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(54) **ENERGY STORING DEVICE AND METHOD OF USING THE SAME INCLUDING A FOOTBALL AND A JUMPROPE**

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(57) **ABSTRACT**

A jump rope includes a first handle and a second handle. A rope connects the first handle and the second handle. The first handle defines a cavity. A generation module is disposed in the cavity and is fixed relative to the handle. The generation module includes a bearing, an electric generator, and a battery. A rotor of the electric generator is mechanically coupled to the bearing and an end of the rope is also coupled to the bearing. The electric generator is electrically coupled to the battery. Rotation of the rope relative to the handle causes at least a portion of the bearing to rotate relative to the handle. The rotation of the bearing rotates the generator which generates electric energy, at least a portion of which is stored in the battery.

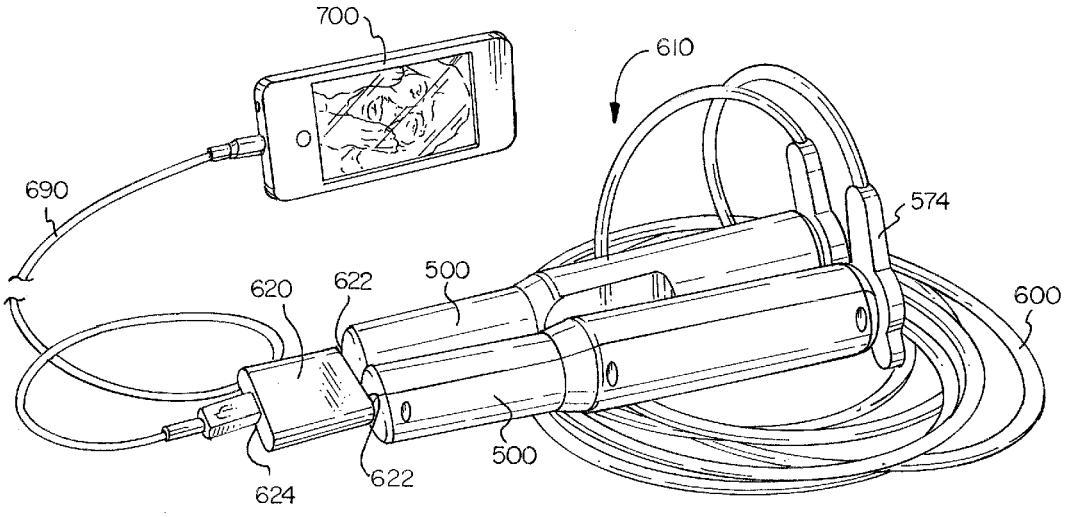


