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(54) **ILLUMINATING AND/OR LASER-EMITTING GOLF BALL**

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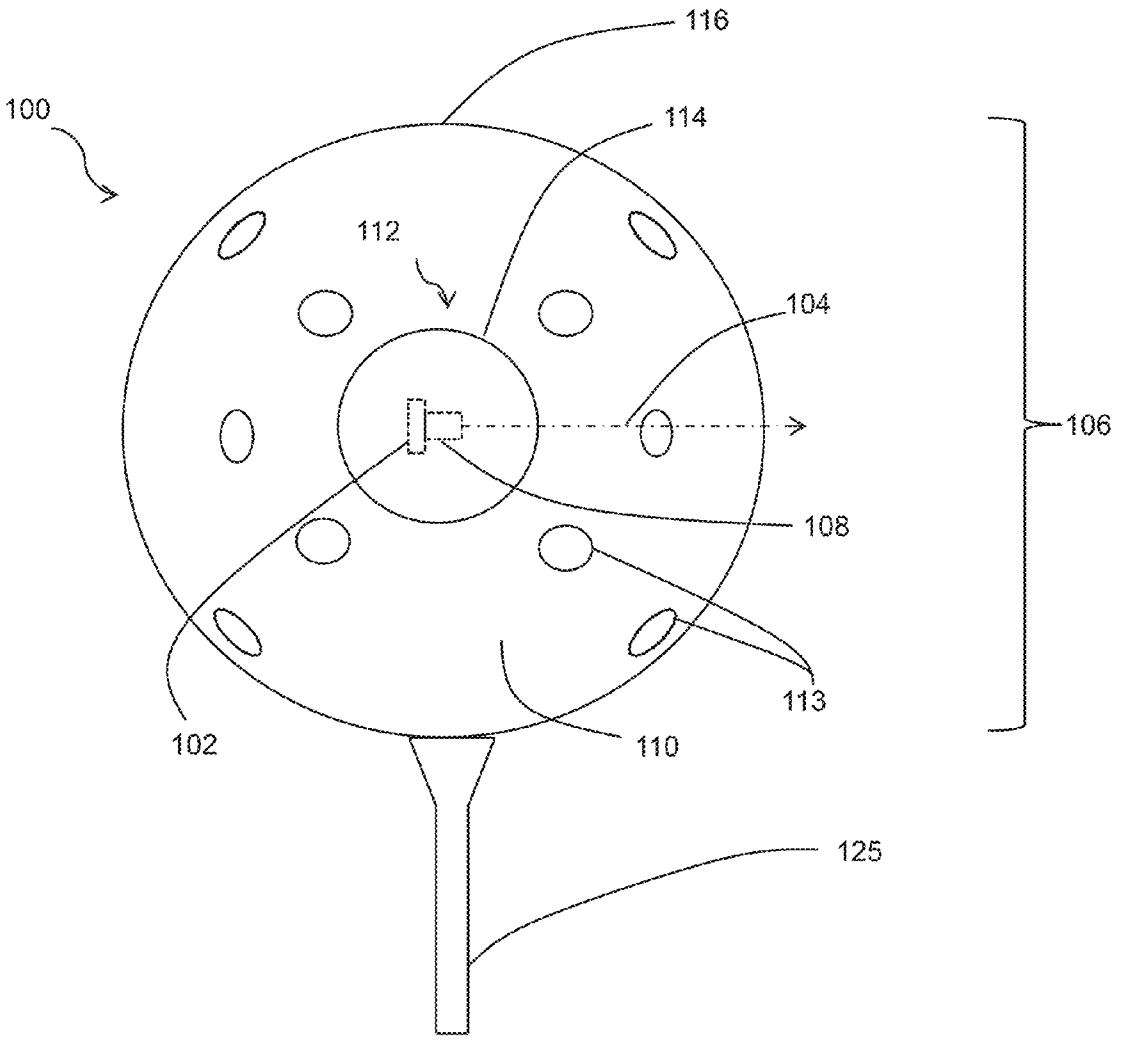
(57) **ABSTRACT**

A laser light-emitting golf ball having a laser emitter for emitting coherent light in an outwardly extending direction from the ball, a power module, and an activation switch. An illuminating tilt-sensing golf ball having an illuminating component for emitting light at a predetermined frequency, a tilt sensor coupled to a control module, and upon the control module receiving a tilt detection signal, the control module being adapted to control the illuminating component to emit light at a second predetermined frequency if the tilt ball tilts more than a predetermined angle. The ball can also include a motion sensor, recording medium and transceiver for storing and transmitting motion sensor readings.



