.

[0010] Teitel, et al. U.S. Pat. No. 5,826,874: The golf game system of the present invention includes at least two magnetic induction coil sensors to simulate the speed and the direction of a golf swing by a golfer. A magnetic strip adhesively attached to the end of the golf club locates the position of the golf club with respect to the sensors. An electronic circuitry panel translates the information provided by the magnetic induction coil sensors into information that is acceptable to the customized software package. The magnetic sensing system interfaces with standard software packages for a personal computer to allow a user to swing a real golf club and have the results entered and displayed by the software package. In one preferred embodiment of the invention, the magnetic sensing system and electronic circuitry panel interfacing with the personal computer are integrated into a golf mat. The magnetic induction coil sensors may be flat induction coils built into the mat to minimize mat thickness. The golf mat further may include means to select functions such as the number of the golf club from the software package without returning to the mouse of the personal computer. The selection means may be realized with a ‘magnetic mouse’ integrated into the golf mat so that the golfer may position the cursor on the computer screen by moving the golf club around an area of the golf mat. Magnetic sensors in the golf mat interact with the magnet on the end of the golf club to position the cursor over the desired function from the software package, and the golfer may then click on that function with a switch or button on the golf mat.

[0011] Teitel, et al. U.S. Pat. No. 5,728,006: The golf game system of the present invention includes a pair of magnetic induction coil sensors to simulate the speed and, optionally, the direction of a golf swing by a golfer. The magnetic sensing system interfaces with standard software packages for a personal computer to allow a user to swing a real golf club and have the results entered and displayed by the software package. The golf game system of the present invention is useful for its recreational and entertainment value, permitting the user to practice his golf swing, and possibly for golf training and teaching applications. A magnetic strip adhesively attached to the end of the golf club
locates the position of the golf club with respect to the sensors, without the need for optical sensing. An electronic circuitry panel translates the information provided by the magnetic induction coil sensors into information that is acceptable to the customized software package.

[0012] Mueller U.S. Pat. No. 4,202,547 A movable golf green is disclosed which is movable along a predetermined track and the golf green is rotatable to provide a multitude of golf green simulation layouts and changing pin positions to the user of the apparatus.

[0013] Curchod U.S. Pat. No. 5,226,660 A golf simulating apparatus having a driving simulator and an actual green area adjacent thereto for simulating a complete game of golf, comprising apparatus for generating signals indicative of the velocity, trajectory and spin of a hit golf ball. A computer apparatus connected to the generating apparatus is provided for receipt of the signals and for processing the signals to determine the distance and location of the hit golf ball would have travelled on a golf course, the computer apparatus calculating the lie of the ball on a simulated hole. Also, display apparatus controlled by the computer apparatus is provided for projecting the simulated hole of golf so that as a golfer moves down the fairway the view of the hole from the golfer’s vantage point is displayed.

[0014] Richards U.S. Pat. No. 5,711,717: An apparatus for guiding a simulated golf swing consists of a golf club handle fixed at one end of a mechanical linkage whose other end can be fixed to a wall. The handle is fixed, so as to be rotatable about its own axis, to a crank of the linkage. The crank is connected in turn to an elongate arm pivoted at the fixing location so as to guide a swing in a basic arc. A central pivot of the crank permits the user’s wrists to flex during the swing. The handle carries a projecting pointer which moves over an index plate fixed to the adjacent connector on the crank. The index plate has stop lugs to limit the rotation of the handle by abutting the turning pointer. A scale on the index plate enables a suitable address position to be selected. By thus controlling and indicating the handle’s rotation it becomes possible to school the user’s hand movements and thereby improve the alignment of the club face during the swing.

[0015] The prior art teaches various golf swing training devices as shown by the above descriptions, but does not teach a golf swing device enabled for measuring force and trajectory in a simple light reflecting device. The present invention fulfills these needs and provides further related advantages as described in the following summary.