FIG. 1

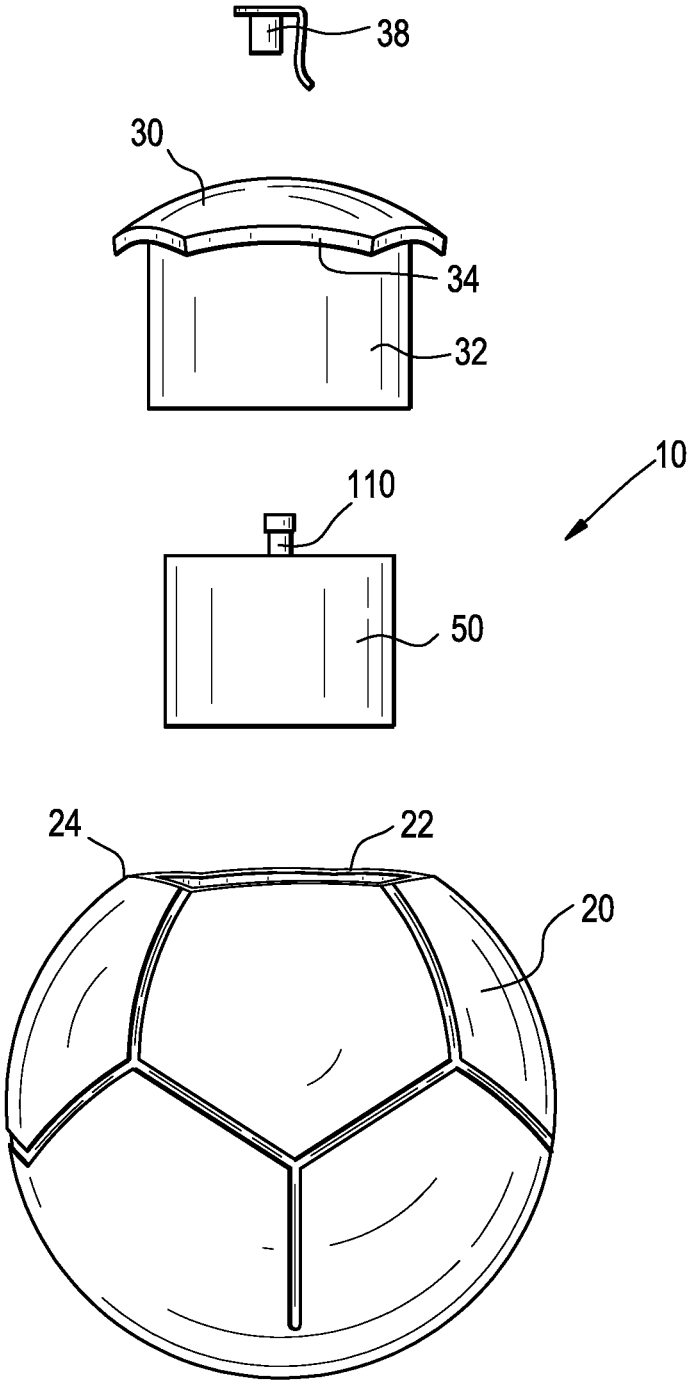


FIG. 2

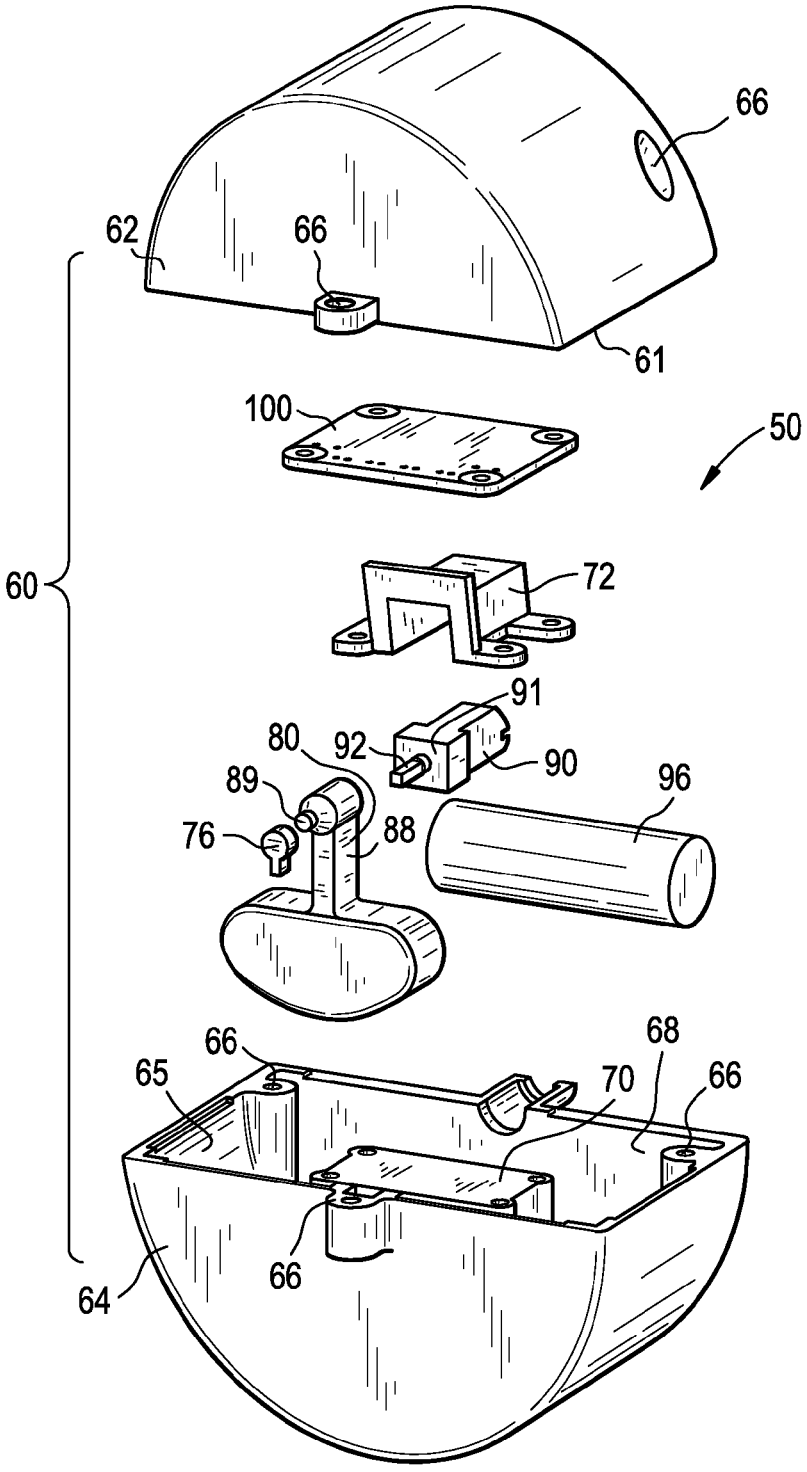


FIG. 3

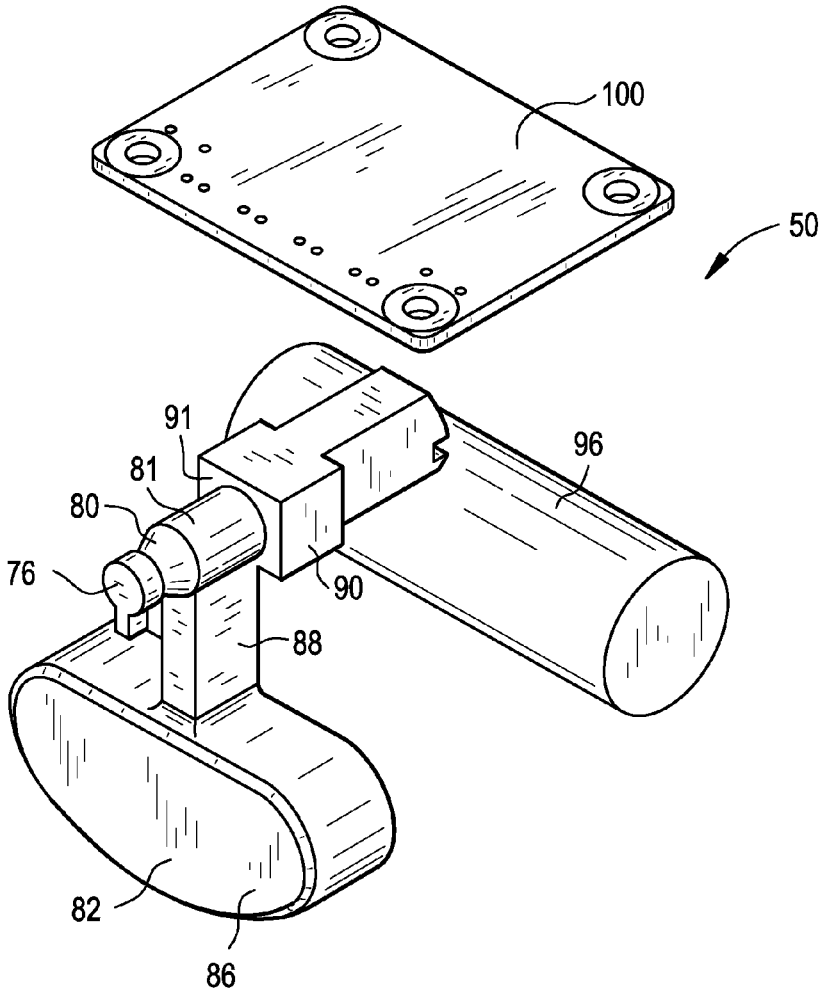


FIG 4

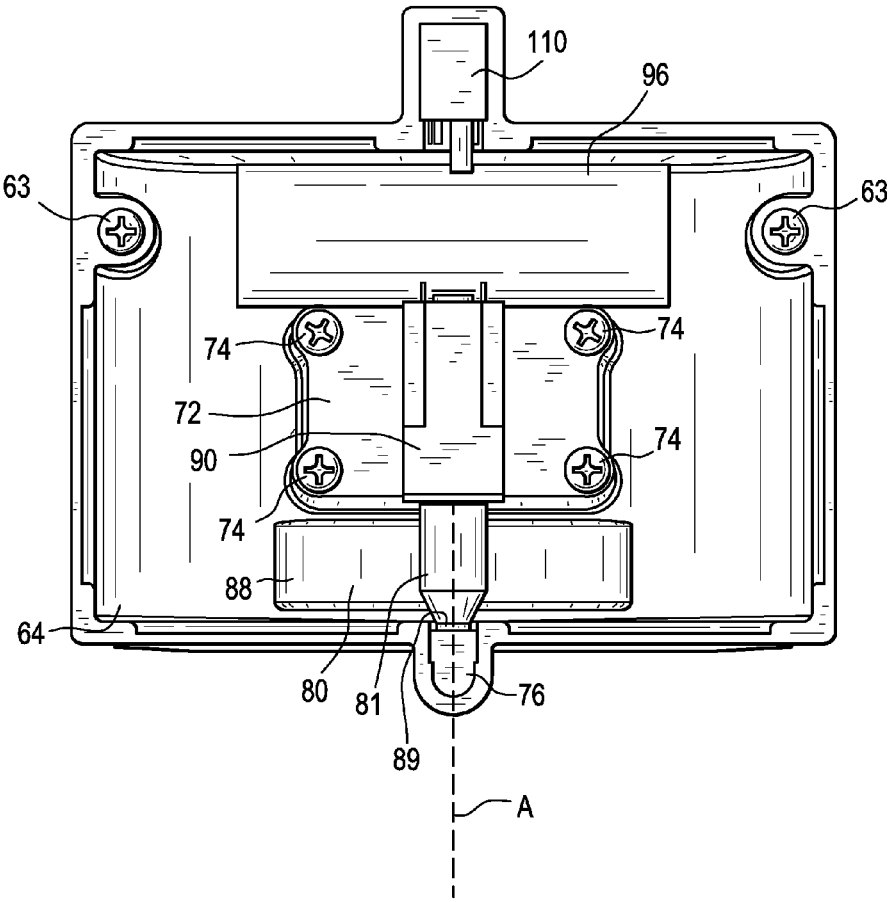


FIG. 5

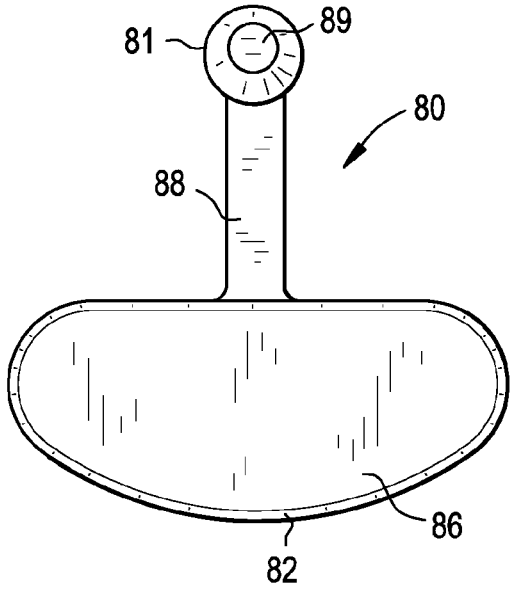


FIG. 6

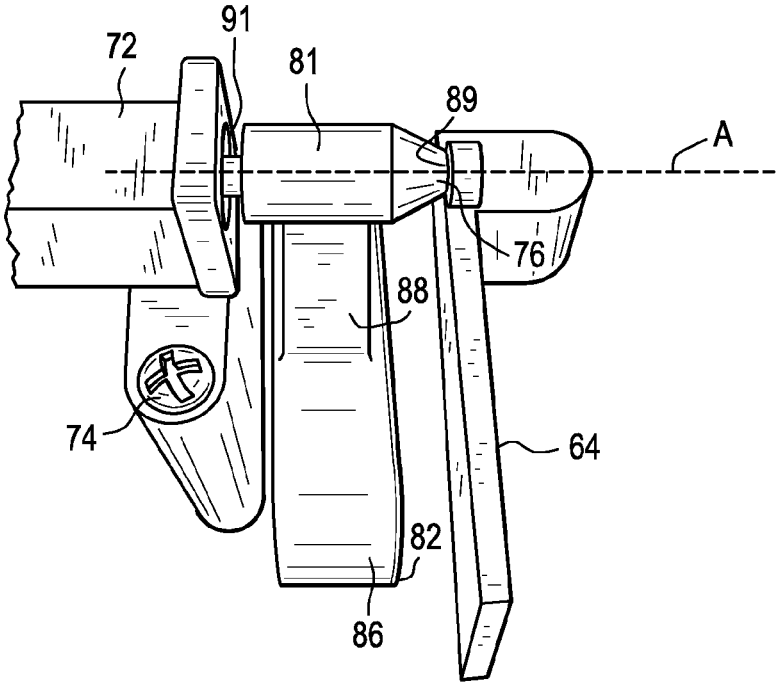
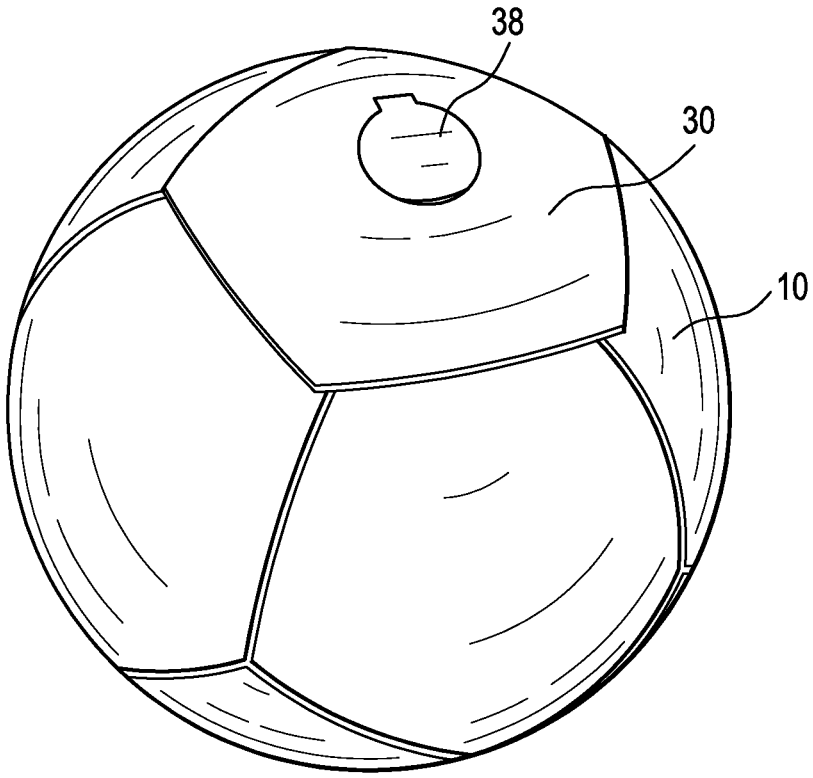