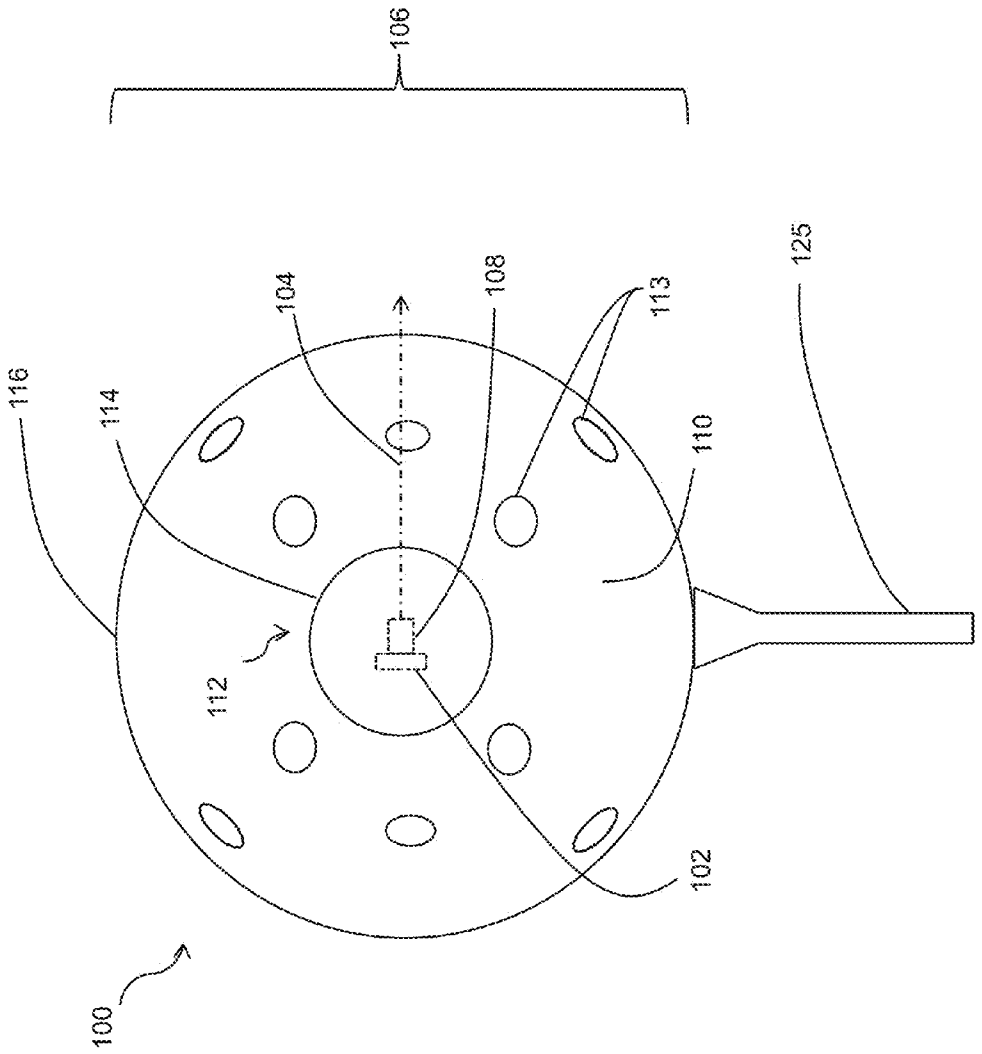


FIG. 1A

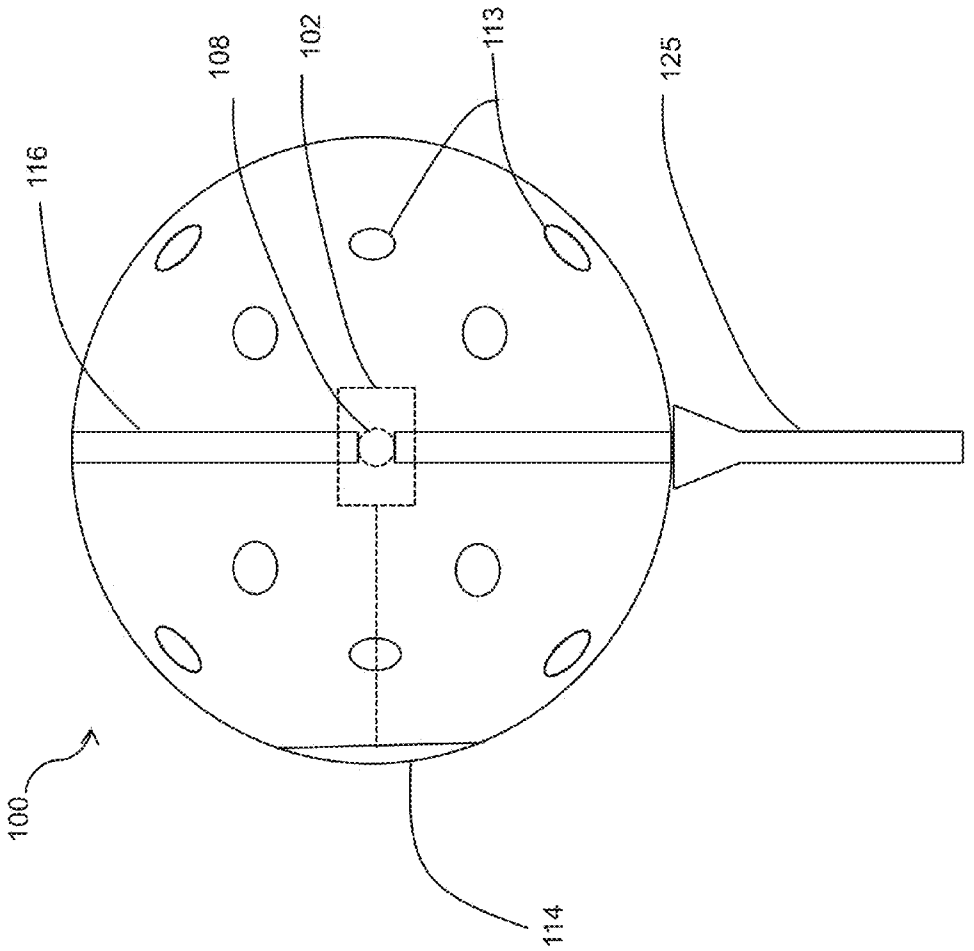


FIG. 1B

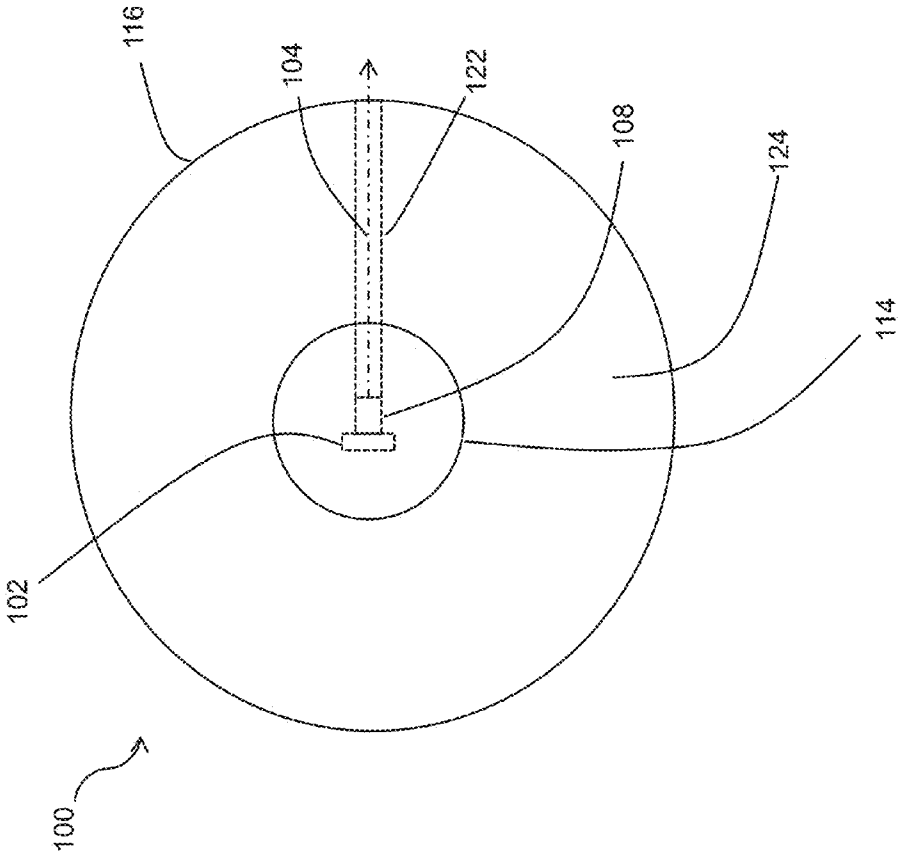


FIG. 2A

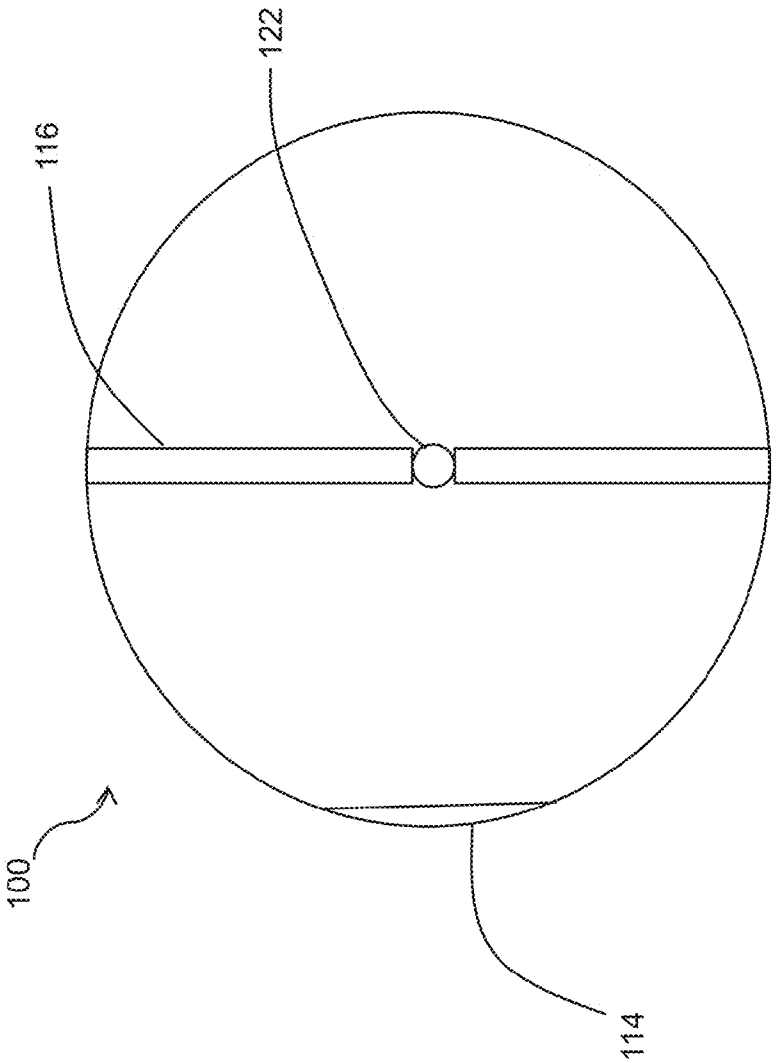


FIG. 2B

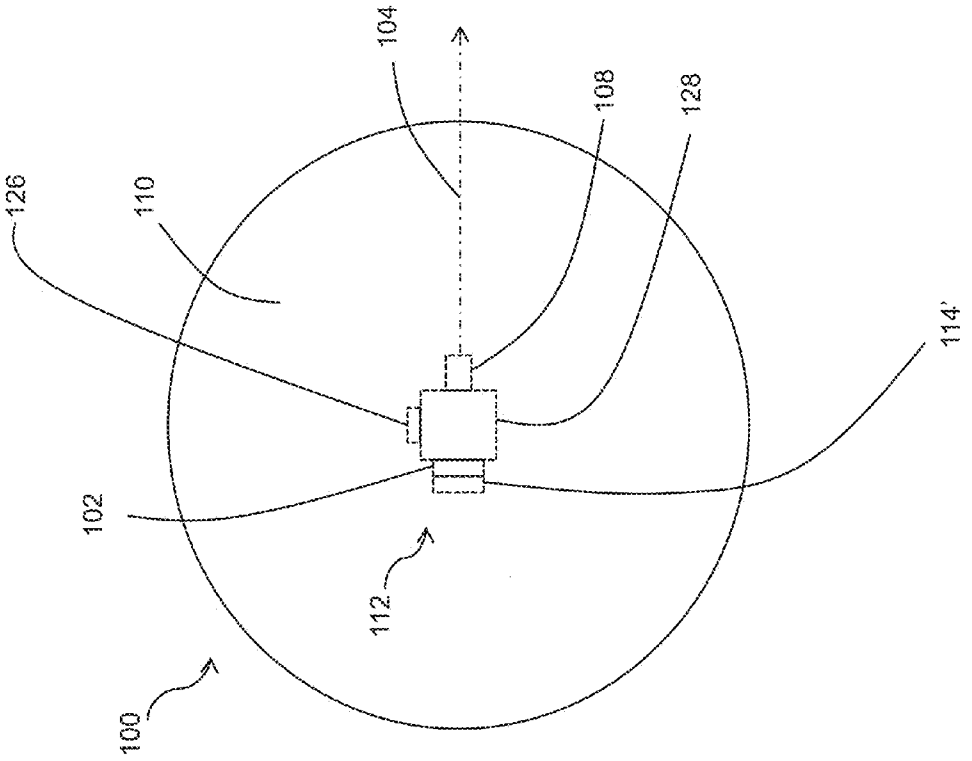


FIG. 3

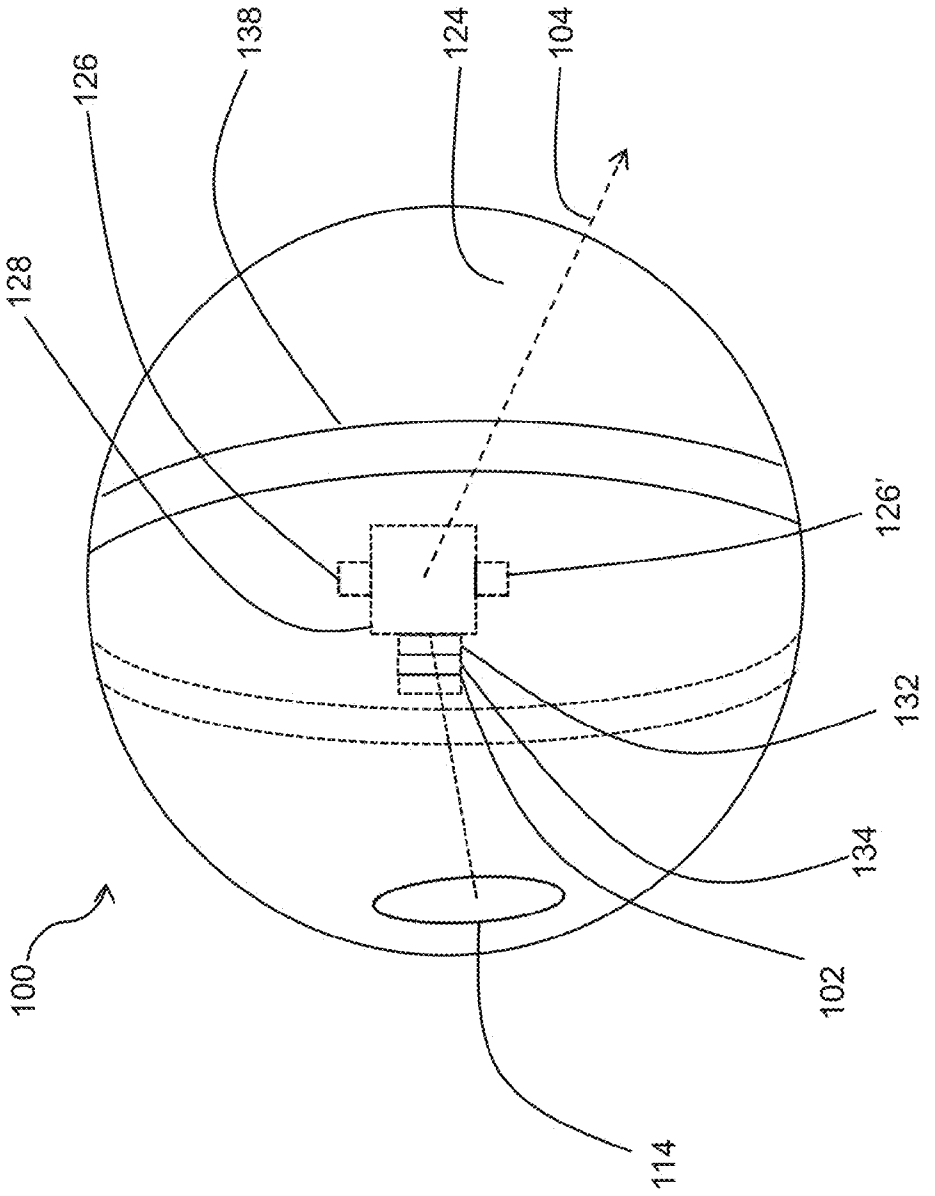


FIG. 4A

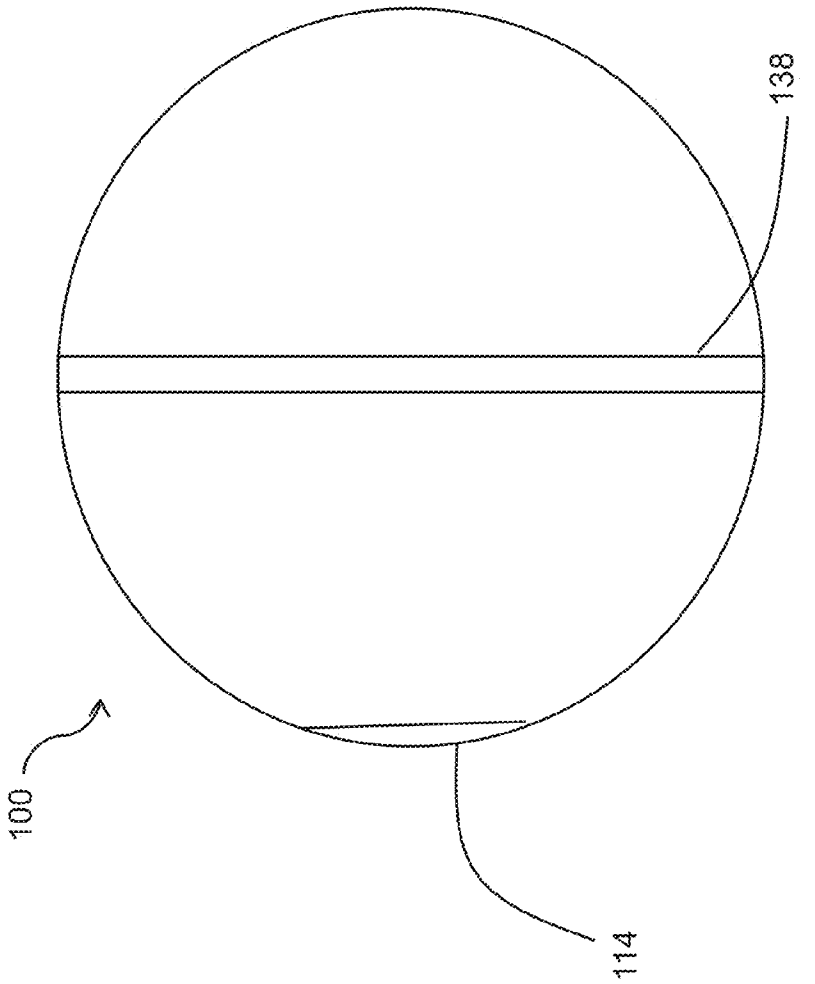


FIG. 4B

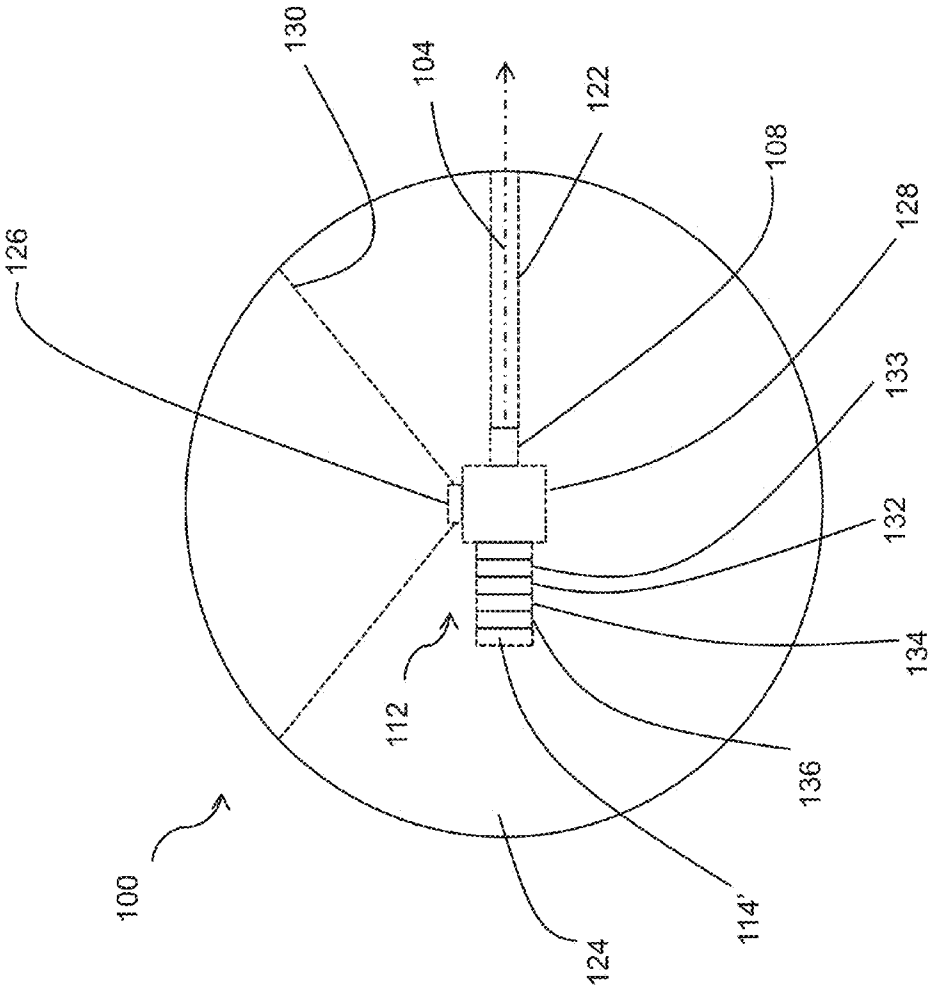


FIG. 5A

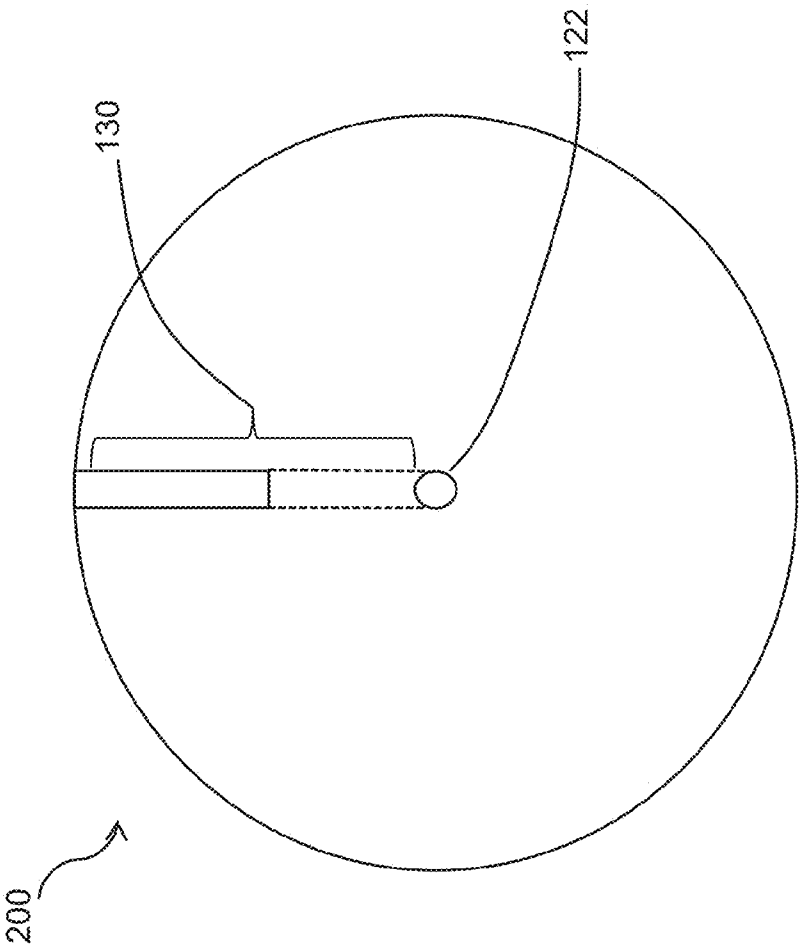