SUMMARY OF THE INVENTION

[0016] The present invention teaches certain benefits in construction and use which give rise to the objectives described below.

[0017] The present invention utilizes a motion processing unit (MPU) that operates on the principle of displacement of position sensing. Various sensing approaches may be used. In the preferred approach, rotation of a swivel-arm attached to a replica golf ball mounted at its upper end will cause movement in a knuckle ball in a socket at its lower end. Movement is sensed optically. Light from a light emitting diode circuit is bounced off the measured ball’s surface to a semiconductor light sensor circuit and forms a received signal. This signal is processed by a digital processor circuit which delivers a digital signal to a computer circuit that is used as an integral part of a computer program that can generate a numerical display of speed and direction or a graphical simulation of the same data (i.e., simulated ball flight). The measured (knuckle) ball is mounted rotatably within a socket with the socket mounted fixedly to the body of the device and a motion detecting optical system is positioned at a fixed distance from the knuckle ball. The knuckle ball is held in place but allowed to rotate as previously described and shown on the drawings supplied. When the replica golf ball is struck by a club, the motion processing unit (MPU) produces a signal output proportional to rotational movement of the knuckle ball.

[0018] The motion processing unit (MPU) consists of an optical sensing unit, located in close proximity behind the knuckle ball (see drawings). This is used to create a digital signal that will be used to compute the movement (velocity) of the replica golf ball. The preferred embodiment used will be similar to the technology invented by Agilent Technologies, that being a light-emitting diode (LED) that will bounce light off of the knuckle ball and be received by a complimentary metal oxide semiconductor sensor. This signal is then sent to a digital signal processor (DSP) that is able to detect patterns in the sequenced images and how they have changed and can thereby determine how far the image has moved. The corresponding coordinates are sent to the computer which mirrors the movement. This technology exists and is used in optical mouse technology (see U.S. Pat. Nos. 5,288,993 and 5,703,356, as well as others).

[0019] This signal output alone is sufficient to actually proportionately represent the movement of the knuckle ball on the computer screen. The data with respect to movement of the knuckle ball is sent from the DSP to the computer serially on the data line which is based on the number of bits per second, thereby allowing the computation of the speed and direction of the ball by measuring the time elapsed during the deviation from any fixed position, for example, the zero position to any other position, i.e. the finished position with respect to both the “X” and “Y” axes.

[0020] A primary objective of the present invention is to provide a simple apparatus and method of use of such apparatus that provides advantages not taught by the prior art.

[0021] Another objective is to provide such an invention capable of measuring the motion of a replica golf ball device and producing a numerical representation of speed and direction of the replicated ball.

[0022] Another objective is to provide such an invention capable of measuring the motion of a simulated golf ball device and projecting such motion visually as to potential line of flight on a computer or TV screen.

[0023] A further objective is to provide such an invention capable of using only one sensing device to measure and project such motion.

[0024] A still further objective is to provide such an invention capable of detecting a “slice” or “hook” in the motion of a replica golf ball (i.e., motion relative to the sphere itself).

[0025] A still further objective is to measure the force applied to a golf ball when struck by a club.
Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the present invention. In such drawings:

FIG. 1 is a schematic diagram (oblique view) of the preferred embodiment of the invention;

FIG. 2 is a sectional view of the apparatus;

FIG. 3 is a planned view of the apparatus;

FIG. 4 is a sectional view of the apparatus with the replica golf ball in the lower position (for putting and other non driver type strokes);

FIG. 5 is a sectional view of the apparatus showing the replica golf ball in the elevated or “driver” position;

FIG. 6 is a cut away sectional view of the detail regarding the means of attachment of the replica golf ball to the swivel arm; and

FIG. 7 is a block diagram showing the inter relationship between the replica golf ball, the swivel arm, the knuckle ball, the light emitting dial (LED), the sensor, the digital signal processor, the computer and the monitor of the apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, there is shown the swing practice device 1 of the present invention. A moulded plastic housing 1 forms a housing intended to protect the movement processing unit (MPU) 10, while providing the base platform for the attachment of other components.

