



US 20160001137A1

(19) **United States**

(12) **Patent Application Publication**
Phillips

(10) **Pub. No.: US 2016/0001137 A1**

(43) **Pub. Date: Jan. 7, 2016**

(54) **ILLUMINATION SYSTEM FOR A SPORTS BALL**

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(21) Appl. No.: **14/510,112**

(22) Filed: **Oct. 9, 2014**

Related U.S. Application Data

(60) Provisional application No. 61/998,687, filed on Jul. 7, 2014.

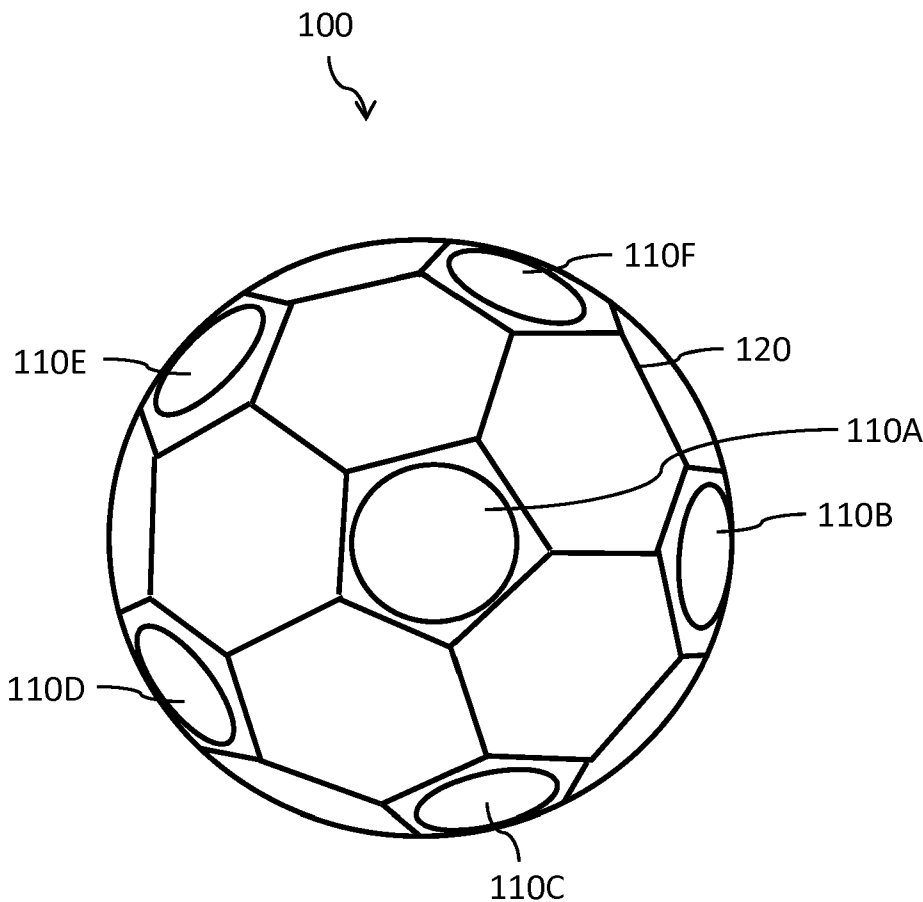
Publication Classification

(51) **Int. Cl.**
A63B 43/00 (2006.01)
A63B 39/00 (2006.01)
A63B 41/00 (2006.01)

(52) **U.S. Cl.**
CPC *A63B 43/008* (2013.01); *A63B 41/00* (2013.01); *A63B 39/00* (2013.01); *A63B 43/004* (2013.01); *A63B 2207/02* (2013.01); *A63B 2220/40* (2013.01); *A63B 2243/0025* (2013.01); *A63B 2243/0083* (2013.01); *A63B 2243/0095* (2013.01); *A63B 2243/007* (2013.01); *A63B 2225/50* (2013.01)

(57) **ABSTRACT**

An illuminated sports ball can be used for both recreational purposes and to aid in training athletes. The ball has interior light source(s), a power source and at least one window from which the light source(s) can be seen. In some embodiments the power source is a rechargeable battery that can be charged wirelessly via induction charging. In other embodiments the source is charged via linear inductive charging. The ball can also comprise an accelerometer. Data from the accelerometer can be used to determine how hard a user has kicked, thrown, and/or thrown the ball and can change the color of the light source to allow the user to visually see this information. In other or the same embodiments, the data from the accelerometer can be used to determine the type of spin being placed on the ball and change the color of the light source accordingly.