FIG. 5B

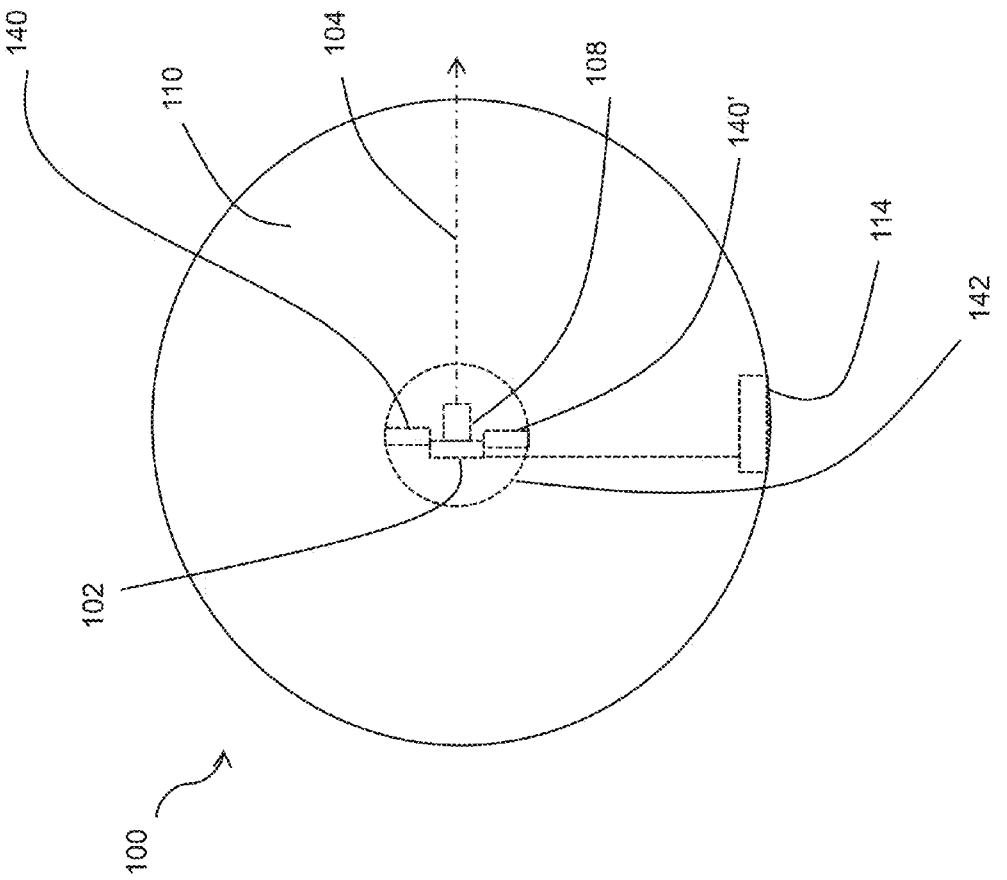


FIG. 6

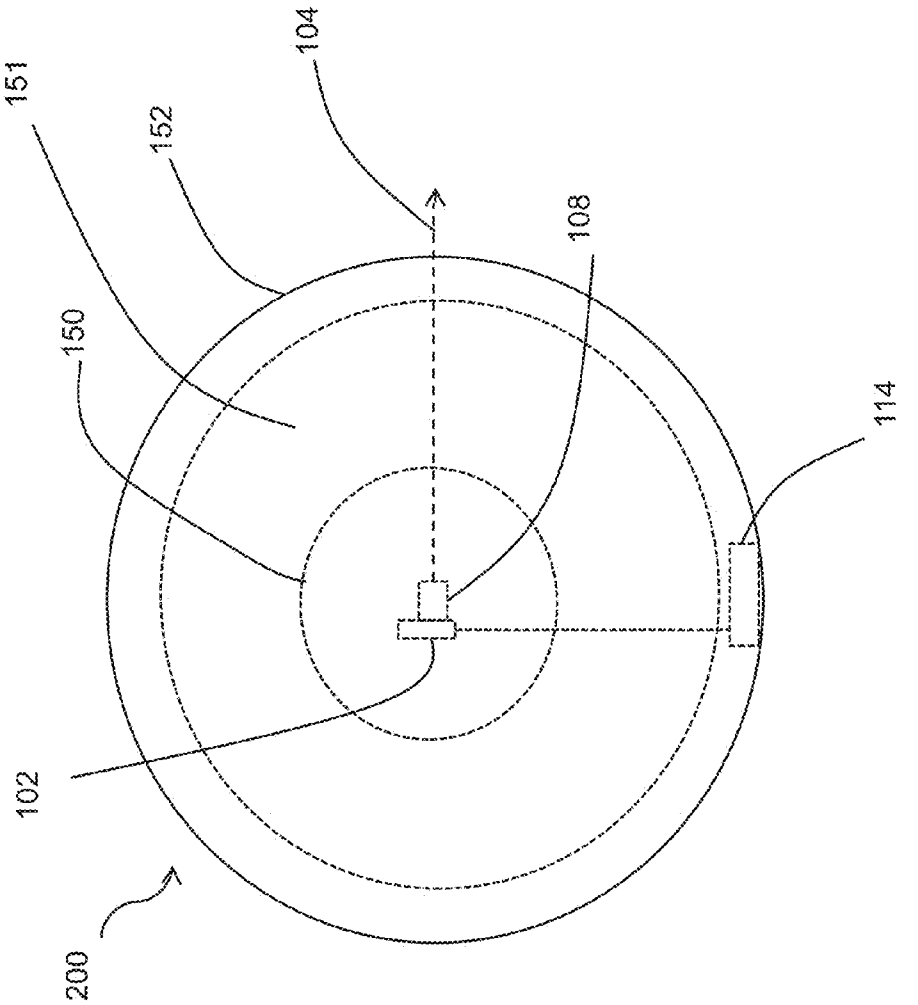


FIG. 7

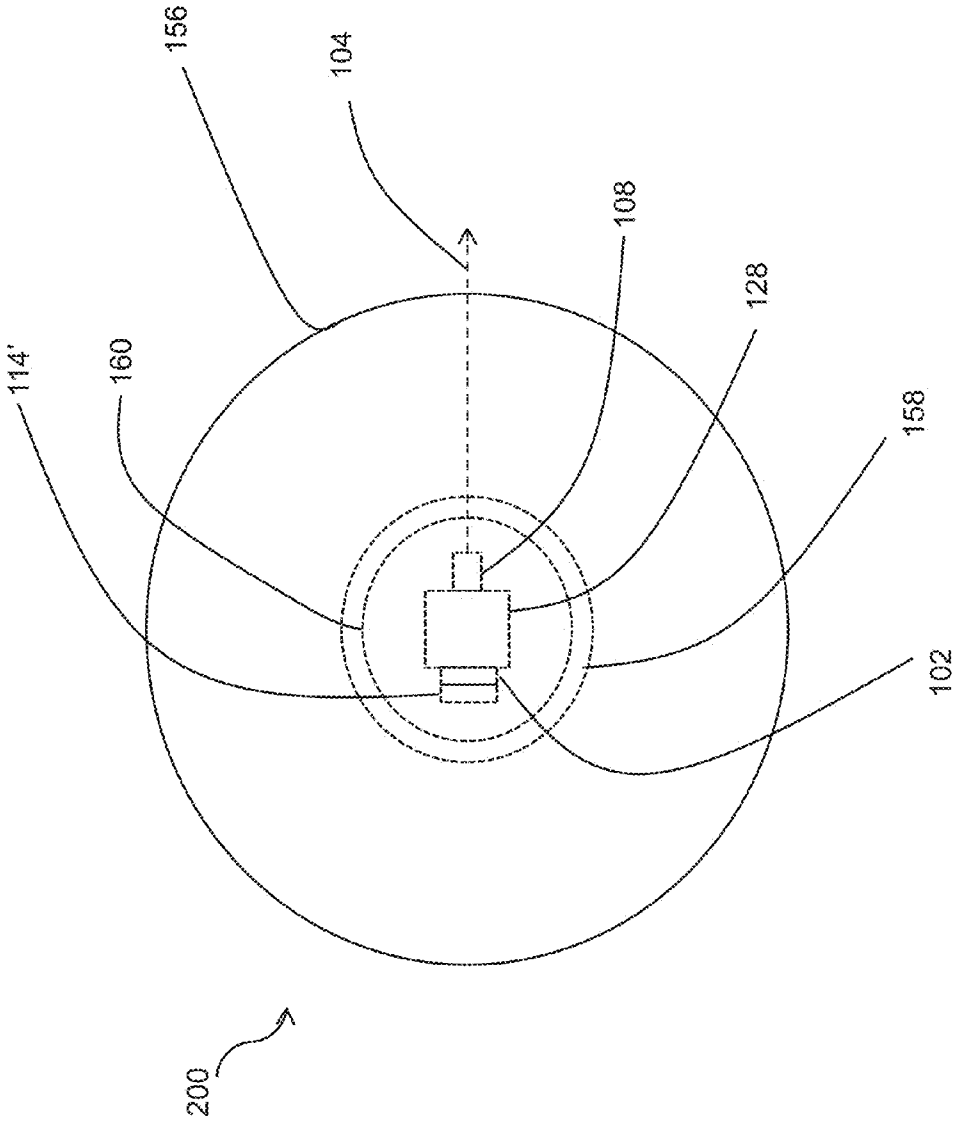


FIG. 8

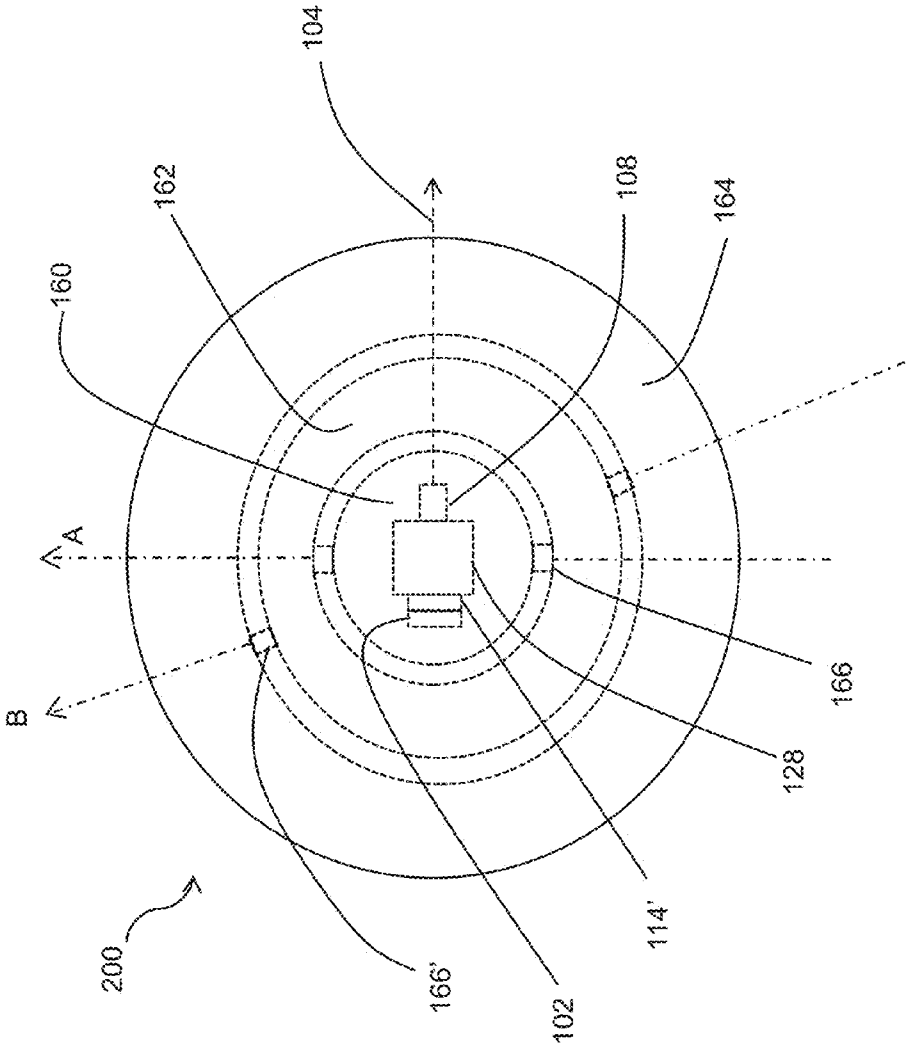


FIG. 9

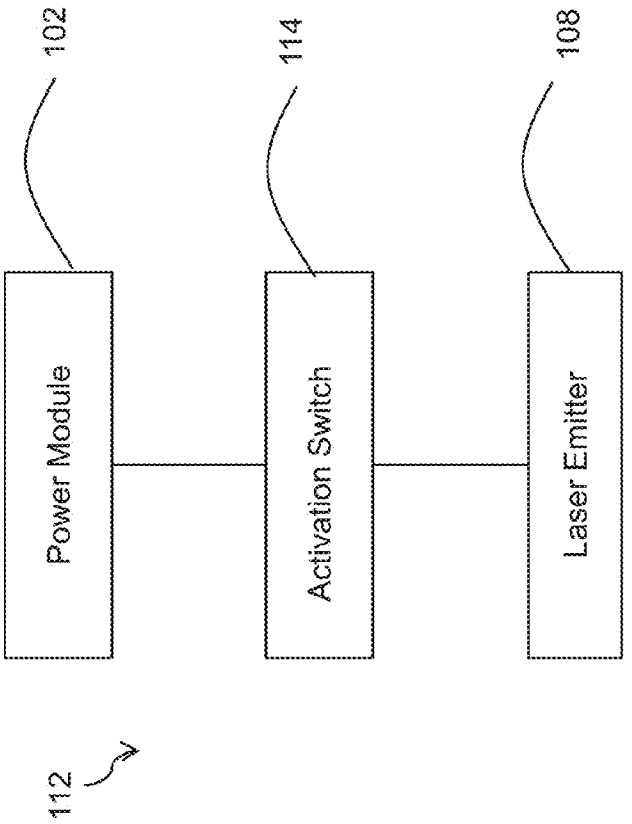

102
114
108
Power Module
Activation Switch
Laser Emitter
112

FIG. 10

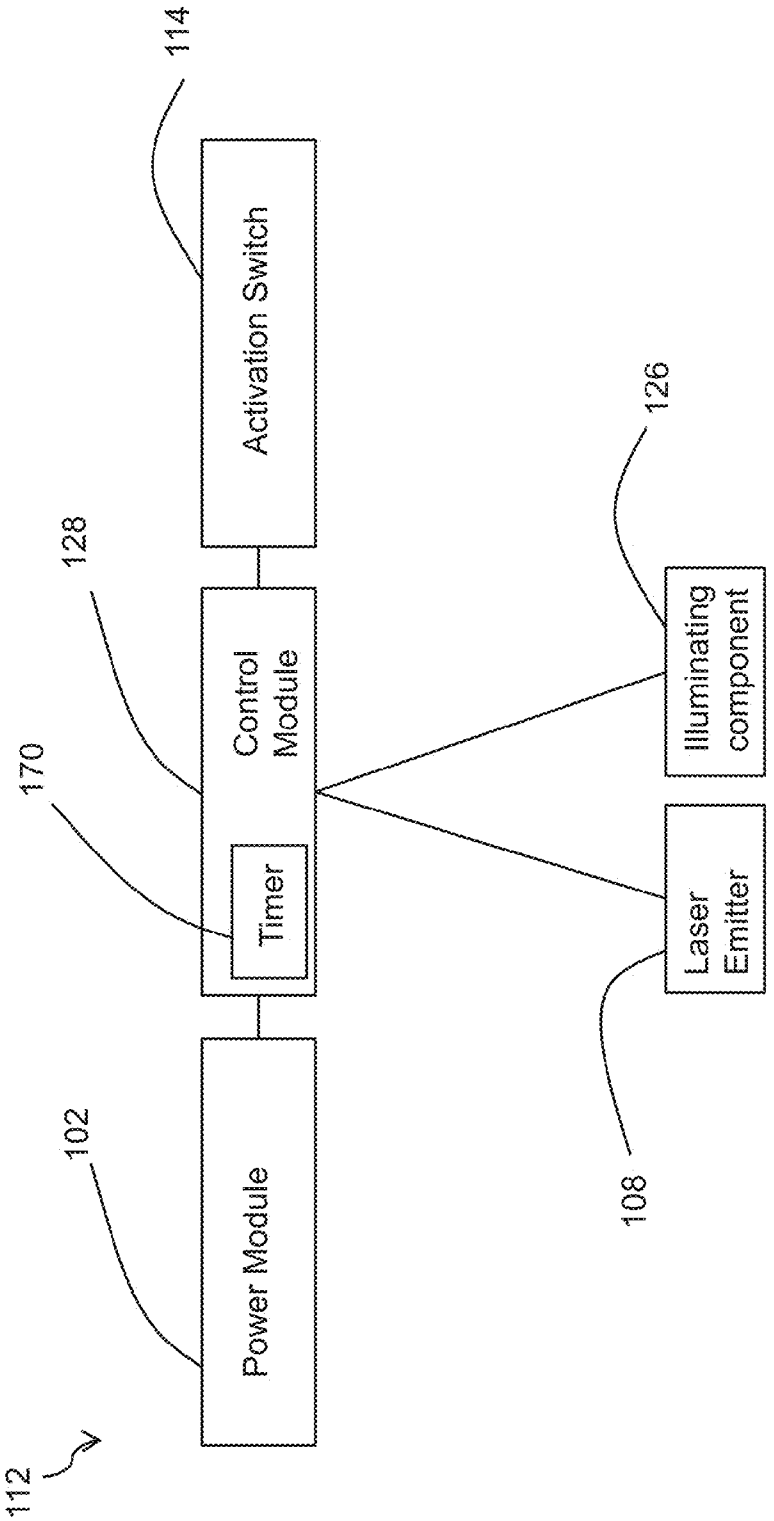

112
102
Power Module
108
Laser Emitter
126
Illuminating component
170
Timer
128