A socket 4 is an integral part of the housing and is intended to maintain the knuckle ball end of the swivel arm 2 in place. The preferred embodiment is a “snap-fit” method of attachment, which relies upon the application of sufficient frictional force to maintain a constant position while allowing rotational movement. A further embodiment would be to provide for a spring loading of the sides of the socket 4.

A replica golf ball 3 is attached to the upper end of the swivel arm 2 so as to allow two distinct heights or elevations of the replica golf ball 3 relative to the housing. This is to accommodate iron shots and putting strokes of the golf club which require a lower position of the golf ball as well as wood shots that require a higher position. A novel embodiment and critical component is the ball attachment detail which allows for only one ball to be used but will provide two heights by rotating the ball on the swivel arm 2. The knuckle ball at the end of the swivel arm 2 will be finished to a roughness grade which will be conducive to the reflection of light from the light emitting diode (LED) (see description of the motion processing unit (MPU) P. 5).

The swivel arm 2 will be at rest at an angle of approximately ten degrees to the vertical. This is to accommodate the self-zeroing/self-centering component of the device and also to accommodate true movement of the swivel arm 2 when struck, i.e. no energy is imparted along the axial center of the swing arm 2, but rather all of the energy is applied normally to this axis.

The self-centering vee-notch 6 is cut into the moulded housing and is flared so as to accommodate the ten degree angle of rest or repose which will allow the cradled swivel arm to have the identical “primed” position prior to impact. The preferred embodiment of the optical sensing device is more further described in U.S. Pat. Nos. 5,288,993 and 5,703,356. A beam is transmitted from the light emitting diode and is reflected off the knuckle ball 5 and is reflected to a digital signal processor (DSP). The digital signal is then transmitted to the computer via a multi-pin connector. The digital signal is then represented on a computer monitor as movement in direct proportion to the speed and direction of movement of the knuckle ball 5.

The software which will enable processing of the digital signal will be such that it will detect and display when the position of the swivel arm is cradled in the self-centering vee and will automatically reset the program to “prime” or a “zero” position before the player strikes the replica golf ball 3.

The above described drawing figures illustrate the invention in at least one of its preferred embodiments, which is further defined in detail in the following description.

The present invention is a golf simulation apparatus having a replica golf ball mounted at an upper end of a rigid shaft (swivel arm) 2. A knuckle mounted ball 5 is mounted rotatably within a socket 4. The knuckle ball 5 is fixed at an opposing, lower end of the rigid shaft (swivel arm) 2 so that when the replica golf ball 3 is struck by a golf club (not shown), the replica golf ball 3, shaft (swivel arm) 2 and knuckle mounted ball 5 all move in harmony as shown in FIGS. 2 and 3, i.e., from right to left in the illustrations. As shown in FIG. 3, the golf ball 3 may move along a line of symmetry 15 or may move to one side or the other side of the line of symmetry depending upon how the ball is struck. A socket 4 is mounted fixedly to a surface 9 so that the ball 3 can only rotate but not translate in any direction whatsoever. A motion processing unit (MPU) 10 is positioned at a fixed distance from the knuckle mounted ball 3 as shown in FIG. 2. The optical system provides a light source, preferably a light emitting diode type, and a semiconductor light sensor receives the reflected light and produces a digital signal output proportional to rotational movement of the knuckle mounted ball 5 as is described in the reference to Kinrot et al. U.S. Pat. No. 6,424,407 which has been incorporated into this application by reference. This process is similar to that used by a computer pointing device such as an optical mouse. A digital processor circuit 11, typically a computer, is interconnected with the optical system for receiving the digital signal of the optical system, and for calculating the trajectory and force of impact of the golf club from the information carried by the digital signal. Such calculations are well known in the art and illustrated in the incorporated references.