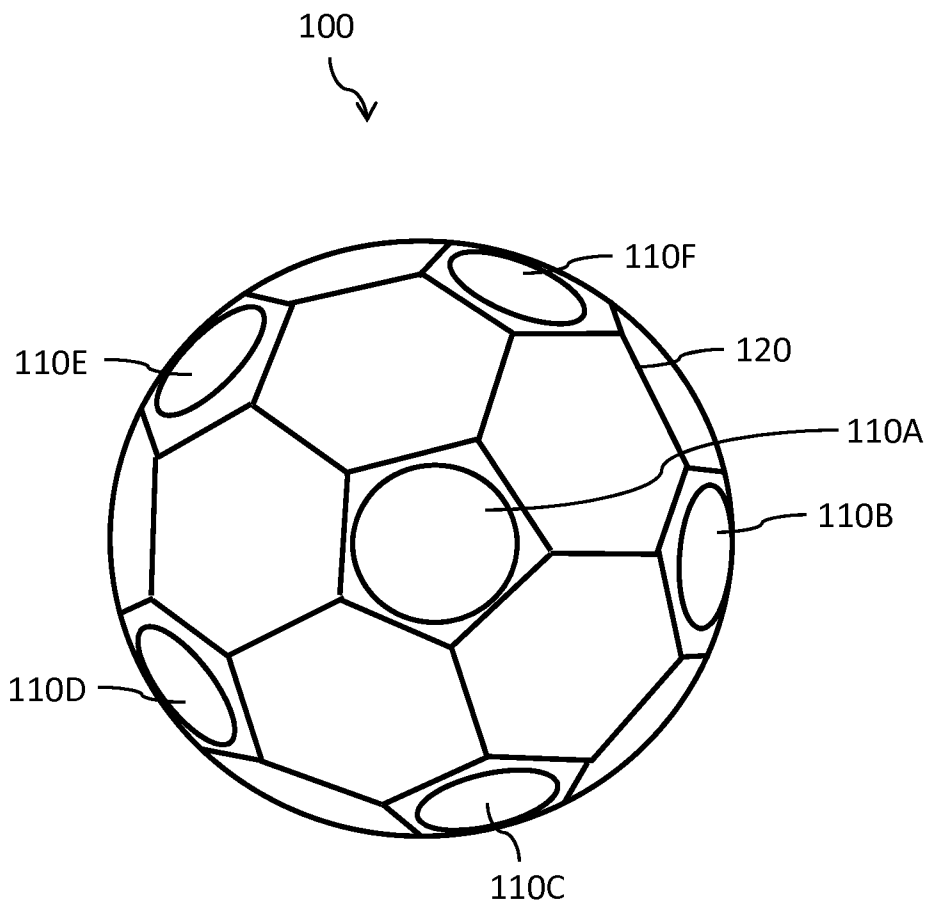


FIG. 1

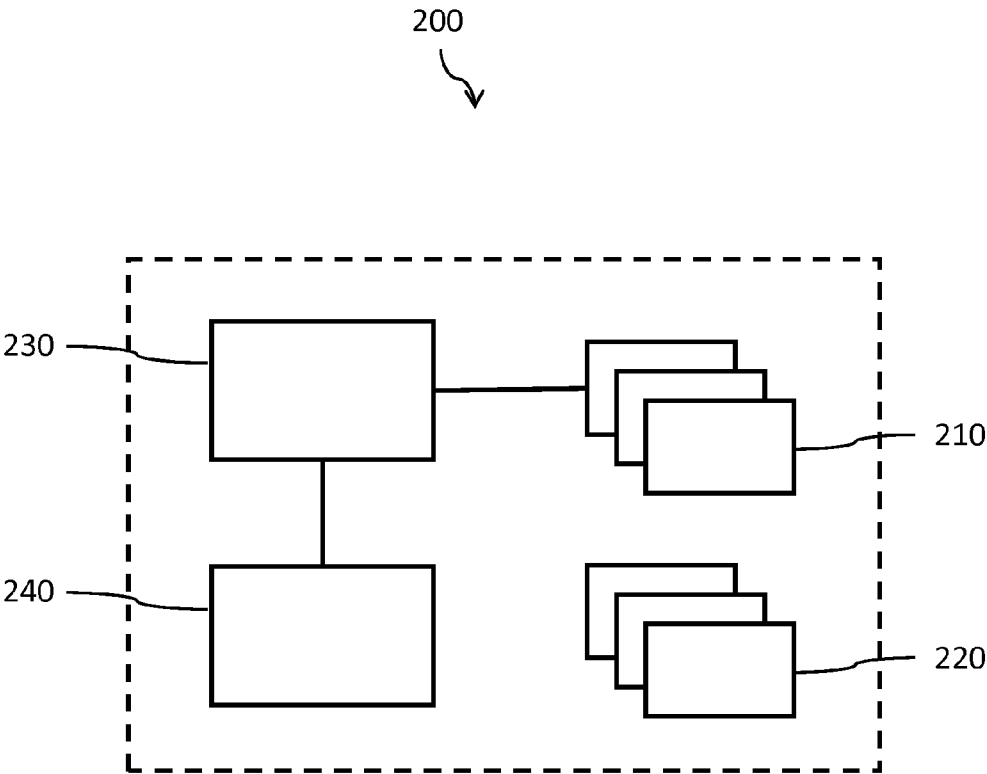


FIG. 2