Control Module
114
Activation Switch

FIG. 11

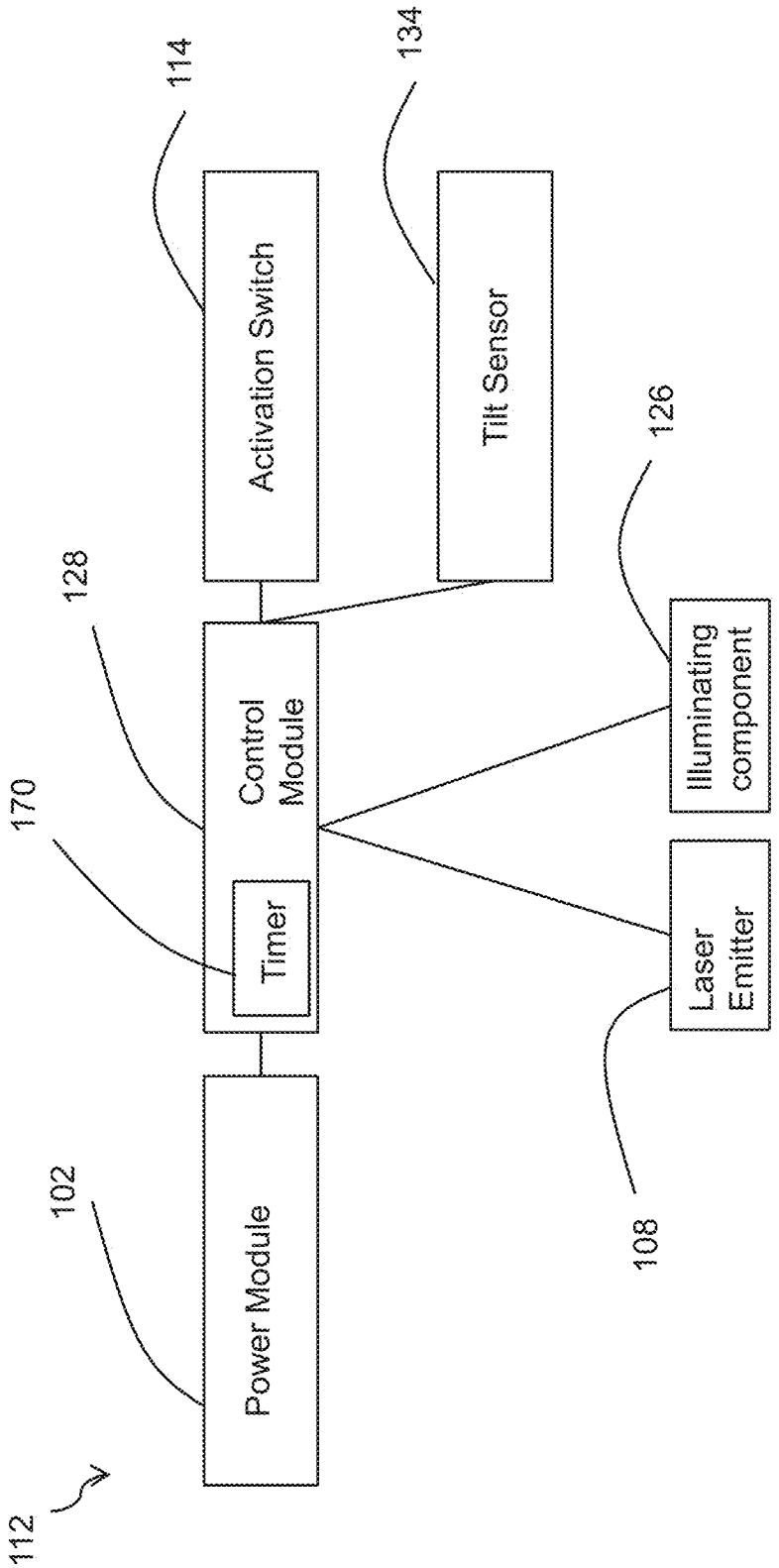

112
102
Power Module
170
Timer
128
Control Module
114
Activation Switch
134
Tilt Sensor
126
Illuminating component
Laser Emitter
108

FIG. 12

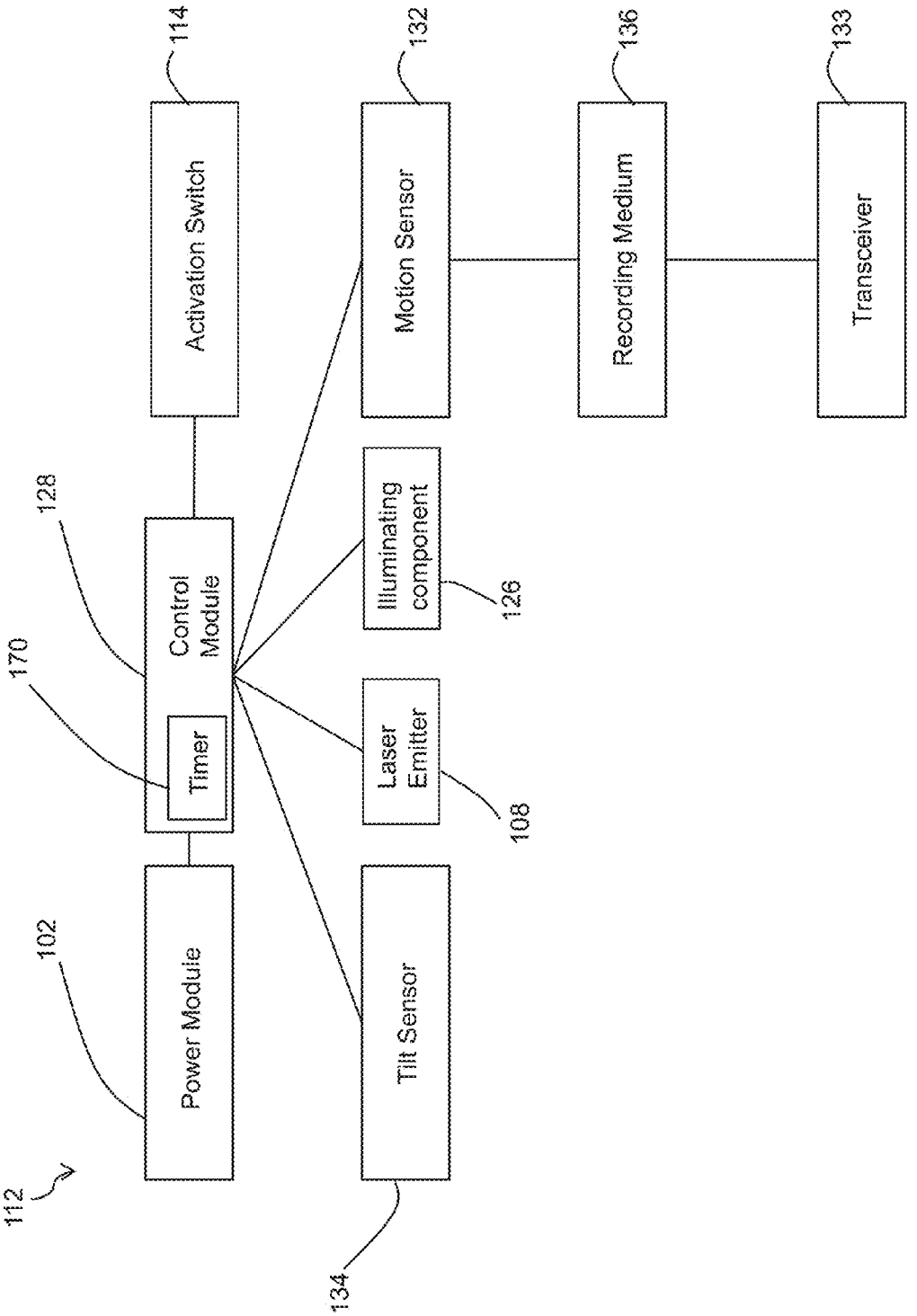

112
102
Power Module
128
Control Module
Timer
170
114
Activation Switch
Illuminating component
126
Laser Emitter
108
Tilt Sensor
134
132
Motion Sensor
136
Recording Medium
133
Transceiver