A display monitor 12 is interconnected for receiving a processed signal from the digital processor circuit 11 and is enabled for displaying the processor signal. Such a monitor is very well known and commonly used with desktop computers of all types. The rotational motion of ball 5 is converted into an estimate of trajectory curvature while the...
rate of rotation provides an estimate of contact force. Prior to each swing, the rigid shaft 2 is placed in a laid-back position in notch 6 so ball 3 is positioned at a known starting position. From that position, the ball 5 rotates under the force of the contact between the golf club and replica ball 3, and such rotation is recognized by optical system.

[0044] In the preferred embodiment, the notch 6 is positioned at, or below, a surface level upon which a golfer stands to interface with the invention so that only the ball 3 is above such surface and wherein cover 1 protects the various components of the invention from damage by the golf club.

[0045] While the invention has been described with reference to at least one preferred embodiment, it is to be clearly understood by those skilled in the art that the invention is not limited thereto. Rather, the scope of the invention is to be interpreted only in conjunction with the appended claims and it is made clear, here, that the inventor(s) believe that the claimed subject matter is the invention.

What is claimed is:

1. A practice golf swing device comprising a swivel arm means connected to a ball rotatably mounted in a socket so as to permit an electrical signal in response to movement of the swivel arm; means to fixedly mount a replica golf ball adjacent to the top of the said swivel arm means so that the said swivel arm can be moved when the ball is struck by the movement of a golf club head against the ball; computer means to access said signal and comprising means to convert said signal to numerical display or to video input information relative to the ball flight movement as if the ball was not fixedly mounted; a video monitor to display said ball flight information; video game information means being selectively removably insertable in said computer means, said information means comprising information for the graphic display of golf course information including a plurality of images of golf playing surfaces.

2. The apparatus of claim 1 wherein the optical systems produces a digital signal output proportional to rotational movement of the knuckle ball.

3. The apparatus of claim 2 further comprising a digital processor circuit interconnected for receiving the digital signal of the optical system.

4. The apparatus of claim 3 further comprising a display monitor interconnected for receiving a signal from the digital processor and enabled for displaying the processor signal.

5. The apparatus of claim 3 further comprising a video game cassette player.

6. The apparatus of claim 1 where the replica golf ball is capable of being attached to the pivot swing arm two different positions, one position higher than the other by means of sufficient frictional means between the center core of the said replica golf ball and the said swivel swing arm.

7. The apparatus of claim 6 where the replica golf ball is fixedly attached to the swivel arm at two different positions having two different heights relative to the moulded housing in such a fashion that the replica golf ball can be pulled upwards from the swivel arm, turned 180 degrees and placed upon the swivel arm in such a fashion that the swivel arm is inserted into the replica golf ball, the result being the replica golf ball is frictionally attached at a position which is higher or lower than the position of the replica golf ball immediately prior to removal of the ball from the swivel arm.

8. The apparatus of claim 1 further comprising a video disk player and wherein said video monitor receives information input from the video cassette player and video disk player.

9. A golf swing practice device comprising: a means to mount a replica golf ball so that the ball can be struck by a golf club in putting, chipping or driving; said mounting means comprising means to permit movement of said mounting means in response to the impact of the club on said ball; computer means to compute the velocity and direction of the golf ball subsequent to impact with the head of a golf club as if the ball were struck in putting, chipping or driving movements, said data including golf ball loft data derived from said signals from said movement.

10. A practice golf swing device of claim 9 further comprising a means to input and display golf course data comprising fairway and green images of selected golf courses so as to super impose the projected speed and flight path of the ball upon the chosen golf course or portion of said golf course chosen by the player.

11. An apparatus of claim 10 further comprising a means to permit the player to choose between any number of selected golf courses so as to enable the player to make use of the said apparatus as if the player was playing any number of holes on any number of selected golf courses as chosen by the player, so as to represent, as near as possible, the player playing any one of a number of selected golf courses.

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