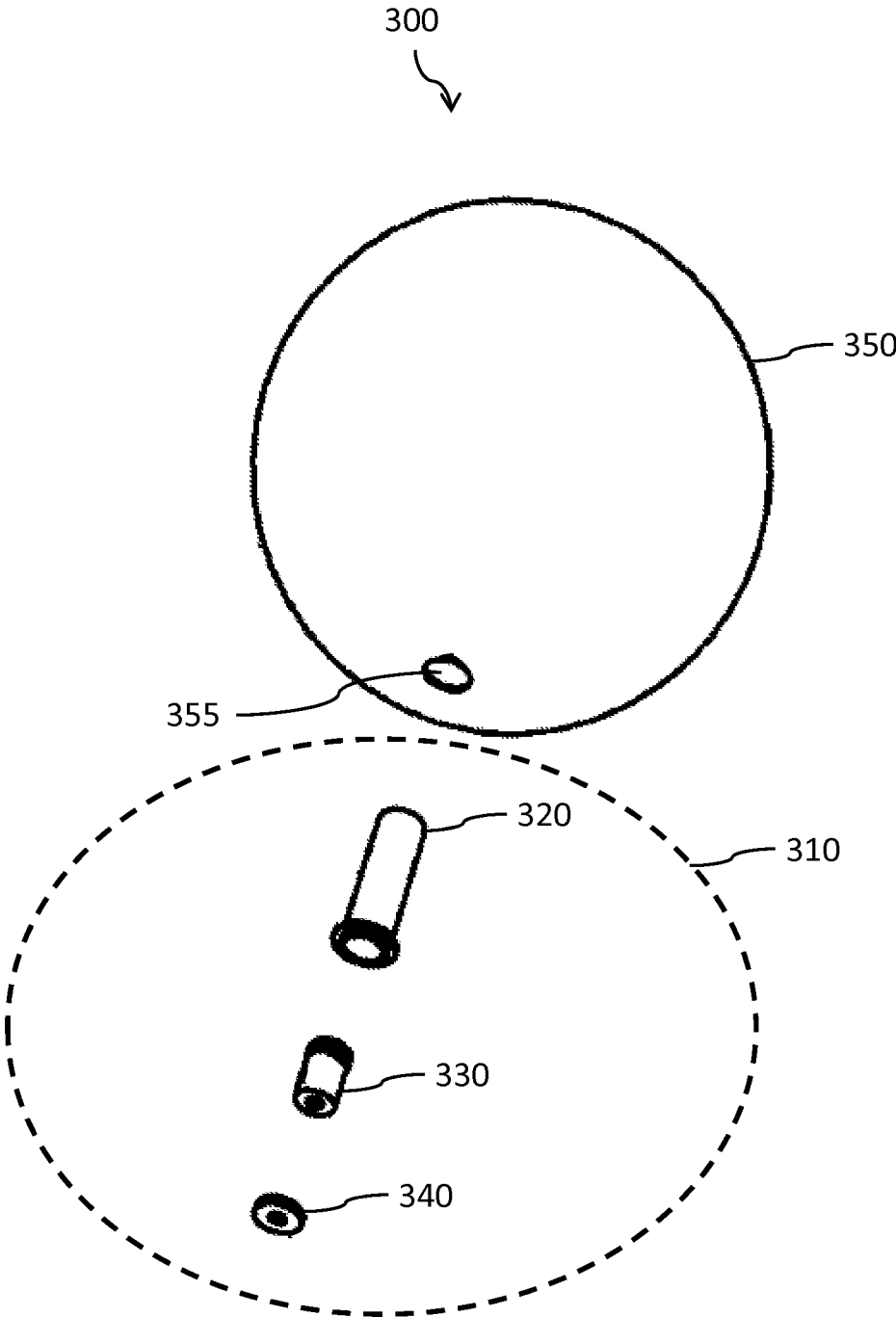


FIG. 3

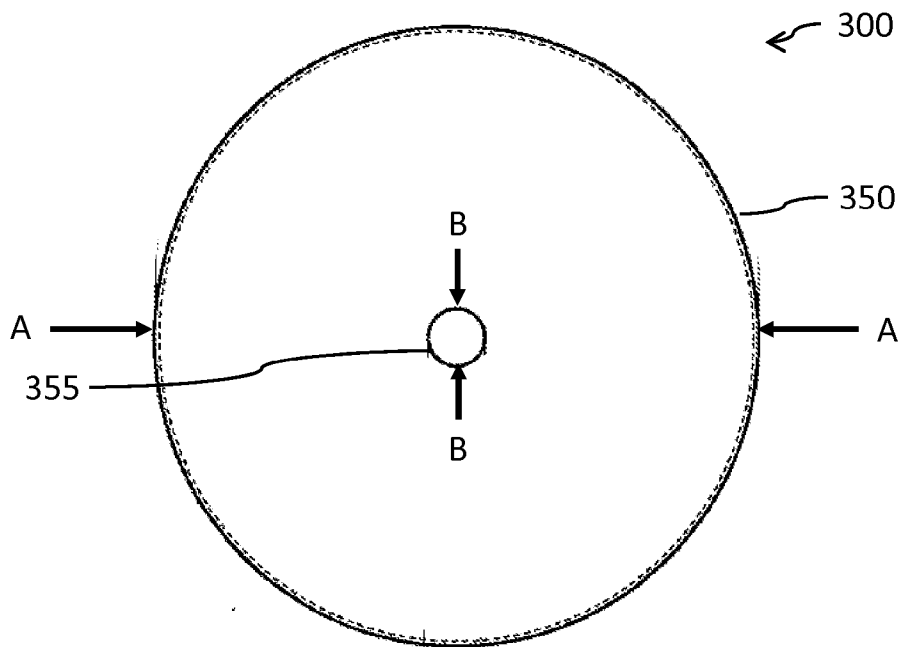


FIG. 4A