FIG. 13

ILLUMINATING AND/OR LASER-EMITTING GOLF BALL

FIELD

[0001] The embodiments described herein relate to illuminating and/or laser-emitting golf balls.

INTRODUCTION

[0002] For each shot in a game of golf, a player strikes their golf ball with a golf club, with the ultimate goal of having their golf ball drop into a target golf hole in the lowest number of successive shots possible. Precise aiming is important to successful play. Golf balls often include alignment markings to help players aim their shots. Before taking a shot, a player may choose to reposition their ball so that the alignment markings point towards their intended target, particularly when training or when taking their first shot for a given hole. The player may then attempt to position their body and club square to the alignment markings, hopefully aligning their shot with their intended target.

[0003] The art teaches golf training devices with laser aiming means to provide improved aiming. The art teaches attaching a laser emitter to a golf club, such that the laser emitter points outwardly from the golf club, guiding a player's shot. Further, the art teaches golf training devices wherein laser emitters are housed in golf-ball-shaped enclosures. See for example, U.S. Pat. No. 6,871,250, U.S. Pat. No. 6,579,191, U.S. Patent Publication No. 2004/0137997 A1. In one embodiment, U.S. Pat. No. 6,872,150 teaches a putting practice kit comprising a laser golf ball having a laser emitter positioned within a central bore of the ball. In use, the player places the laser ball on a stand behind their play ball, and activates the laser ball such that it emits a planar laser beam over their play ball.

[0004] When training for golf, a player may wish to know whether or not they tend to hit their ball squarely, such that it rolls straight forward on a flat surface, or whether their ball spins or tilts to either side after being struck. The art teaches some embodiments of illuminated golf balls. See, for example, U.S. Pat. No. 6,257,995 B1. The art does not appear to teach golf balls which provide a means of alerting a player as to whether the ball they have hit has tilted after being hit.

SUMMARY

[0005] The embodiments described herein provide in one aspect, a laser light emitting golf ball comprising: a substantially spherical body including a transparent section wherein at least the transparent section is made of at least partially transparent material; light-emitting module positioned at least in part within the body having: a laser emitter for emitting coherent light in an outwardly extending direction from the ball through at least a portion of the transparent section along a target alignment plane; a power module coupled to the laser emitter for powering the laser emitter; and an activation switch coupled to the power module for activating the laser emitter; wherein the ball is balanced, such that the ball has a center of gravity at approximately a center of the substantially spherical body.

[0006] In some embodiments, the body is made of at least partially transparent material; and the light-emitting module further comprises an illuminating component coupled to the power module for emitting light at a predetermined frequency.

[0007] In some embodiments, the body further includes a second transparent section made of at least partially transparent material coplanar with the target alignment plane; and the light-emitting module further includes an illuminating component coupled to the power module for emitting light at a predetermined frequency through at least a portion of the second transparent section.

[0008] In some embodiments, the light-emitting module further includes: a control module coupled to the illuminating component for controlling the illuminating component; and a tilt sensor coupled to the control module, wherein the tilt sensor is adapted to determine if the target alignment plane tilts more than a predetermined angle from vertical; upon said determination the tilt sensor generating a tilt detection signal and inputting the tilt detection signal to the control module; and upon the control module receiving a tilt detection signal, the control module being adapted to control the illuminating component to emit light at a second predetermined frequency.

[0009] In some embodiments, the light-emitting module further comprises a motion sensor for sensing the motion of the ball and generating motion sensor readings, a recording medium for storing motion sensor readings, and a transceiver for transmitting motion sensor readings.

[0010] The embodiments described herein provide in another aspect, an illuminating and tilt-sensing golf ball comprising: a substantially spherical body having a transparent section wherein at least the transparent section is made of at least partially transparent material and wherein the ball is balanced such that it has a center of gravity at approximately a center of the substantially spherical body; a light-emitting module positioned at least in part within the body including: an illuminating component for emitting light at a predetermined frequency through at least a portion of the transparent section along a target alignment plane; a control module coupled to the illuminating component for controlling the illuminating component; a power module coupled to the illuminating component for powering the illuminating component; and an activation switch coupled to the power module for activating the illuminating component; a tilt sensor coupled to the control module, wherein the tilt sensor is adapted to determine if the target alignment plane tilts more than a predetermined angle from vertical; upon said determination, the tilt sensor generates a tilt detection signal and inputs the tilt detection signal to the control module; and upon the control module receiving a tilt detection signal, the control module being adapted to control the illuminating component to emit light at a second predetermined frequency.

[0011] In some embodiments, the body further comprises a second transparent section made of at least partially transparent material, said transparent section being coplanar with the target alignment plane; and the light-emitting module further including a laser emitter coupled to the power module for emitting coherent light in an outwardly extending direction from the ball through at least a portion of the second transparent section.

[0012] In some embodiments, the light-emitting module further comprises a motion sensor for sensing the motion of the ball and generating motion sensor readings, a recording medium for storing motion sensor readings, and a transceiver for transmitting motion sensor readings.

[0013] Further aspects and advantages of the embodiments described herein will appear from the following description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] For a better understanding of the embodiments described herein and to show more clearly how they may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings which show at least one example embodiment, and in which:

[0015] FIG. **1**A is a side view of an embodiment of a light-emitting golf ball having a transparent body, a laser emitter and an activation switch;

[0016] FIG. **1**B is a front perspective view of an embodiment of a light-emitting golf ball having a transparent body, a laser emitter and an activation switch;

[0017] FIG. **2**A is a side view of an embodiment of a light-emitting golf ball having a light-inhibiting body, with a transparent section for light emission;

[0018] FIG. **2**B is a front perspective view of an embodiment of a light-emitting golf ball having a light-inhibiting body, with a transparent section for light emission;

[0019] FIG. **3** is a side view of an embodiment of a light-emitting golf ball having a control module, a motion activation switch and an illuminating component;

[0020] FIG. **4**A is a perspective view of an embodiment of a light-emitting golf ball having a tilt sensor, a motion sensor and an illuminated alignment stripe;

[0021] FIG. **4**B is a front perspective view of an embodiment of a light-emitting golf ball a tilt sensor, a motion sensor and an illuminated alignment stripe;

[0022] FIG. **5**A is a side view of an embodiment of a light-emitting golf ball for communication with a user device and having a partial illuminated alignment stripe;

[0023] FIG. **5**B is a front perspective view of an embodiment of a light-emitting golf ball for communication a user device and having a partial illuminated alignment stripe;

[0024] FIG. **6** is a top view of an embodiment of a light-emitting golf ball with a mounting core;

[0025] FIG. **7** is a top view of an embodiment of a light-emitting golf ball with at least one shock absorption layer;

[0026] FIG. **8** is a side view of an embodiment of a light-emitting golf ball having an outer layer separated from an inner core by a low-friction layer;

[0027] FIG. **9** is a side view of an embodiment of a light-emitting golf ball having three layers coupled to one another with gimbals;

[0028] FIG. **10** is diagram illustrating an embodiment of a light-emitting module of the invention;

[0029] FIG. **11** is diagram illustrating an embodiment of a light-emitting module of the invention;

[0030] FIG. **12** is diagram illustrating an embodiment of a light-emitting module of the invention; and

[0031] FIG. **13** is diagram illustrating an embodiment of a light-emitting module of the invention.

[0032] The skilled person in the art will understand that the drawings, described below, are for illustration purposes only. The drawings are not intended to limit the scope of the applicants' teachings in anyway. Also, it will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

DESCRIPTION OF VARIOUS EMBODIMENTS

[0033] It will be appreciated that numerous specific details are set forth in order to provide a thorough understanding of the example embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein may be practiced without these specific details. In other instances, well-known methods, procedures and components have not been described in detail so as not to obscure the embodiments described herein. Furthermore, this description is not to be considered as limiting the scope of the embodiments described herein in any way, but rather as merely describing the implementation of the various embodiments described herein.

[0034] Furthermore, it will be appreciated that for simplicity and clarity of illustration, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

[0035] As used herein, the wording "and/or" is intended to represent an inclusive-or. That is, "X and/or Y" is intended to mean X or Y or both, for example. As a further example, "X, Y, and/or Z" is intended to mean X or Y or Z or any combination thereof.

[0036] Referring now to FIGS. **1** to **6**, shown therein are various embodiments of a light-emitting golf ball made in accordance with the teachings of this invention, referred to generally as light-emitting ball **100** comprising a light-emitting module for light emission, referred to generally as light-emitting module **112**. Light-emitting module **112** generally refers to the electrical and mechanical components of the ball necessary for light emission.

[0037] Referring now to FIG. **1**A and **1**B, shown therein is an example embodiment of ball **100** comprising a transparent body **110**, a light-emitting module **112**, a circumferential alignment stripe **116** and dimples **113**. In the illustrated embodiment, light-emitting module **112** comprises a power module **102** for powering the components of light-emitting module **112**, a laser emitter **108** for emitting coherent light in an outwardly extending direction **104** from the ball and an activation switch **114** for activating light emission from the ball. Laser emitter **108** is electrically connected to the activation switch **114** and power module **102**.

[0038] In use, when preparing to strike the ball **100** before a golf shot, a user activates activation switch **114**, causing laser emitter **108** to emit coherent light outwardly from the ball in an outwardly extending direction **104** through the transparent body **110**. To line up their shot, the user (i.e. a golf player) can reposition the ball **100** on tee **125**, or on the ground, so that the coherent light emitted along the outwardly extending direction **104**, as well as the alignment stripe **116**, both indicate the user's desired direction of travel for the ball. In the illustrated embodiment shown in FIG. **1**, the emitter **108** only emits coherent light while the activation switch **114** is activated, such that when the user ceases to activate the activation switch **114**, emitter **108** no longer emits coherent light. While all embodiments of the ball **100** will generally be useful as a training aid—such as for putting training or driving training—in some embodiments, the ball can also be used for regular play without damaging the components of light-emitting module **112**.

[0039] As shown more clearly in FIG. **1**B, in some embodiments, the ball comprises circumferential alignment stripe **116**. Circumferential alignment stripe **116** comprises an area of colouring on the ball's surface, disposed to be coplanar with the outwardly extending direction **104**. Circumferential

alignment stripe **116** (or the illuminated alignment stripe described below) is coplanar with the outwardly extending direction **104**; this plane is referred to hereafter as the "target alignment plane". When the user lines up their shot, the user will adjust the ball such that the target alignment plane will be approximately vertical and aligned with the user's intended target. If after the user strikes the ball **100**, the ball tilts tangentially from the desired direction of travel, the target alignment plane will be tilted from vertical.

[0040] In alternate embodiments, it is contemplated that the circumferential alignment stripe **116** (or the illuminated alignment stripe described below) is otherwise shaped and may not extend around the entire circumference of the ball. It is merely important that the alignment stripe provides a visual reference to the user to align their ball with an intended direction of travel for the ball along the target alignment plane.

[0041] In some embodiments, the ball's body is made so that the ball **100** emulates as closely as possible the characteristics of a regulation ball, i.e. the look and feel, as well as strength, weight (maximum of 45.93 g of mass), and flight characteristics of a regulation golf ball. In some alternate embodiments, the look and feel, mass, strength, weight and/or flight characteristics of the ball **100** do not all emulate a regulation ball.

[0042] A person of ordinary skill in the art will comprehend materials suitable for making the ball's body such that it emulates the characteristics of a regulation golf ball. In some embodiments the ball's body may be made of rubber, metal, iron, steel, polyurethane, ionomer resin and/or other materials known to those of skill in the art. In some embodiments, the ball's body comprises multiple layers of materials. For example, in some embodiments the ball's core may be made of a different material than the ball's outer shell. It will be understood that the ball's materials may also be selected to meet a particular application. For example, where the ball **100** is intended to be struck by a metal golf club, the ball may be at least partially made of material chosen to approximately match the properties of the driver's metal. Further, for example, where the ball is only intended to be used for training and it is not desired that the balls travels for a long distance when struck, the ball's body may be made of a lighter material.