FIG. 7



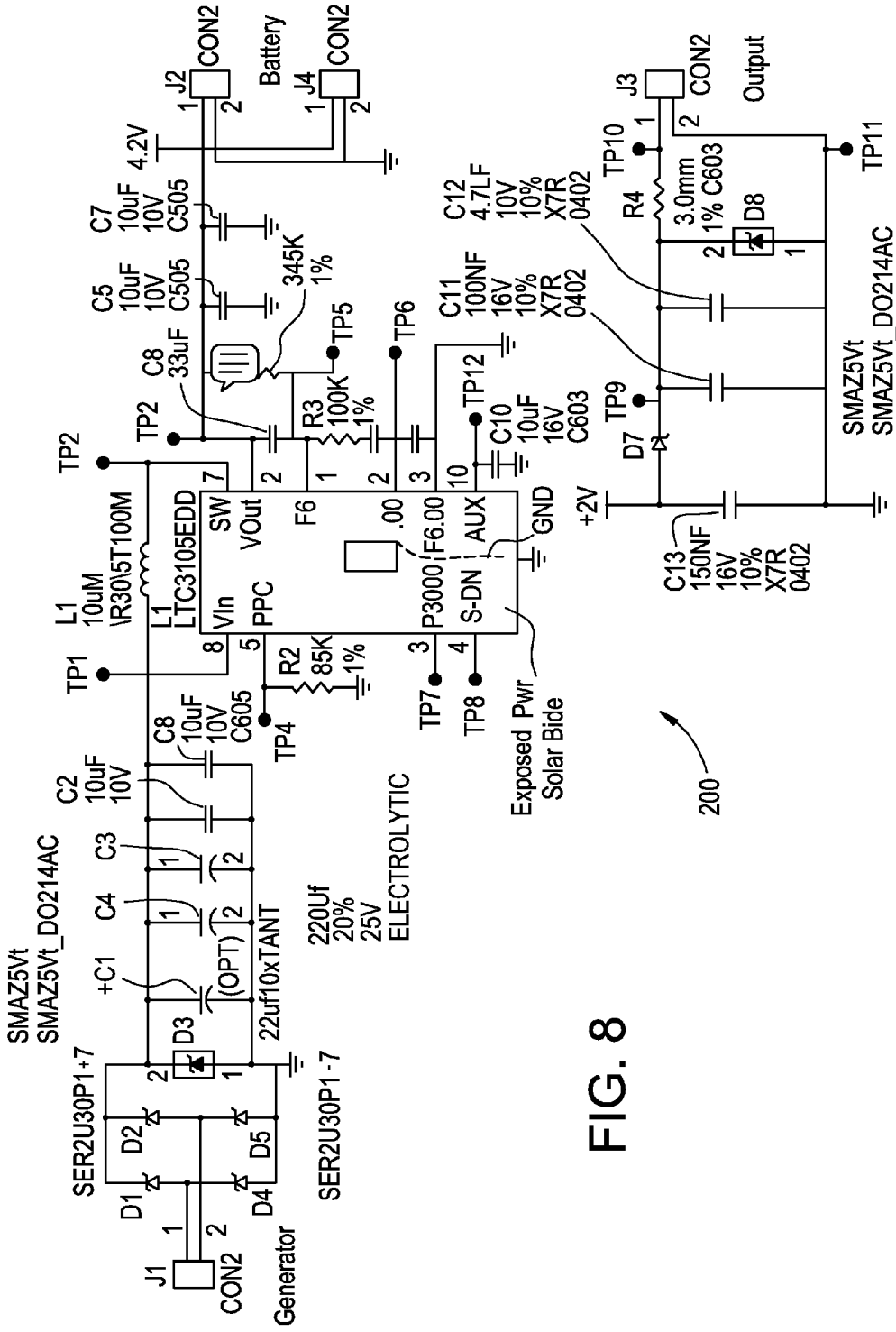
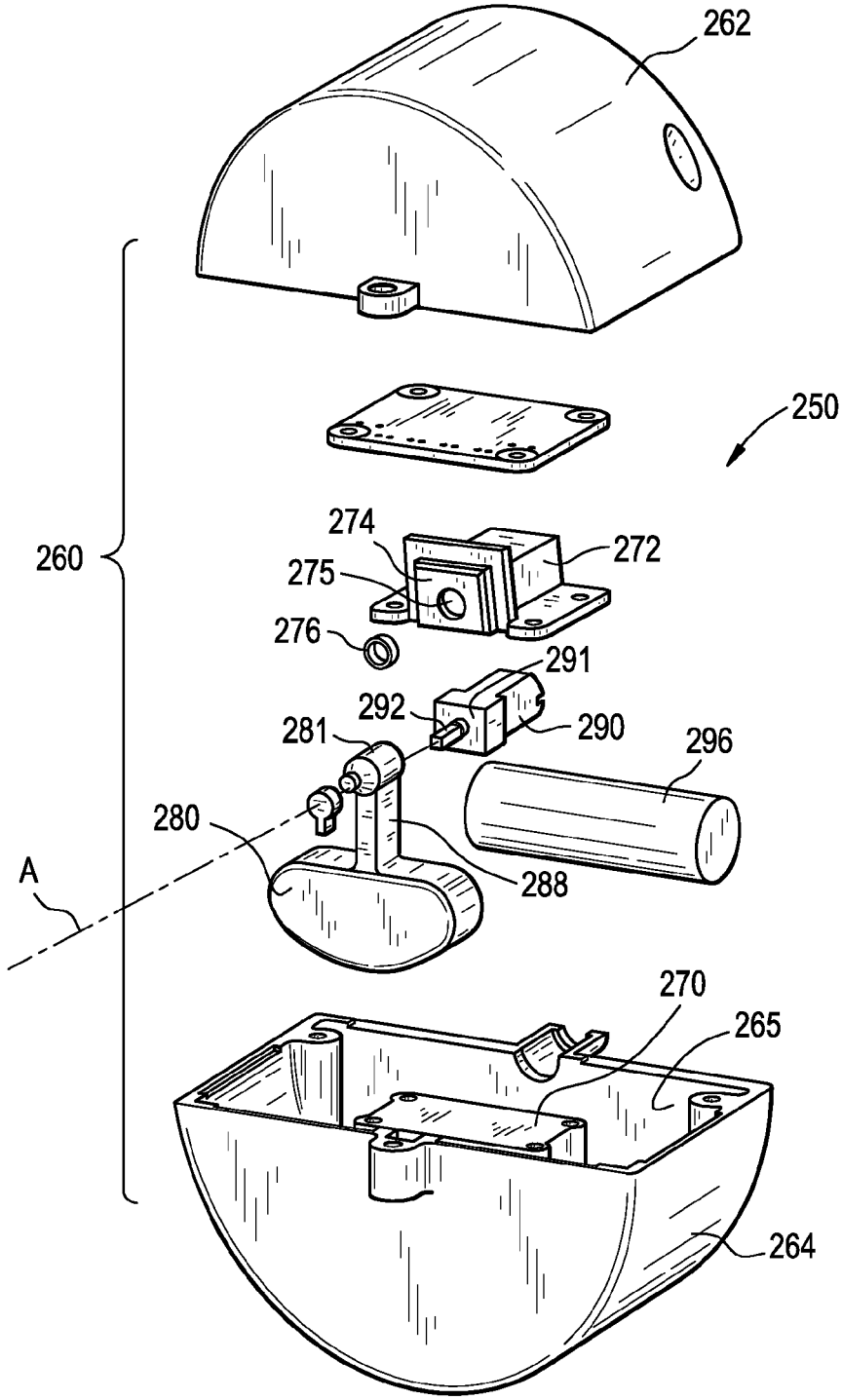