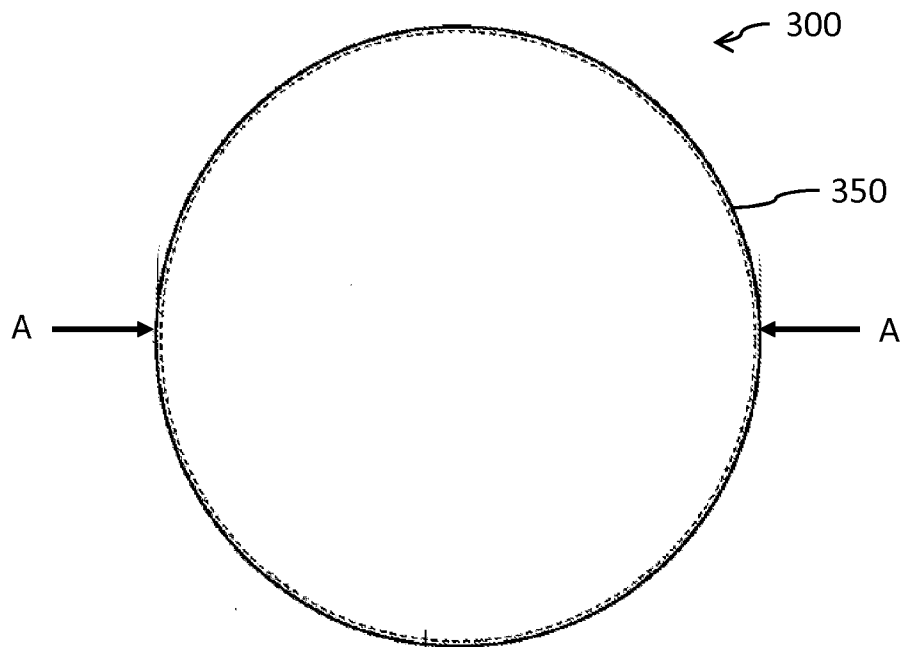
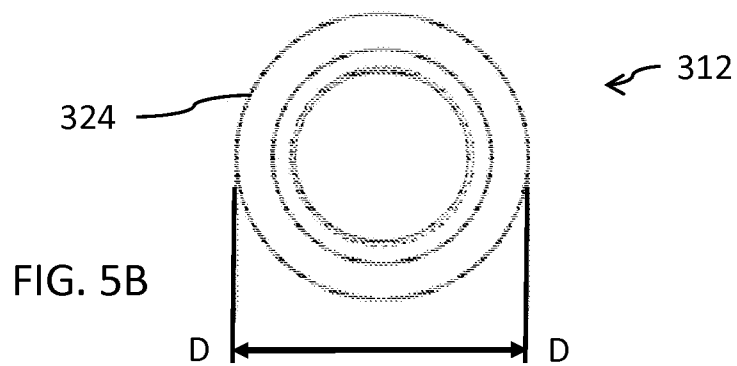
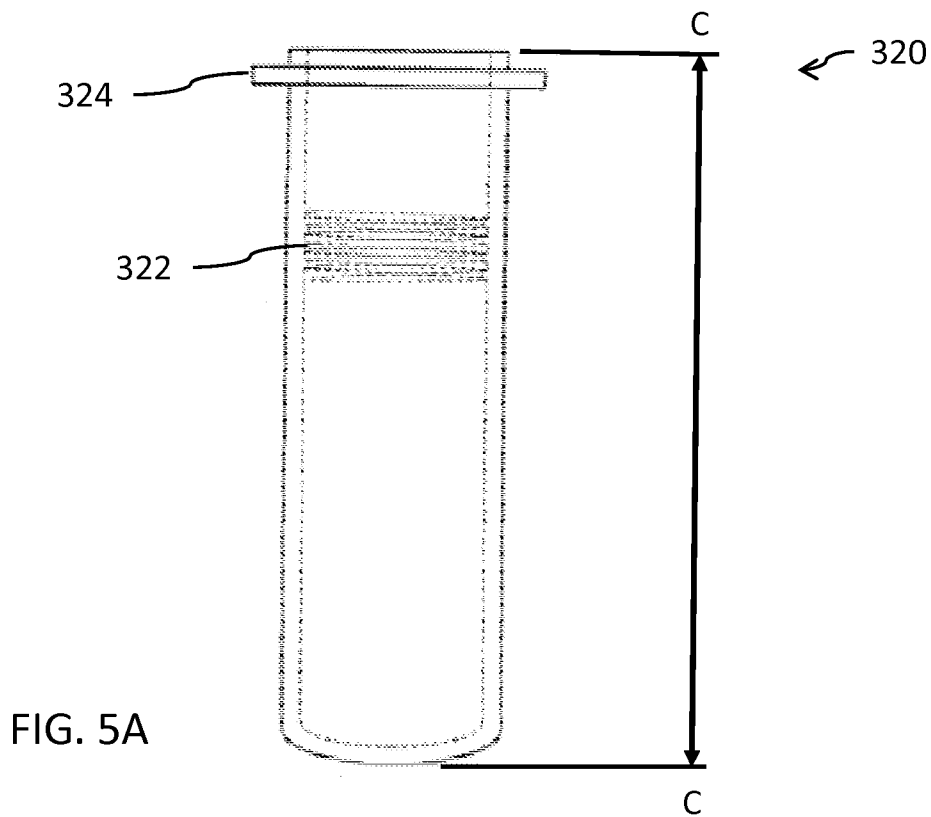