[0043] In various embodiments described in more detail below, the ball body may comprise a variety of different sections alone or in combination, such as transparent body **110**, light inhibiting section **124**, transparent section **122**, transparent section **138**, partial transparent section **130**. These different sections are described in more detail with respect to particular embodiments below. In the illustrated embodiment in FIG. **1**, the ball's body comprises the transparent body **110**. In some embodiments, the ball comprises a combination of at least one section that permits at least partial transmission of light (i.e. at least partially transparent), and at least another section that at least partially blocks the transmission of light.

[0044] The at least partially transparent sections of the various embodiments of the ball's body, such as transparent body **110** in the illustrated embodiment of FIG. **1**, as well as transparent section **122**, transparent section **138** and partial transparent section **130** in later embodiments described below, will be made of materials permitting at least some transmission of light, such as at least partially transparent or translucent materials. In some embodiments, the transparent sections of the various embodiments of the ball's body are made of transparent ionomer resin, such as Dupont™s transparent Surlyn™ ionomer resin, transparent polyurethane and/or transparent rubber. In some embodiments, the transparent sections of the various embodiments of the ball's body are replaced at least partially by bores in the ball's body that permit light transmission.

[0045] In some alternate embodiments, the diameter **106** of the ball **100** may be larger than the diameter of a regulation golf ball. Regulation balls have a diameter of 1.680" or larger, often approximately 1.680". The increased diameter of the ball **100** may enhance the ball's usefulness as a training aid because it may encourage the user to swing through the ball, improving the user's aim. In some embodiments, the ball **100** may have a diameter 5% to 20%, and as much as 100%, larger than 1.680".

[0046] In some embodiments, the ball **100** comprises dimples **113**. Dimples **113** may be added to the ball where it is desired that the ball has the look, feel and flight characteristics of a regulation ball. Dimples may be arranged in different patterns on the surface of the ball, as known to those of skill in the art. Dimples have been omitted from FIGS. **2** to **9** figures for clarity.

[0047] Light-emitting module **112** is positioned at least in part within the approximately spherical body of the ball. In the illustrated embodiment, light-emitting module **112** is positioned at least partly within transparent body **110**. In some embodiments, light-emitting module **112** is positioned within a bore of the ball's body. In some embodiments the ball's body is shaped to receive the components of light-emitting module **112**.

[0048] In most contemplated embodiments, the ball is balanced such that its center of gravity is centered. Balancing the ball involves a comparison of the mass and volume of the components of module **112**, with the mass of the remaining volume of the ball surrounding the components of module **112** (for a given volume of the ball)—i.e. the ball's body, such that the weighted relative position of the distributed mass sums to zero at the center of the ball's approximately spherical body. Balancing the ball can be accomplished mathematically or using experimentation. Where the ball is balanced such that its center of gravity is centered, when it is struck it behaves similarly to a regulation golf ball.

[0049] In some embodiments, the laser emitter **108** is a laser diode outputting coherent light at a wavelength in the visible spectrum of light. In most embodiments the laser emitter **108** is a laser diode having an output wavelength of about 390 to 700 nm, typically in the range of 630 nm to 680 nm. A person of ordinary skill in the art would contemplate that other suitable emitters for emitting coherent light could be used. As conventionally known, laser diodes are electrically pumped semiconductor lasers which emit coherent light when current biased in the forward direction. Laser diodes are more rugged than equivalent gas lasers, and are well suited for use in articles that may experience sudden impacts from being bounced or shaken, such as a golf ball. In some embodiments laser emitter **108** comprises optical elements to provide increased beam coherence. In some embodiments, emitter **108** comprises a collimating lens, aperture and/or anamorphic prisms. In some embodiments, laser emitter **108** is connected in series with a load resistor which limits the current passing through the laser emitter. In some embodiments, the laser emitter **108** has an output power of between 1 mW to 5W. In some embodiments, the laser emitter **108** has an output

power of between 3 mW to 25 mW. It will be understood that the laser emitter output power may be selected based on the desired operating condition. Where it is desired that coherent light output from the laser emitter **108** is visible during daylight, the output power may be selected to be higher than if it is only desired that coherent light output from the laser emitter is visible at night or otherwise where there is diminished ambient light where the ball is used.

[0050] Power module **102** comprises a power source, such as at least one battery cell (battery), for powering the components of module **112**. In some embodiments power module **102** comprises at least one battery cell, suitable for placement in the ball **100** to power the components of module **112**, such as laser emitter **108**. It should be understood that a plurality of battery cells can be positioned in series to increase the voltage to the components of module **112**, such as emitter **108**. However, a plurality of batteries can be positioned in parallel to provide for longer battery life. Power module **102** preferably comprises two to four batteries, such as the CR 2325 series lithium batteries manufactured by Renata™ of Switzerland, connected in parallel. Without limitation, the preferred range of operation for the power source is between 1V and 12V DC. In some embodiments, the batteries are electrically connected to metal leads of laser emitter **108**.

[0051] In some embodiments, the ball is only useful as a light-emitting ball for a single charge of power module **102**, such that when power module **102** runs out of power, emitter **108** is no longer operable to emit coherent light.

[0052] In alternate embodiments the ball is adapted to allow the power source of power module **102**—such as batteries—to be replaced or recharged. In such embodiments, the ball comprises an access port (not shown) providing access to the power source, such that the user can replace or recharge the power source. In embodiments where the power source is rechargeable, the access port may provide access to an electrical port electrically connected to the power source. In some embodiments, the access port comprises a bore in the ball's body with a suitable cover or plug. The cover or plug may be sized to fit into the bore, such that the access port is flush with the ball's surface when the cover or plug is inserted into the bore.

[0053] In some alternate embodiments, the power source in power module **102** can be recharged by placing the ball in a wireless recharging unit (not shown) that does not require a wired connection to the power module **102** to recharge the power source. In such embodiments, the ball and wireless recharging unit comprise hardware to provide wireless recharging when the ball is placed in the recharging unit. It will be understood that various embodiments of the recharging unit are contemplated. In some embodiments the wireless recharging unit charges the power module **102** via inductive charging. In such embodiments, the ball **100** and wireless recharging unit may comprise induction coils to permit inductive charging from the wireless recharging unit to at least one rechargeable battery in the power module.

[0054] The ball comprises an activation switch for activating light emission from the ball. In the illustrated embodiment, the ball comprises activation switch **114**. As described in relation to other figures below, in some embodiments the ball may also or alternatively comprise motion activated switch **114'** and/or a wireless activation switch. In some embodiments, as illustrated in FIG. **1**, when depressed or otherwise activated by the user, the switch **114** completes a circuit between the laser emitter **108**, and power module **102**, such that the emitter emits coherent light while the switch **114** is depressed.

[0055] As illustrated, in some embodiments activation switch **114** is located perpendicularly to the outwardly extending direction **104** at or near the surface of the ball. It is contemplated that activation switch **114** could be otherwise positioned. Positioning of the switch will depend on the type of switch used. For example, a touch-activated switch is positioned at or near the surface of the ball. In most embodiments, activation switch **114** is not located on the side of the ball opposite to the outwardly extending direction **104**, because this may lead to damage to the activation switch when the ball is struck by the user.

[0056] In some embodiments, switch **114** is a membrane switch, flush with the outer surface of the ball when not depressed. In other embodiments, the switch is a capacitance touch switch, which can be activated by the body capacitance of a user. Other embodiments of the activation switch **114** are reasonably contemplated.

[0057] In some embodiments, visual or tactile indicia (not shown) are provided on the surface of the ball above the activation switch **114**, so that the user can readily locate the activation switch **114**. In some embodiments, the visual indicium is a coloured area on the ball's surface. In some embodiments, the visual indicium is text or an icon to make it clear to the user that it provides the location of the activation switch **114**. In some embodiments, the tactile indicium is raised from the surface of the ball.

[0058] Referring now to FIG. **2**A and **2**B, shown therein is a particular embodiment of ball **100**. In the illustrated embodiment, the ball comprises light-inhibiting section **124** and transparent section **122**. Light-inhibiting section **124** can be made of materials suitable for making the ball's body as described above. Light-inhibiting section **124** is made of materials which blocks at least some transmission of light. In various embodiments, section **124** is made of opaque materials or translucent materials.

[0059] In the illustrated embodiment, the ball comprises transparent section **122**. Transparent section **122** is made of similar materials as transparent body **110** and permits at least partial transmission of light therethrough. Transparent section **122** is aligned with emitter **108**, such that when activated, emitter **108** emits coherent light through at least part of transparent section **122** in the outwardly extending direction **104**. In some embodiments, as described above, transparent section **122** at least partially comprises a bore running through light-inhibiting section **124** to the emitter **108**.

[0060] Referring now to FIG. **3**, shown therein is an example embodiment of ball **100** that can be illuminated, such that it is particularly suitable for playing golf or training in dimly lit conditions, though it is not so limited. In the illustrated embodiment, light-emitting module **112** comprises power module **102** for powering the components of module **112**, illuminating component **126** for emitting light outwardly from the ball, motion activation switch **114'** for activating light emission from the ball when the ball is struck or shaken, laser emitter **108** for emitting coherent light in the outwardly extending direction **104** and control module **128** for controlling the components of light-emitting module **112**. In the illustrated embodiments, laser emitter **108**, activation switch **114'** and power module **102** are electrically connected to the control module **128**.

[0061] In use, as further described below, according to a particular embodiment, when the user activates the motion activation switch **114'** by shaking or striking the ball—such as by tapping the ball **100** against a club head—control module **128** controls the laser emitter **108** to emit coherent light for a predetermined period of time, and controls the illuminating component **126** to emit light outwardly through transparent body **110** for a second predetermined period of time.

[0062] In the illustrated embodiment, the ball **100** comprises at least one illuminating component **126** for emitting visible light outwardly from the ball through transparent body **110** at a predetermined frequency (i.e. colour), such that illuminating component **126** illuminates the ball. In some embodiments, illuminating component is at least one LED. It will be understood that in various embodiments, the illuminating component may be other types of activatable light emitters than LEDs. In some embodiments, the light emitting component may be a removable chemiluminescent light-emitter. As conventionally known, LEDs are semiconductor diodes that emit visible light when current biased in the forward direction. Unlike standard bulb type lamps, LEDs are immune to failure conditions such as filament breakage due to sudden shocks or bumps and are well suited for use in articles that may experience sudden impacts from being bounced or shaken such as a golf ball **100**.

[0063] In addition LEDs are relatively energy efficient as they only require a relatively small amount of energy to generate significant amounts of light. For example, a typical incandescent lamp operates on 5 volts and uses a current of 115 milliamps while a LED can operate on 3 volts and draw current on the order of 5 milliamps. Accordingly, LEDs are a particularly desirable lighting source in applications involving small and lightweight devices where the desired size and weight limits the strength of power sources available thereby making energy efficiency important.

[0064] The LED(s) of illuminating component **126** may be a 5 mm high intensity wide dispersion LED. Since the rated lifetime of an LED is approximately 15 years, illuminating component **126** provides an extremely energy efficient, long lasting, light-weight and durable light source. In some embodiments, illuminating component **126** is connected in series with a load resistor which limits the current passing through the illuminating component.

[0065] Motion activation switch **114'** is a switch or sensor known to those of skill in the art, operable to activate components of the light-emitting module **112**, specifically control module **128**, when the ball is shaken vigorously, struck or bounced (referred to hereafter as "motion-triggered"). In various embodiments, when the ball is motion-triggered, activation switch **114'** is activated, activating control module **128**, and control module sleep timer **170**. In some embodiments, activation switch **114'** comprises an element for generating electricity from kinetic energy imparted to the ball **100**—such as a piezoelectric element—which then activates a switch to activate control module **128**. In other embodiments, activation switch **114'** comprises a spring switch, wherein when the ball is bounced or shaken, a spring comes into contact with a lead, closing the switch. In some embodiments, motion activation switch **114'** is calibrated so that it will only activate when the ball's acceleration exceeds a certain threshold, such as 0.5 m/s^2. In some embodiments, the motion activation switch **114'** is calibrated so that it will activate when the ball is tapped against a user's putter. This avoids unintentional activation during handling.

[0066] Control module **128** controls illuminating component **126**, emitter **108** and other components of the light-emitting module **112** in various embodiments. Control module **128** may comprise a hardware controller containing logic circuitry that controls the output of emitter **108** and illuminating component **126**. The control module **128** may comprise a processor, an ASIC, a hardware controller and the like, which can be programmed or otherwise configured to provide control signals to control components of light-emitting module **112**. The control module **128** may be provided with software instructions to implement certain functionality. Accordingly, the control module **128** may be provided with software instructions to implement certain functionality depending on its implementation.

[0067] When activated by switch **114'**, control module **128** activates emitter **108** and illuminating component **126** for a first predetermined time and a second predetermined time, respectively. In an example embodiment, control module **128** activates emitter **108** for fifteen seconds and activates illuminating component for fifteen minutes after the activation switch **114'** is activated.

[0068] Though the functionality of control module **128** was described above in relation to activation switch **114'**, the inventor contemplates that the same functionality and timed activation of the emitters is achieved with alternate or additional activation switches. Accordingly, in some embodiments, the ball comprises activation switch **114**, and control module **128** activates emitter **108** and illuminating component **126** for a first and second predetermined time when switch **114** is activated.