J1
CON2
Generator
D1
D2
D4
D5
SER2U30P1-7
SMAZ5Vt
SMAZ5Vt_DO214AC
D3
+C1
(OPT)
22uf10xTANT
C2
10uF
10V
C3
C4
SER2U30P1-7
220Uf
20%
25V
ELECTROLYTIC
TP1
L1
10uM
\R30\5T100M
C8
10uF
10V
C605
TP4
R2
85K
1%
L1
LTC3105EDD
VIn
PPC
SW
VOut
8
5
7
2
TP2
C8
33uF
C5
10uF
10V
C505
C7
10uF
10V
C505
4.2V
J2
CON2
Battery
J4
CON2
345K
1%
TP5
TP6
R3
100K
1%
F6
.00
P3000
F6.00
S-DN
AUX
GND
3
4
10
TP7
TP8
TP12
C10
10uF
16V
C603
C11
100NF
16V
10%
X7R
0402
C12
4.7LF
10V
10%
X7R
0402
Exposed Pwr
Solar Bide
+2V
TP9
D7
TP10
R4
3.0mm
1% C603
J3
CON2
Output
D8
TP11
SMAZ5Vt
SMAZ5Vt_DO214AC
C13
150NF
16V
10%
X7R
0402
200

FIG. 8

FIG. 9


262
250
260
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272
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276
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292
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A
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265
264

FIG. 10C

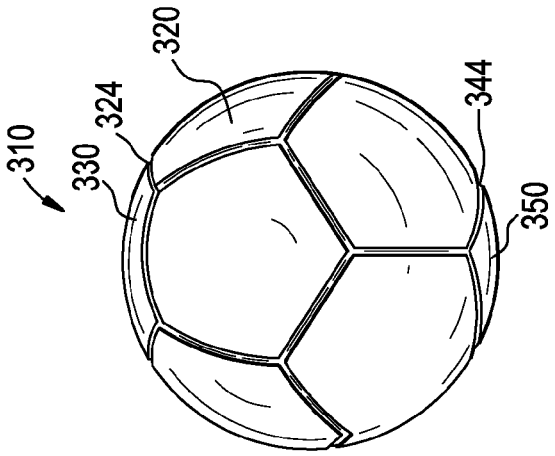


FIG. 10B

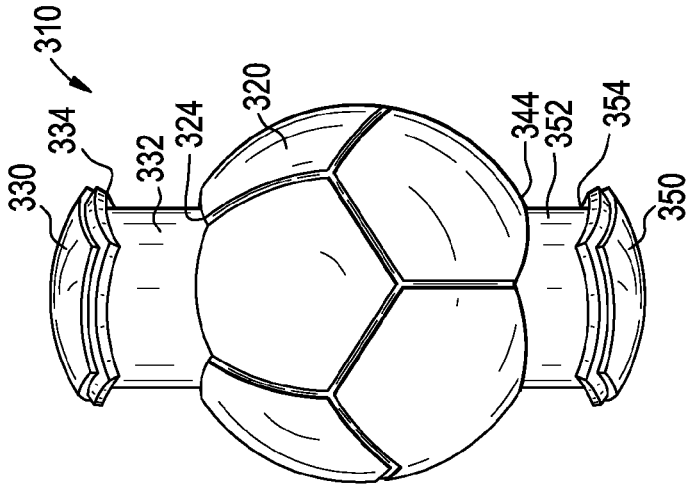
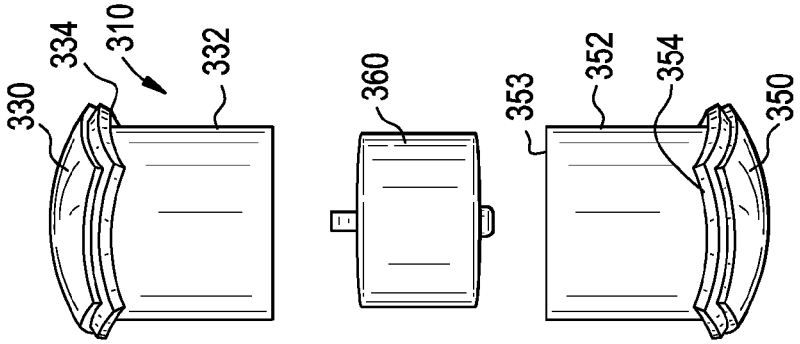