FIG. 4B



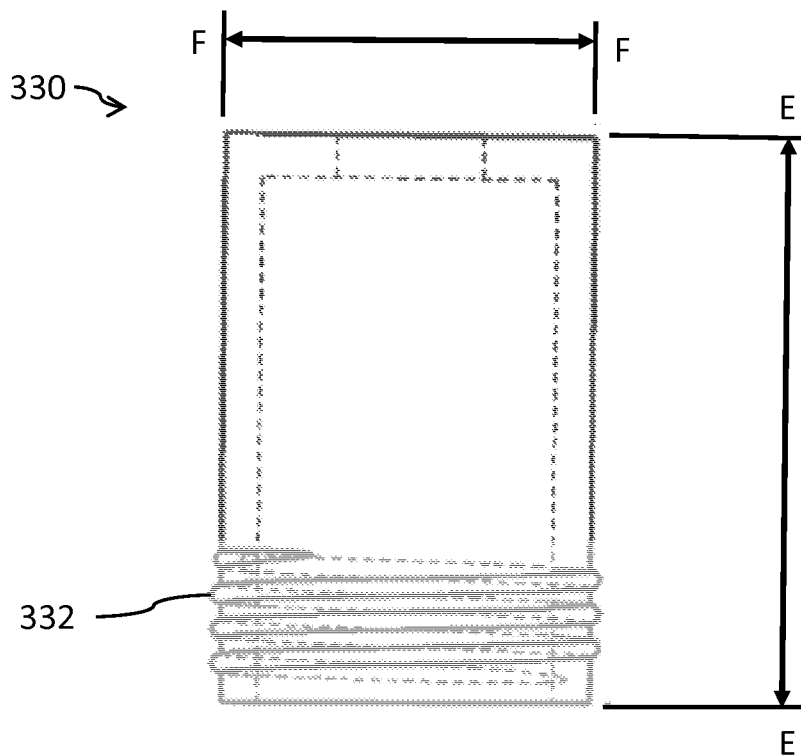


FIG. 6A

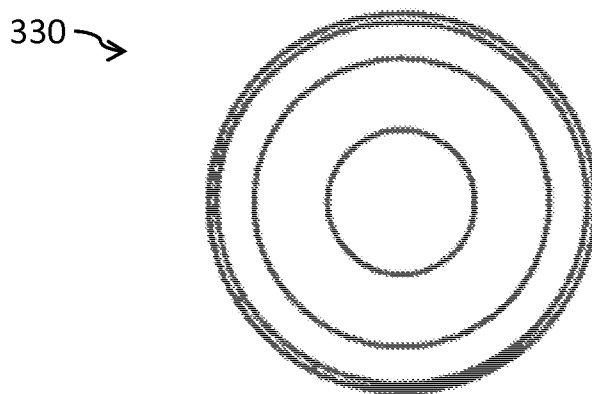


FIG. 6B

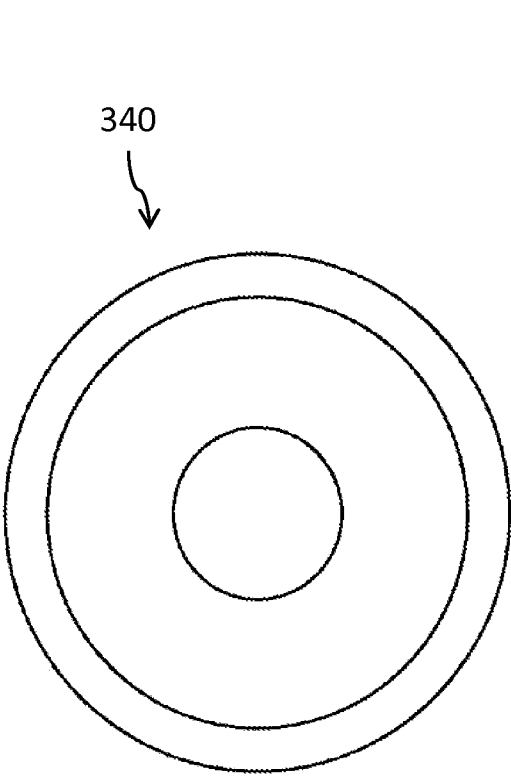


FIG. 7A

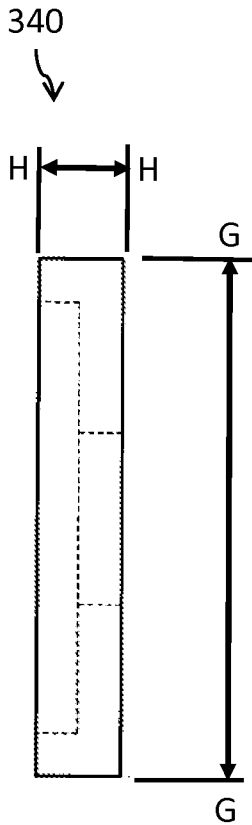


FIG. 7B

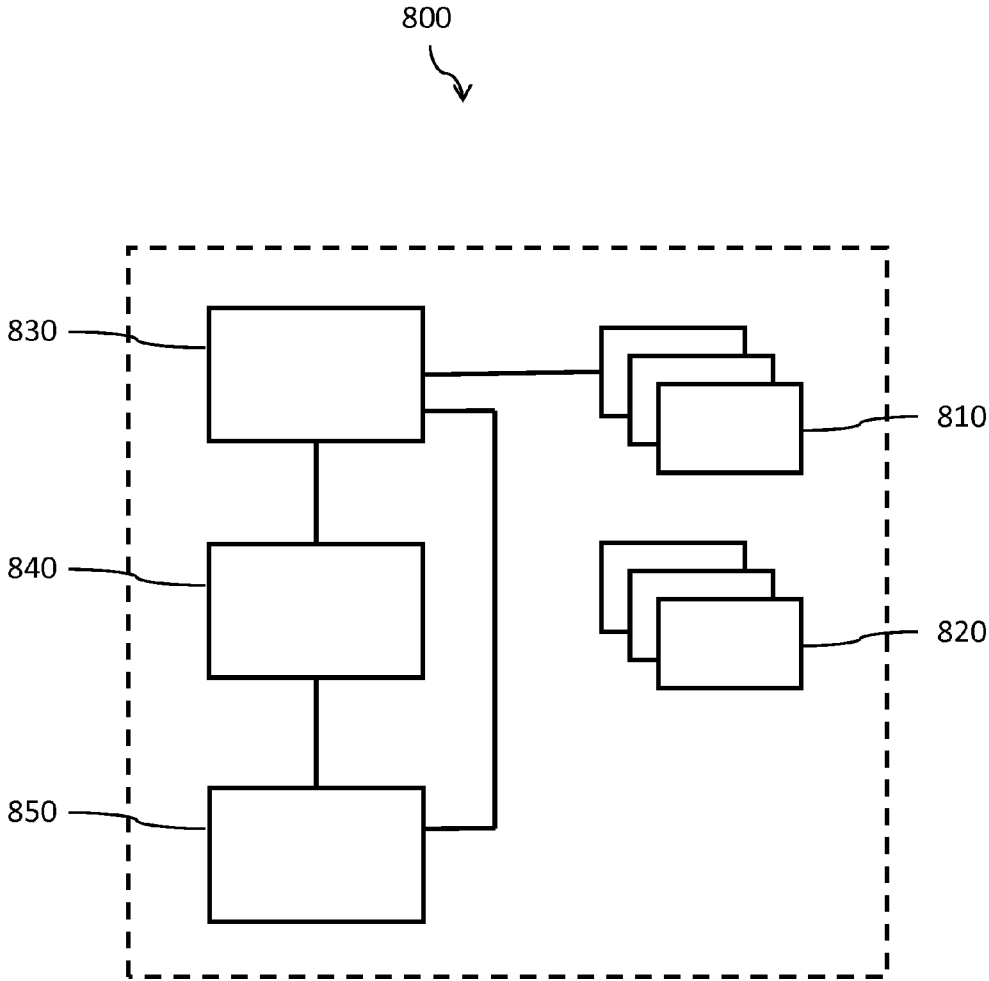


FIG. 8

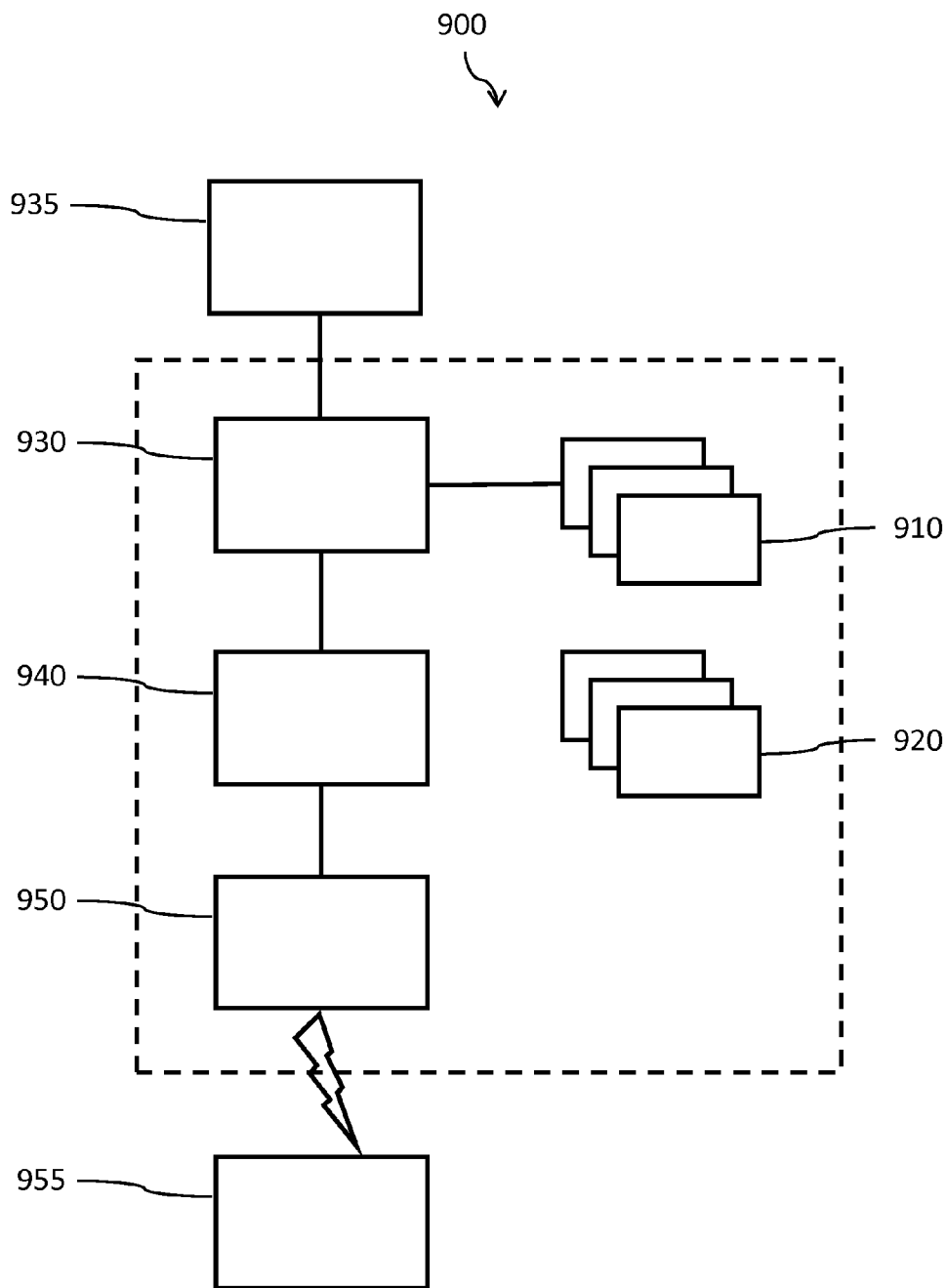


FIG. 9

ILLUMINATION SYSTEM FOR A SPORTS BALL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is related to and claims priority benefits from U.S. Provisional Application No. 61/998,687 having a filing date of Jul. 7, 2014, entitled "After Hours Sportsman Illumination Balls for Kids". The '687 application is hereby incorporated in its entirety by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to illumination systems for sports balls and, in particular, illumination systems that enhance visibility of sports balls, and perception and understanding of their motion in individual and team athletic activities.

BACKGROUND OF THE INVENTION

[0003] Sports balls are used in a variety of individual and team athletic activities including sports such as soccer, football, baseball, basketball, tennis and the like.

[0004] It can be desirable to enhance the visibility of a sports ball, for example in low light conditions, or to make the sports ball more readily distinguishable against a background to players and/or spectators.

[0005] In enhancing the visibility of the sports ball, it is desirable not to affect the flight of the ball, or the handling of the ball by the player.

[0006] Conventional approaches of enhancing the visibility of sports balls typically use colors and/or patterns marked on the surface of the sports balls.

[0007] In one example, a casing of a ball such as a soccer ball is produced in a first color, and a graphic of a second color positioned on the casing of the ball so as to improve visual acuity. Benefits of improved visual acuity include the ability of a player to recognize the ball more readily (for example, in the player's peripheral vision) and the ability to track the flight or movement of the ball more accurately.

[0008] In another example, a ball such as a football is circumscribed with contrasting indicia, configured such that a visually distinctive image can be observed when the ball executes a predetermined motion, for example rotation about a longitudinal or transverse axis.

[0009] In another approach, a soccer ball is provided with one or more internal LED lamps to make the ball glow in the dark. The lamps can be triggered to switch on when the ball is kicked and to stay illuminated for a predetermined period of time. In yet another example, the LED lamps can be switched on and off manually.