[0069] In some alternate embodiments, the ball **100** comprises one of emitter **108** or illuminating component **126**.

[0070] Alternately, in some embodiments, the ball **100** comprises an activation switch **114** and an activation switch **114'**, and each switch is connected to one of the illuminating component **126** or the laser emitter **108**. In some embodiments comprising both switch **114** and **114'**, the laser emitter **108** may be coupled to the activation switch **114**, such that the laser emitter is only activated when the activation switch **114** is depressed, and the illuminating component **126** may be coupled to the activation switch **114'**, such that the illuminating component **126** is only initially activated when the activation switch **114'** is activated.

[0071] In alternate embodiments, a wireless activation switch (not shown) may be used instead of or in addition to motion activate switch **114'** and/or switch **114**. In such embodiments, the wireless activation switch is operable to activate components of the light-emitting module **112**, specifically the control module **128**, in response to a wireless activation signal. The wireless activation signal may be sent, for example, from a wireless communication device or a remote. The wireless communication device or remote could be configured with hardware controller circuitry and components, such as a transceiver operable to output a wireless activation signal to activate the ball. It will be understood that in such embodiments control module **128** may comprise a hardware controller containing logic circuitry that controls the output of emitter **108** and/or illuminating component **126** in response to receiving a wireless activation signal. The control module **128** may comprise a processor, an ASIC, a hardware controller and the like, which can be programmed or otherwise configured to provide control signals to control components of light-emitting module **112** in response to

wireless activation signals. The control module **128** may further comprise a transceiver to receive wireless activation signals.

[0072] In alternate embodiments, the ball comprises activation switch **114'**, power module **102**, and comprises emitter **108** and/or illuminating component **126**; and, activation switch **114'** is operable to selectively activate the power emitter **108** and/or illuminating component **126**, without first activating control module **128**. In such embodiments, control module **128** may not be included in the ball. In such embodiments, when the ball is motion-triggered, activation switch **114'** is activated, activating emitter **108** and/or illuminating component **126**. In such embodiments, the emitter **108** and/or illuminating component **126** may remain activated until the ball is motion-triggered again. In some embodiments, the activation switch **114'** is calibrated such that if the ball is motion-triggered with an acceleration that is too high or too low—the activation switch will not be activated. Accordingly, the activation switch **114'** may be calibrated so that only a specific user action within a given threshold would activate activation switch **114'**—such as tapping the ball against a user's putter. This would prevent accidental activation during regular handling, and also may prevent deactivation when the ball is struck by a golf club. Accordingly, in some embodiments, the activation switch **114'** is only activated when the ball is motion-triggered resulting in acceleration above a certain amount, and in some cases below a certain amount.

[0073] In alternate embodiments, wireless activation switch or activation switch **114** are operable to selectively activate the power emitter **108** and/or illuminating component **126** without first activating control module **128**, as described above.

[0074] Referring now to FIG. **4**A and **4**B, shown therein is a particular embodiment of the light-emitting ball **100**. In the illustrated embodiment, light-emitting module **112** comprises a power module **102**, a control module **128**, an activation switch **114**, a tilt sensor **134** for measuring tilt of the target alignment plane from vertical, a motion sensor **132** for outputting motion sensor readings relating to motion of the ball, and illuminating components **126**, **126'**. The components of module **112** are electrically connected to control module **128**. The illustrated ball **100** comprises a light-inhibiting section **124** and a transparent section **138**.

[0075] In use, in the illustrated embodiment, when the user activates activation switch **114**, control module **128** controls the laser emitter **108** to emit coherent light in the outwardly extending direction **104** for a predetermined period of time, and control module **128** controls the illuminating component **126** to emit light outwardly through transparent section **138** for a second predetermined time at a predetermined frequency (i.e. colour). Further, the control module **128** activates tilt sensor **134** and motion sensor **132**. When illuminating component **126** is illuminated, if tilt sensor **134** senses that the ball tilts such that the target alignment plane has tilted more than a predetermined angle from vertical, the control module **128** controls the illuminating component **126** to emit light at a second predetermined frequency (i.e. the light emitted from the illuminated component **126** changes colour). In some embodiments, when illuminating component **126** is illuminated, if motion sensor **132** detects that the ball has stopped moving, the control module **128** deactivates the illuminating component **126** and other active components of light-emitting module **112** after a predetermined time.

[0076] In the illustrated embodiment, ball **100** comprises a light-inhibiting section **124** and a transparent section **138** coplanar with the outwardly extending direction **104**. When illuminating component **126** is illuminated, transparent section **138** provides an illuminated circumferential alignment stripe coplanar with the outwardly extending direction **104** (i.e. coplanar with the target alignment plane).

[0077] It is contemplated that various embodiments of the ball **100** that comprise both an illuminating component **126** and a light-inhibiting section **124** could have a transparent section **138** coplanar to the outwardly extending direction **104** for providing an illuminating alignment stripe. In some embodiments, further described below in relation to FIG. **5**, the transparent section **138** may not extend around the entire circumference of the ball, such that it is a partial transparent section **130** (described below) and provides a partial illuminating alignment stripe along the target alignment plane when illuminating component **126** is active.

[0078] Motion sensor **132** comprises at least one sensor for sensing motion of ball **100** and outputting a digital or analog signal indicative of the sensed motion. The output signal is a motion sensor reading. When active, motion sensor **132** generates motion sensor readings and outputs them to control module **128**. In some embodiments, motion sensor **132** comprises at least one accelerometer for measuring acceleration. In some embodiments, a plurality of accelerometers or a single multiple-axis accelerometer is mounted in order to sense motion along multiple axes, such as two or three axes, representing two or three dimensions.

[0079] As described above, control module **128** activates illuminating component **126** when activation switch **114** is activated. In some embodiments, when control module **128** receives signals from motion sensor **132** indicating that the ball has come to a rest, control module **128** disables the illuminating component **126** and laser emitter **108** (if it is still active) after a predetermined time. In some embodiments, the control module **128** disables the illuminating component **126** and laser emitter **108** immediately after the ball comes to a rest. In some embodiments, the motion sensor readings may indicate that the ball has come to a rest after they stop changing in amplitude for a predetermined period of time.

[0080] Tilt sensor **134** comprises a sensor mounted to sense if the target alignment plane tilts more than a predetermined angle from vertical, where vertical is defined as the direction of gravity. It will be understood that a multitude of different sensors operable to detect tilting are contemplated. In some embodiments, the tilt sensor **134** comprises at least one accelerometer. In some embodiments, when active, tilt sensor **134** outputs tilt sensor readings to control module **128**. In some embodiments, tilt sensor readings indicate how much the target alignment plane has tilted from vertical.

[0081] As described above, control module **128** activates illuminating component **126** to emit light at a predetermined frequency (i.e. colour) when activation switch **114** is activated. If the control module **128** receives a tilt sensor reading that indicates that the ball has tilted such that the target alignment plane is more than a predetermined degree from vertical, control module **128** controls illuminating component **126** to emit light at a second predetermined frequency (i.e. a second colour). Accordingly, if tilt sensor **134** detects that the ball has tilted more than a predetermined angle, control module **128** controls illuminating component **126** to emit light of a different colour. In some embodiments, if tilt sensor **134** detects

that the ball has tilted more than a predetermined angle, the illuminating component **126** emits red light.

[0082] In an alternate embodiment, the control module **128** only receives a tilt sensor reading from tilt sensor **134** when the sensor detects that the ball has tilted beyond a predetermined angle. Accordingly, the control module **128** controls illuminating component **126** to emit light at a second predetermined frequency if it detects a tilt sensor reading. In such embodiments, for example, tilt sensor **134** may be, for example, a rolling ball tilt sensor.

[0083] It will be understood that in order for control module **128** to analyze motion sensor readings or tilt sensor readings to determine if the ball has come to a rest or has tilted from the vertical, the control module **128** may comprise a processor, memory, an ASIC, application program instructions and the like, which can be programmed or otherwise configured to interpret motion sensor readings and tilt sensor readings.

[0084] Referring now to FIG. **5**A and **5**B, shown therein is a particular embodiment of the light-emitting ball **100**.

[0085] In the illustrated embodiment, light-emitting module **112** comprises motion sensor **132** for outputting motion sensor readings, a recording medium **136** for receiving and storing motion sensor readings and a transceiver **133** for outputting motion readings to a user device (not shown). Motion sensor **132**, recording medium **136** and transceiver **133** are electrically connected to control module **128**.

[0086] In the illustrated embodiment, control module **128** comprises circuitry, hardware and software instructions for communicating with nearby a user device. For example, control module **128** may comprise a processor, an ASIC, a hardware controller and the like, which can be programmed or otherwise configured to provide control signals and communicate with a user device. The control module **128** may be provided with software instructions to implement the specified functionality. In some embodiments, the processor receives motion sensor readings, analyzes them in conjunction with the stored software instructions and writes them to the recording medium **136**. Further, the processor processes software instructions to allow communication with a user device using transceiver **133**.

[0087] In use, when activation switch **114'** is activated, control module **128** activates motion sensor **132**, recording medium **136** and transceiver **133**. When activated, motion sensor **132** outputs motion sensor readings to control module **128**. Control module **128** writes motion sensor readings to recording medium **136** for storage. In some embodiments, a user can retrieve the motion sensor readings from control module **128** after pairing a user device with control module **128** by sending a request from a paired user device to control module **128**. Transceiver **133** allows for wireless communication between control module **128** and user device. In some embodiments, control module **128** also records tilt sensor readings to recording medium **136** and can communicate tilt sensor readings to a user device.

[0088] The embodiment of light-emitting ball **100** illustrated in FIG. **5**A and **5**B comprises a light-inhibiting section **124** and a partial transparent section **130**. When illuminating component **126** is active, partial transparent section **130** provides a partial illuminated circumferential alignment stripe along the target alignment plane, similarly to transparent section **138**. It will be appreciated that the partial illuminated alignment stripe provided by partial transparent section **130** in FIGS. **5**A and **5**B does not extend fully around the circumference of the ball, in contrast to transparent section **138**.

[0089] In alternate embodiments, the transparent sections (**130**, **138**, **122**) can be otherwise shaped. Further, more than one transparent section may be included having different shapes—such as arrows or a plurality of parallel transparent sections. It will be understood that it is merely important that an included transparent section provides a visual reference that can be illuminated by illuminating component **126** for use by a user in aligning the ball with an intended direction of travel for the ball—i.e. providing an illuminated alignment stripe. Accordingly, the transparent section provides a visual reference along the target alignment plane. Additionally, where a laser emitter **108** is included, at least a transparent section is disposed to allow transmission of coherent light from the laser emitter along the outwardly extending direction **104**.

[0090] Referring now to FIG. **6**, shown therein is an embodiment of the invention with a mounting core **142**. In various embodiments described in relation to FIG. **1**, the light-emitting module **112** is mounted within a body of the ball **100**, shaped for mating with the components of module **112**. In some embodiments, as illustrated example in FIG. **6**, the ball **100** comprises a mounting core **142** for mounting the components of light-emitting module **112**. In such embodiments, the components of module **112** are positioned at least partially within the mounting core. As described above in relation to various embodiments, the components should be mounted within the ball such that their weight, in combination with the weight of the body of the ball, is balanced, such that the center of gravity of the ball is centered. The embodiments with mounting core **140** may be preferred in order to minimize costs, as these embodiments may not require a customized manufacturing of the body of the ball for the specific components of module **112**.

[0091] In some embodiments, mounting core **142** comprises mounting supports **140**, **140'** for mounting the components of module **112** in the ball. Mounting supports **140**, **140'** comprise means of mounting the components of module **112** at least partially within the mounting core **142**. It will be understood that as many mounting supports as needed may be included in mounting core. In some embodiments the mounting supports may be rigid, in order to rigidly support the components of module **112**. In some embodiments the mounting supports **140**, **140'** may be flexible, such that the mounting supports flex when the ball compresses after impact with a club. In some embodiments, the mounting supports **140** may be hardening foam, adhesive or mechanical mounting means.

[0092] In alternate embodiments, mounting supports **140**, **140'** may be used to mount the components of module **112** within the ball **100** even if the ball **100** does not comprise a discrete mounting core **142**.

[0093] Referring now to FIGS. **7** to **9**, shown therein are various alternate embodiments of the body of a light-emitting golf ball made in accordance with the teachings of this invention, referred to generally as light-emitting ball **200** comprising a light-emitting module for light emission, generally referred to as light-emitting module **112**. The functionality and components of light-emitting module **112** are substantially as described previously in relation to FIGS. **1** to **6**, and with respect to FIGS. **10** to **13** below. Generally, the embodiments of the ball described in relation to FIGS. **7** to **9** can be made of similar materials as the embodiments of the ball **100** and may provide similar functionality. The embodiments described below provide a specific number of layers in order

to provide clear illustration, but it will be understood that alternate numbers of layers may be provided. Further, in some alternate embodiments the layers may not be entirely spherical. For example, a shock absorption layer may be ovoid, or may only be positioned in proximity to an intended point of impact of the ball.

[0094] Referring now to FIG. **7**, shown therein is an alternate embodiment of the body of the light-emitting ball. Light-emitting ball **200** comprises an inner core **150**, a middle layer **151** and a cover layer **152**. As in previous embodiments, light-emitting module **112** is mounted at least partially within the ball **200**. In some embodiments, activation switch **114** is mounted near the surface of the ball **200** in the cover layer **152**, while the rest of the components of module **112** are mounted within the inner core **150**. In some embodiments, at least one layer of inner core **150**, middle layer **151** or cover layer **152** is made of a material having a relatively lower rigidity compared to the other at least one layer. In such an embodiment, at least one layer having a relatively lower rigidity serves as a shock absorption layer. The shock absorption layer is made of materials known as providing less rigidity than the other layers. According to this embodiment, when the ball is struck by a club, the shock absorption layer absorbs some kinetic energy from the impact, helping protect the components of light-emitting module **112**. In some embodiments the inner core **150** and cover layer **152** are made of material having a higher rigidity, while the middle layer **151** serves a shock absorption layer.