[0010] Conventional sports ball designs generally do not include an intelligent illumination system such as a system that can control the brightness, color, and temporal and spatial patterns of illumination, for example, according to the player's needs or in response to the motion of the ball. A benefit of a sports ball comprising an intelligent illumination system would be improved visual acuity in relation to the ball and more effective indication of the trajectory and motion of the ball.

SUMMARY OF THE INVENTION

[0011] An illuminated sports ball can be used for both recreational purposes and to aid in teaching and training

athletes. The ball has at least one interior light source, a power source and at least one window from which the light source(s) can be seen.

[0012] In some embodiments the power source is a rechargeable battery that can be charged wirelessly via induction charging. In other embodiments the source is charged via linear inductive charging. Solar panels located on the ball can also be used to charge the power source.

[0013] In at least one embodiment the ball has an accelerometer. Data from the accelerometer can be used to determine how hard a user has kicked, thrown, and/or thrown the ball and can change the color of the light source to allow the user to visually see this information. In other or the same embodiments, the data from the accelerometer can be used to determine the type of spin being placed on the ball and change the color of the light source accordingly.

[0014] In some embodiments the ball can be configured to work with a monitoring system so that it can indicate, for example by a change in color of its light source, when it goes past a predetermine boundary, for example a goal line. The monitoring system can also record how hard the ball is being kicked, thrown, and/or hit by recording and/calculating either the ball trajectory and/or data received from an accelerometer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a perspective view of a sports ball comprising an illumination system.

[0016] FIG. 2 is a block diagram of the illumination system referred to in the description of FIG. 1.

[0017] FIG. 3 is a perspective view of a sports ball comprising a button subassembly.

[0018] FIGS. 4A and 4B are front and back views respectively of the sports ball of FIG. 3.

[0019] FIGS. 5A and 5B are side and top views respectively of the threaded insert of FIG. 3.

[0020] FIGS. 6A and 6B are side and top views respectively of the button of FIG. 3.

[0021] FIGS. 7A and 7B are top and side views respectively of the rubber trim of FIG. 3.

[0022] FIG. 8 is a block diagram of an illumination system for a sports ball comprising an accelerometer.

[0023] FIG. 9 is a block diagram of another embodiment of an illumination system for a sports ball.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT(S)

[0024] As used herein "sports ball" is intended to mean a ball used for an individual or team athletic activity such as a sport or a game, or a practice activity for the above. Though the example embodiments described herein are mostly in reference to a soccer ball, many activities involving sports balls can take advantage of these advancements. This includes, but is not limited to, soccer, football, rugby football, basketball, baseball, volleyball, tennis and cricket. The sports ball can be essentially spherical or non-spherical (for example, a prolate spheroidal shape). The system described herein can be sized accordingly.

[0025] FIG. 1 is a perspective view of a sports ball 100 comprising an illumination system. The illumination system is housed in the interior of sports ball 100 and is not shown in FIG. 1.

[0026] Sports ball 100 comprises one or more windows such as 110A through 110F. Windows 110A through 110F are situated in the surface of sports ball 100 and are configured to allow light from the illumination system in the interior of sports ball 100 to shine through to the exterior.

[0027] Windows 110A through 110F can be constructed of transparent or semi-transparent material, the material being clear or colored. Windows 110A through 110F can be shaped for aesthetic reasons, for visual impact or enhancement, or to accrue a benefit for the player using the ball such as for when the ball is used as a training tool or in competition.

[0028] Similarly, windows 110A through 110F can be located in the surface of sports ball 100 for aesthetic reasons, for visual impact or enhancement, or to accrue a benefit for the player using the ball such as for when the ball is used as a training tool or in competition.

[0029] The number, size and location of windows (such as windows 110A through 110F) can be configured to suit the sports ball and the intended application.

[0030] For example, in a specific embodiment, windows 110A through 110F can be circular, colored red and regularly-spaced in the surface of sports ball 100. In this embodiment, light from the illumination system in the interior of sports ball 100 can provide a plurality of red lights on the surface of sports ball 100 for the purpose of enhancing visibility of sports ball 100 to the player when sports ball 100 is being used in low ambient light conditions such as at dusk or at night.

[0031] In some embodiments, the number, size and location of windows can be configured to enhance visibility of the sports ball. In other embodiments, the windows can be configured to reduce the power consumption. In yet other embodiments, the windows can be configured to produce a pattern, distinctive image, or other suitable visual effect when the motion of the sports ball conforms approximately to a desired motion, for example, when a desired spin is imparted by a player to the ball.

[0032] Sports ball 100 can optionally comprise one or more markings or seams such as pattern 120. Pattern 120 can be configured to enhance visibility of sports ball 100. Pattern 120 can be provided for aesthetic reasons.

[0033] FIG. 2 is a block diagram of the illumination system 200 referred to in the description of FIG. 1.

[0034] Illumination system 200 comprises one or more light sources 210. For example, each of the one or more light sources 210 can be a light emitting diode (LED), a laser or other suitable alternative. Light sources 210 can emit light of the same color or of different colors.

[0035] Illumination system 200 can comprise one or more light dispersing elements 220 such as a diffuser, an element comprising photo-luminescent paint, an optic fiber or other suitable alternative.

[0036] Illumination system 200 further comprises a power source 230 and a control subsystem 240. Power source 230 can be one or more batteries, one or more rechargeable batteries or other suitable alternative. Power source 230 can be configured to be recharged in situ by means of a recharging subsystem (not shown in FIG. 2 and described in reference to FIG. 9).

[0037] Control subsystem 240 can be configured to switch light sources 210 on and off and/or to control the brightness or color of illumination provided by light sources 210. Control subsystem 240 can be configured to adjust the illumination and/or provide a fixed or dynamic pattern of illumination such as flashing for example. Control subsystem 240 is optional.

[0038] When describing elements of FIGS. 3-7, the same number is used to identify elements that are the same or substantially similar to each other in the different views illustrated in FIGS. 3-7.

[0039] FIG. 3 is a perspective view of a sports ball 300 comprising a button subassembly 310. Button subassembly 310 is shown in an exploded view in FIG. 3. For clarity, the surface of sports ball 300 is illustrated without markings or illumination windows.

[0040] Button subassembly 310 comprises a threaded insert 320, a button 330 and a rubber trim 340. Button subassembly 310 can be inserted through surface 350 of sports ball 300 via opening 355.

[0041] Button subassembly 310 can be configured to switch the illumination on and off, or to adjust the illumination brightness, color or temporal or spatial pattern. For example, button subassembly 310 can be configured to execute a predetermined sequence. An example sequence can be as follows: a) when illumination is off, press once to switch illumination on, b) press a second time to cause the system to enter a flashing mode in which the illumination (such as light sources 210 of FIG. 2) flash at half-second intervals, and c) press a third time to switch the illumination off.

[0042] FIGS. 4A and 4B are front and back views respectively of sports ball 300 of FIG. 3. Sports ball 300 comprises surface 350 and opening 355.

[0043] The diameter of sports ball 300 is indicated by arrows AA. The diameter of opening 355 is indicated by arrows BB. In an example embodiment, diameter AA can be eight (8) inches, and diameter BB can be three-quarters ($\frac{3}{4}$) of an inch.

[0044] FIGS. 5A and 5B are side and top views respectively of threaded insert 320 of FIG. 3. Threaded insert 320 comprises a thread 322 and a top-piece 324.

[0045] The length of threaded insert 320 is indicated by double-headed arrow CC. In an example embodiment, length CC is two and one-half (2.5) inches.

[0046] The diameter of top-piece 324 is indicated by double-headed arrow DD. In an example embodiment, diameter DD is one (1) inch.

[0047] In some embodiments, threaded insert 320 can be manufactured from PETG (polyethylene terephthalate glycol-modified) polymer by an injection molding process. Suitable alternative materials and/or manufacturing processes can also be used.

[0048] FIGS. 6A and 6B are side and top views respectively of button 330 of FIG. 3. Button 330 comprises a thread 332.

[0049] The length of button 330 is indicated by double-headed arrow EE. In an example embodiment, length EE is 0.984 inches.

[0050] The diameter of button 330 is indicated by double-headed arrow FF. In an example embodiment, diameter FF is five-eighths (0.625) of an inch.

[0051] In some embodiments, button 330 can be manufactured from PETG polymer by an injection molding process. Suitable alternative materials and/or manufacturing processes can also be used.