[0095] Referring now to FIG. **8**, shown therein is an alternate embodiment of the body of the light-emitting ball. In the illustrated embodiment, ball **200** comprises a cover layer **156**, a low-friction layer **158** and a core layer **160**. In some embodiments, the components of light-emitting module **112** are positioned within inner core layer **160**. In the illustrated embodiment, low-friction layer **158** is made of a low-friction, material, such as a liquid. In some embodiments, layer **158** is water. Layer **158** allows inner core **160** to rotate relative to cover layer **156**. Because inner core **160** is not coupled to cover layer **156**, when the ball is struck, layer **158** may provide shock absorption for the components of light-emitting module **112** if they are mounted in inner core layer **160**. In most embodiments, where the components of light-emitting module **112** are mounted in inner core layer **160**, all three of the layers are at least partially made of at least partially transparent material, such that if the cores rotate with respect to one-another, light emission from the ball is not blocked. Because the layers are rotatable with respect to one another, the ball **200** preferably comprises a motion activation switch **114'** or a wireless activation switch, as it may be impractical to electrically connect a switch located on the surface of the ball with the module **112** in the core of the ball **160**.

[0096] Referring now to FIG. **9**, shown therein is an alternate embodiment of the body of the light-emitting ball. Ball **200** comprises an inner core **160**, a primary layer **162** and a secondary layer **164**. In some embodiments, the components of light-emitting module **112** are positioned at least partially within inner core **160**. In the illustrated embodiment, the inner core **160** is rotationally coupled to primary layer **162** with a rotational coupling **166**. Secondary layer **164** is rotationally coupled to primary layer **162** with a rotational coupling **166'**. Rotational couplings **166**, **166'** may be axially disposed on inner core **160** and layer **162** respectively, such that they serve as gimbals. In some embodiments, at least one of inner core **160**, layer **162** or layer **164** is made of a material having a relatively low rigidity compared to at least one of the other layers. Accordingly, in some embodiments at least one of the inner core **160** or the layers **162** or **164** serves as a shock absorption layer. Accordingly, in some embodiments, at least one of the inner core **160** or layers **162** or **164** absorbs kinetic energy when the ball is struck by a club, protecting the components of light-emitting module **112**. Though, in the illustrated embodiment, the ball **200** comprises motion activation switch **114'**, in some embodiments the ball **200** comprises activation switch **114**, and wiring is threaded through rotational couplings **166**, **166'** to connect the activation switch **114** with the rest of the components of module **112**.

[0097] Referring now to FIGS. **10** to **13**, shown therein are block diagrams illustrating example embodiments of the light-emitting module, referred to generally as light-emitting module **112**, for use in various embodiments of light-emitting ball **100** or **200**.

[0098] FIG. **10** is a block diagram illustrating a simple example embodiment of the light-emitting module **112**. In the illustrated embodiment, light-emitting module **112** comprises an activation switch **114**, a power module **102** and a laser emitter **108**. Activation switch **114** is electrically connected to power module **102** and laser emitter **108**, such that when activation switch **114** is activated by a user, emitter **108** emits coherent light.

[0099] It will be understood that in the various embodiments of the invention described below (or above) activation switch **114** can be replaced or supplemented by motion activation switch **114'** and/or a wireless activation switch.

[0100] FIG. **11** is a block diagram illustrating an example embodiment of the light-emitting module **112**. In the illustrated embodiment, light-emitting module **112** comprises a power module **102**, a control module **128**, an activation switch **114**, a laser emitter **108** and an illuminating component **126**. Control module **128** comprises a sleep timer **170**. Power module **102**, activation switch **114**, laser emitter **108** and illuminating component **126** are all electrically connected to control module **128**. The control module **128** controls the emitter **108** and illuminating component **126**.

[0101] When activation switch **114** is activated, the control module **128** is activated, and the control module **128** activates emitter **108**, illuminating component **126** and starts a sleep timer **170**. In some embodiments, the emitter **108** is only activated while the activation switch **114** is depressed. In other embodiments, control module **128** activates emitter **108** for a first predetermined time when activation switch **114** is activated. In some embodiments, the first predetermined time is five seconds to fifteen minutes, particularly five seconds to sixty seconds, such that the user has time to align their shot while emitter **108** remains active.

[0102] Control module **128** activates illuminating component **126** for a second predetermined time after the activation switch **114** is activated. In some embodiments, the second predetermined time is ten seconds to eight hours, and in particular about 15 minutes. The second predetermined time may be longer than 15 minutes, for example, where it is desired that the illuminated component remains illuminated for an entire round of golf. The second predetermined time is shorter when the ball is only intended to remain illuminated for the length of a single shot. The control module **128** receives timing signals from timer **170** to determine whether the predetermined times have elapsed.

[0103] In some embodiments, it is contemplated that the light-emitting module **112** as illustrated in FIG. **11** comprises only one of the laser emitter **108** or the illuminating component **126**.

[0104] FIG. **12** is a block diagram illustrating an example embodiment of the light-emitting module **112**. In the illustrated embodiment, light-emitting module **112** comprises a power module **102**, a control module **128**, an activation switch **114**, a laser emitter **108**, an illuminating component **126** and a tilt sensor **134**. Control module **128** comprises a sleep timer **170**. Power module **102**, activation switch **114**, laser emitter **108**, illuminating component **126** and tilt sensor **134** are all electrically connected to control module **128**.

[0105] In the illustrated embodiment, the functionality of light-emitting module **112** is similar to the embodiment described above in relation to FIG. **11**, except that the ball comprises tilt sensor **134**. When activated, control module **128** activates emitter **108**, illuminating component **126** and tilt sensor **134**. When activated by control module **128**, illuminating component **126** emits light at a first predetermined frequency (i.e. colour). In some embodiments, light emitted at the first predetermined frequency is green visible light.

[0106] While illuminating component is illuminated, if tilt sensor **134** senses that the ball tilts such that the target alignment plane tilts more than a predetermined angle from vertical, the control module **128** controls the illuminating component to emit light at a second predetermined frequency. In some embodiments, the light emitted at the second predetermined frequency is red light. Accordingly, while the illuminating component **126** is active, if the tilt sensor **134** detects that the ball tilts more than a predetermined angle, the illuminated component emits a different colour of light. In some embodiments, the predetermined angle is between five to ninety degrees and in particular forty-five degrees.

[0107] FIG. **13** is a block diagram illustrating an example embodiment of the light-emitting module **112**. In the illustrated embodiment, light-emitting module **112** comprises a power module **102**, a control module **128**, an activation switch **114**, a laser emitter **108**, an illuminating component **126**, a tilt sensor **134**, a motion sensor **132**, a recording medium **136** and a transceiver **133**. Control module **128** comprises a sleep timer **170**. Power module **102**, activation switch **114**, laser emitter **108**, illuminating component **126**, tilt sensor **134**, motion sensor **132**, recording medium **136** and transceiver **133** are all electrically connected to control module **128**.

[0108] In the illustrated embodiment, when activation switch **114** is activated, the control module **128** activates motion sensor **132**, recording medium **136** and transceiver **133** for a predetermined time or until motion sensor **132** stops sensing motion.

[0109] While motion sensor **132** is activated it takes motion sensor readings and outputs them to control module **128**. As discussed above in relation to FIG. **5**, control module **128** may comprise a processor, an ASIC, a hardware controller and the like, which can be programmed or otherwise configured to provide control signals. The control module **128** may be provided with software instructions to implement certain functionality. Accordingly, the control module **128** may be provided with software instructions to implement certain functionality depending on its implementation. In the illustrated embodiment, the control module **128** reads motion sensor readings and analyzes them in conjunction with the stored software instructions. Further, the control module **128** comprises software instructions to allow communication with a user device. A user can retrieve the motion sensor readings stored on the recording medium, by communicating with control module **128** via transceiver **133**.

[0110] In some embodiments comprising a motion sensor **132**, as in FIG. **13**, the control module **128** only activates the illuminating component **126** and other components of the module **112** while motion sensor readings output from motion sensor **132** and analyzed by the control module **128** indicate that the ball remains in motion, or until a predetermined time thereafter. Accordingly, in some embodiments, when switch **114** (or **114'**) is activated, the control module **128** activates illuminating component **126** until control module **128** determines that the ball is no longer in motion.

[0111] It will be appreciated that while the light-emitting module **112** has been described in the context of a golf ball in order to provide an application-specific illustration, it should be understood that the light-emitting module **112** could also be applied to any other sports balls, which would benefit from illuminating, such as tennis balls or soccer balls.

[0112] In alternate embodiments, the components of module **112** are positioned at or near the surface of the light-emitting ball instead of near its center, such that the body of the ball would not need to have transparent sections or bores in line with the laser emitter **108** or illuminating component **126** to permit emission of light outwardly from the ball. The ball would still have to be balanced such that its center of gravity is at its center.

[0113] It will be appreciated that the illustrated embodiments shown to provide some example embodiments of the invention. The invention is not limited to the above-described embodiments, but contemplates reasonable variations therefrom. Various combinations of the illustrated embodiments and elements are contemplated. For example, in some embodiments the light-emitting ball has an illuminating component and/or a laser emitter, and may have a transparent body or may have a light-inhibiting body with appropriate transparent sections. Further, in the various embodiments the transparent sections can extend circumferentially such that the ball has an illuminated circumferential alignment stripe, or may extend only partially around the circumference of the ball, such that the ball has a partial circumferential alignment stripe. Further, any of the embodiments can have a motion sensor, recording medium and transceiver. Further, it will be understood that electrical and mechanical connections and couplings described above are described for illustration only. Other electrical and mechanical connections and couplings are contemplated to achieve the desired functionality.

[0114] Numerous specific details are set forth herein in order to provide a thorough understanding of the example embodiments described herein. However, it will be understood by those of ordinary skill in the art that these embodiments may be practiced without these specific details. In other instances, well-known methods, procedures and components have not been described in detail so as not to obscure the description of the embodiments. Furthermore, this description is not to be considered as limiting the scope of these embodiments in any way, but rather as merely describing the implementation of these various embodiments.

We claim:

1. A laser light emitting golf ball comprising:

a substantially spherical body including a transparent section wherein at least the transparent section is made of at least partially transparent material;

a light-emitting module positioned at least in part within the body having:

a laser emitter for emitting coherent light in an outwardly extending direction from the ball through at least a portion of the transparent section along a target alignment plane;

a power module coupled to the laser emitter for powering the laser emitter; and

an activation switch coupled to the power module for activating the laser emitter;

wherein the ball is balanced, such that the ball has a center of gravity at approximately a center of the substantially spherical body.

2. The ball of claim **1**, wherein the body is made of at least partially transparent material; and

the light-emitting module further comprises an illuminating component coupled to the power module for emitting light at a predetermined frequency.

3. The ball of claim **1**, wherein the body further includes a second transparent section made of at least partially transparent material coplanar with the target alignment plane; and

the light-emitting module further includes an illuminating component coupled to the power module for emitting light at a predetermined frequency through at least a portion of the second transparent section.

4. The ball of claim **2** or **3**, wherein the light-emitting module further includes:

a control module coupled to the illuminating component for controlling the illuminating component; and

a tilt sensor coupled to the control module, wherein the tilt sensor is adapted to determine if the target alignment plane tilts more than a predetermined angle from vertical; upon said determination the tilt sensor generating a tilt detection signal and inputting the tilt detection signal to the control module; and upon the control module receiving a tilt detection signal, the control module being adapted to control the illuminating component to emit light at a second predetermined frequency.

5. The ball of claim **1**, wherein the light-emitting module further comprises a motion sensor for sensing the motion of the ball and generating motion sensor readings, a recording medium for storing motion sensor readings, and a transceiver for transmitting motion sensor readings.

6. An illuminating and tilt-sensing golf ball comprising:

a substantially spherical body having a transparent section wherein at least the transparent section is made of at least partially transparent material and wherein the ball is balanced such that it has a center of gravity at approximately a center of the substantially spherical body;

a light-emitting module positioned at least in part within the body including:

an illuminating component for emitting light at a predetermined frequency through at least a portion of the transparent section along a target alignment plane;

a control module coupled to the illuminating component for controlling the illuminating component;

a power module coupled to the illuminating component for powering the illuminating component; and

an activation switch coupled to the power module for activating the illuminating component;

a tilt sensor coupled to the control module, wherein the tilt sensor is adapted to determine if the target alignment plane tilts more than a predetermined angle from vertical; upon said determination, the tilt sensor generates a tilt detection signal and inputs the tilt detection signal to the control module; and upon the control module receiving a tilt detection signal, the control module being adapted to control the illuminating component to emit light at a second predetermined frequency.

7. The ball of claim **6**, wherein the body further comprises a second transparent section made of at least partially transparent material, said transparent section being coplanar with the target alignment plane; and

the light-emitting module further including a laser emitter coupled to the power module for emitting coherent light in an outwardly extending direction from the ball through at least a portion of the second transparent section.

8. The ball of claim **7**, wherein the light-emitting module further comprises a motion sensor for sensing the motion of the ball and generating motion sensor readings, a recording medium for storing motion sensor readings, and a transceiver for transmitting motion sensor readings.

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