[0052] FIGS. 7A and 7B are top and side views respectively of rubber trim 340 of FIG. 3.

[0053] The diameter of rubber trim 340 is indicated by double-headed arrow GG. In an example embodiment, length GG is three-quarters ($\frac{3}{4}$) of an inch.

[0054] The thickness of rubber trim **340** is indicated by double-headed arrow HH. In an example embodiment, diameter HH is one-eighth (0.125) of an inch.

[0055] In some embodiments, rubber trim **340** can be manufactured by an injection molding process. Suitable alternative manufacturing processes can be used.

[0056] FIG. 8 is a block diagram of an illumination system **800** for a sports ball comprising an accelerometer **850**. Illumination system **800** comprises one or more light sources **810**, one or more light dispersing elements **820**, a power source **830**, a control subsystem **840**, and accelerometer **850**.

[0057] Accelerometer **850** can be configured to determine the motion and/or orientation of the sports ball. Accelerometer **850** is connected to control system **840**. Accelerometer **850** provides acceleration data to control system **840**. The acceleration data can be used by control system **840** to control the illumination system, for example switching the light sources on and off, selecting one or more light sources, and adjusting the brightness, color and temporal and spatial pattern of the illumination.

[0058] In use, for example, illumination system **800** can be configured to adjust the color of the sports ball based at least in part on how hard the sports has been hit or kicked, or based at least in part on the kind of spin (top spin, side spin and the like) imparted to the ball.

[0059] FIG. 9 is a block diagram of another embodiment of an illumination system **900** for a sports ball. Illumination system **900** comprises one or more light sources **910**, one or more light dispersing elements **920**, a rechargeable power source **930**, and a control subsystem **940**.

[0060] Illumination system **900** further comprises a recharging system **935** connectable to rechargeable power source **930**. In some embodiments, recharging system **935** is wirelessly connectable to rechargeable power source **930**. For example, recharging system **935** can be inductively coupled to rechargeable power source **930**.

[0061] In some embodiments, the sports ball can comprise a casing comprising one or more photovoltaic cells or solar panels on the exterior surface. Rechargeable power source **930** can be recharged using the solar panels.

[0062] In the other or same embodiments, the sports ball can benefit from linear induction charging. In these embodiments the sports ball contains a generator which consists of a hollow copper coil with a permanent magnet inside of it. The magnet is allowed to slide up and down the copper coil. The movement of the magnet creates a magnet field that moves through the copper wire and creates electricity which can then be used to charge a capacitor or battery that then runs the illumination system.

[0063] Illumination system **900** further comprises a communication subsystem **950** wirelessly connectable to monitoring subsystem **950**. Control subsystem **940** can be configured to exchange information or data with monitoring subsystem **955** via communication subsystem **950**.

[0064] In an example embodiment, monitoring subsystem can be configured to determine when the sports ball travels across a predetermined boundary, and to instruct control subsystem **940** to switch on or off the illumination, or to adjust the brightness, color or temporal or spatial pattern of illumination.

[0065] Control subsystem **940** can be configured to log data, for example acceleration data, ball speed and trajectory,

pattern of illumination and the like. Monitoring subsystem **950** can be configured to log data wirelessly transmitted from control subsystem **940**.

[0066] The system can be beneficial for training and coaching applications. For example, being able to track the motion and spin of a sports ball can be beneficial to a player training to throw or hit the ball.

[0067] Particular elements and the configuration of those elements (such as the size, shape and color of the windows, the accelerometer, the control subsystem and the like) as described in the embodiments above can be incorporated into sports balls in other suitable combinations or arrangements, for example to suit particular applications. In at least some embodiments, the various elements such as, but not limited to, the power source, accelerometer, and/or the light source are positioned in the sports ball in such a way that they have as little effect as possible on the sport ball's weight and/or center of gravity. In some embodiments, the sports ball can be constructed such that its weight is the same or substantially the same as the traditional sport ball it is meant to substitute.

[0068] While particular elements, embodiments and applications of the present invention have been shown and described, it will be understood, that the invention is not limited thereto since modifications can be made by those skilled in the art without departing from the scope of the present disclosure, particularly in light of the foregoing teachings.

What is claimed is:

1. A sports ball comprising:
 - (a) a first light source;
 - (b) a power source; and
 - (c) a first window located on the exterior surface of said sports ball.
2. The sports ball comprising of claim 1, further comprising:
 - (d) a second window located on the exterior surface of said sports ball.
3. The sports ball comprising of claim 2, further comprising:
 - (e) a second light source,
 wherein said second light source is configured to be seen via said second window and said first light source is configured to be seen via said first window.
4. The sports ball of claim 1, wherein said first light source is a light emitting diode.
5. The sports ball of claim 1, wherein said power source is a rechargeable battery.
6. The sports ball of claim 5, wherein said rechargeable battery recharges wirelessly via induction charging.
7. The sports ball of claim 1, wherein said power source is charged via linear inductive charging.
8. The sports ball of claim 1, further comprising:
 - (d) an accelerometer; and
 - (e) a control subsystem.
9. The sports ball of claim 8, wherein said first light source changes from a first color to a second color based on data provided from said accelerometer.
10. The sports ball of claim 1, wherein said first window is circular.
11. The sports ball of claim 1, wherein said sports ball is a soccer ball.
12. The sports ball of claim 1, wherein said sports ball is a tennis ball.

13. The sports ball of claim **1**, wherein said sports ball is a volleyball.

14. The sports ball of claim **1**, wherein said sports ball is a football.

15. The sports ball of claim **3**, wherein said first window and said second window are configured to aid a user in determining whether said user is putting a first spin on said sports ball.

16. The sports ball of claim **15**, wherein said first light source is a first color and said second light source is a second color.

17. An illumination training system comprising:

(a) an illuminated sports ball wherein said sports ball comprises:

(1) a first light source;

(2) a power source; and

(3) a first window formed on the exterior surface of said sports ball;

(b) a communication subsystem; and

(c) a monitoring subsystem.

18. The illumination training system of claim **17**, wherein said monitoring subsystem is configured to determine when said sports ball travels across a predetermined boundary and communicate with said communication subsystem to change a first color of said light source to a second color.

* * * * *