FIG. 10A



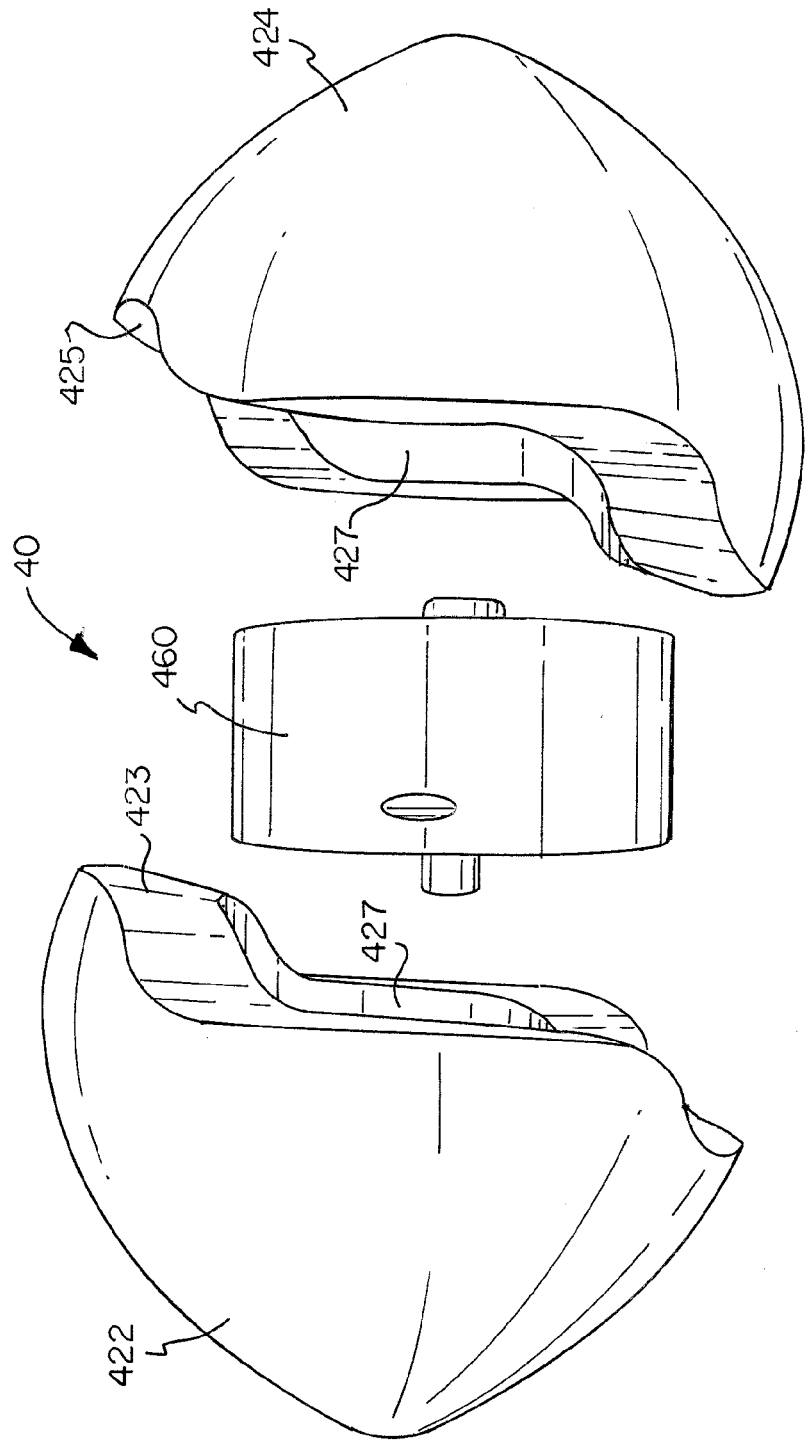


FIG. 11

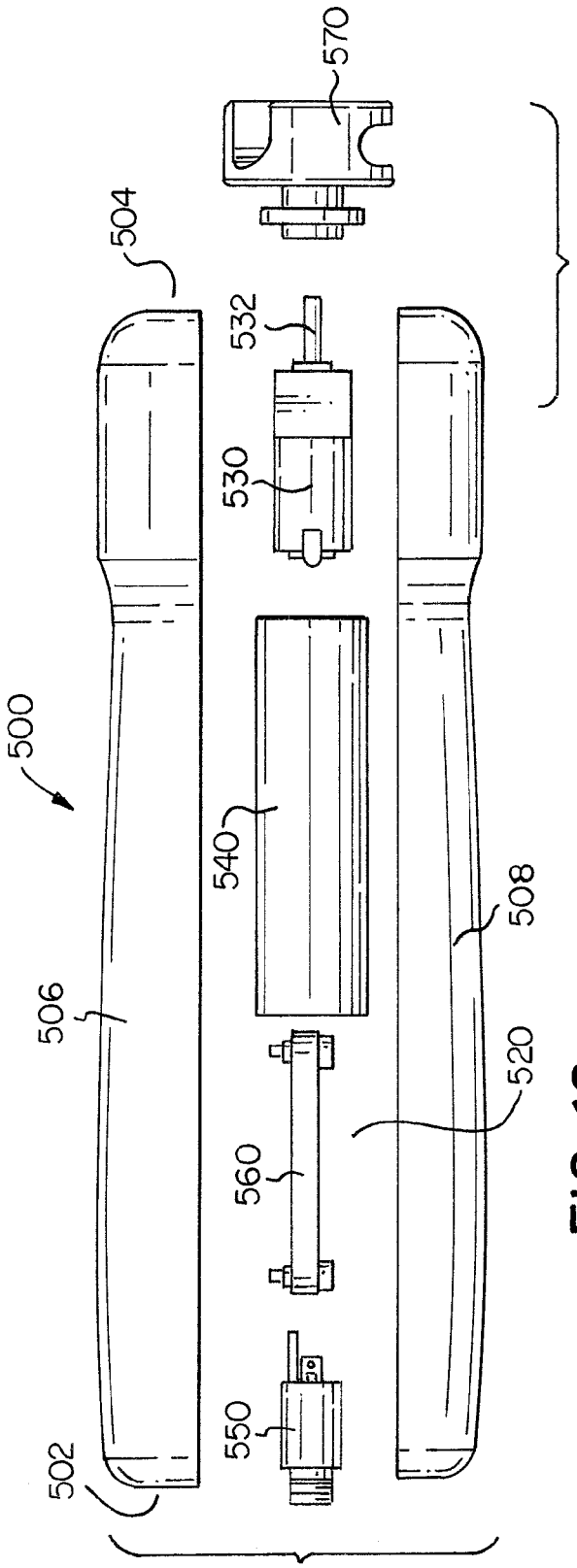


FIG. 12

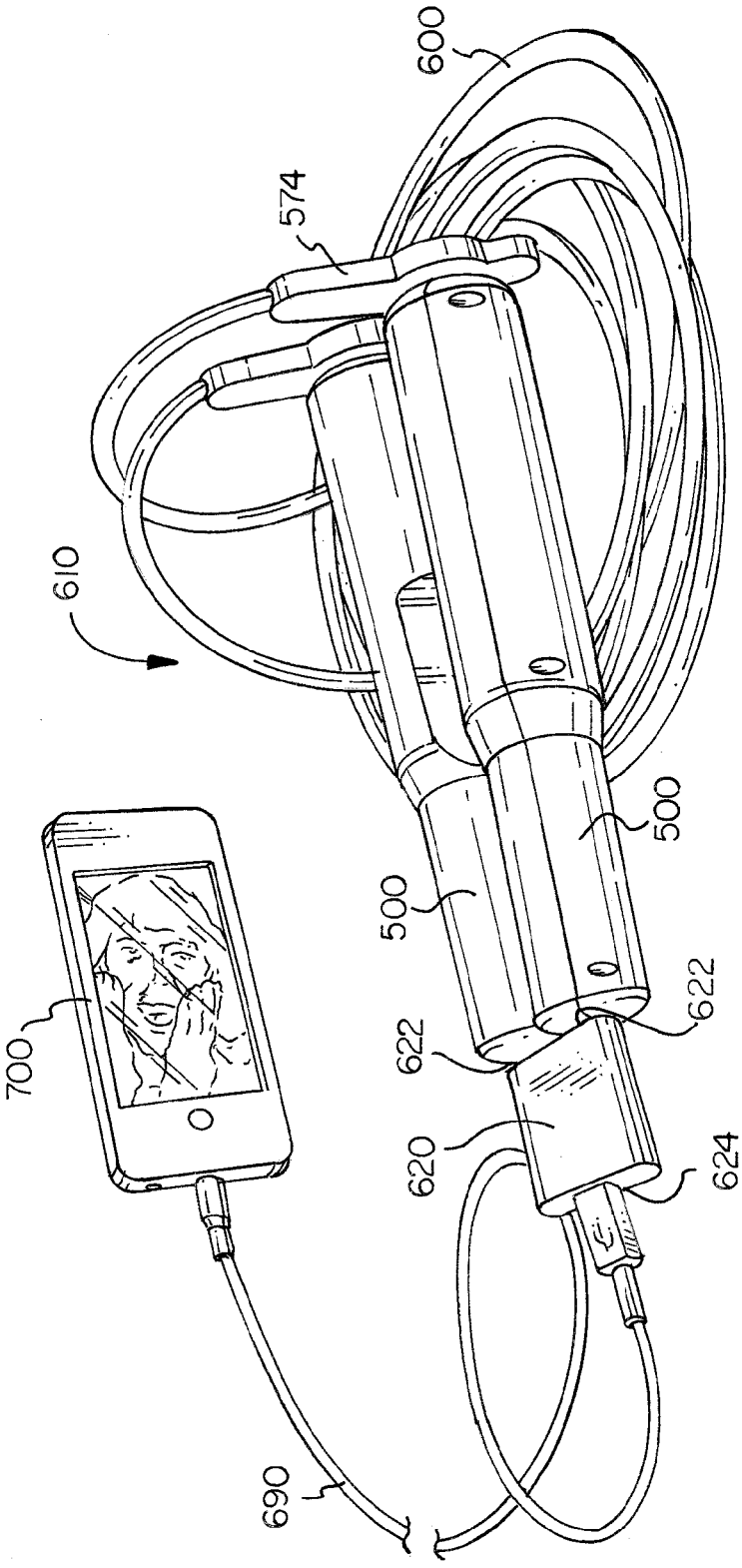


FIG. 13

ENERGY STORING DEVICE AND METHOD OF USING THE SAME INCLUDING A FOOTBALL AND A JUMPROPE

FIELD OF THE INVENTION

[0001] The present invention relates to a ball having a generation module disposed therein. More specifically, the present invention relates to a soccer ball having a generation module disposed in a cavity of the ball, wherein the generation module generates electrical energy from the balls kinetic energy and stores that electrical energy.

BACKGROUND OF THE INVENTION

[0002] The total number of individuals in the World without electric power is put at about 1.5 billion, or a quarter of the world's population, concentrated mostly in Africa and southern Asia. See Nathanial Gronewold, One-Quarter of World's Population Lacks Electricity, Scientific American (Nov. 24, 2009). This "energy poverty" is a serious problem that has dire environmental, health, and economic consequences, especially for families in the developing world. With few other alternatives, households without reliable access to electricity often depend on pollutant kerosene lamps to provide extra hours of light after the sun goes down. The noxious fumes from the burning kerosene are bad for the environment and for respiratory health: just one night of exposure to the kerosene smoke is equivalent to smoking two packs of cigarettes. Furthermore, kerosene is expensive: a family can spend up to 30% of their income on kerosene each year. See Eva Rehfuess, *Fuel for Life: Household Energy and Health*, World Health Organization (Geneva: 2006). Further, there are now widely available technologies that can significantly improve the conditions of those people living in remote parts of the world, but these devices also require electricity to operate. For example, a farmer in a remote area can use a relatively inexpensive cellular phone to monitor market prices for her crops and to help decide when and where to harvest and sell her crops. This information can substantially increase the price offered for the product to the farmer, but only if the farmer has access to electrical energy to operate the cellular phone. With respect to both lighting and technological access, the lack of readily available electricity is a significant problem.

SUMMARY OF THE INVENTION

[0003] In one embodiment, the present invention resides in a jump rope. The jump rope includes a first handle and a second handle. A rope connects the first handle and the second handle. The first handle defines a cavity. A generation module is disposed in the cavity and is fixed relative to the handle. The generation module includes a bearing, an electric generator, and a battery. A rotor of the electric generator is mechanically coupled to the bearing and an end of the rope is also coupled to the bearing. The electric generator is electrically coupled to the battery. Rotation of the rope relative to the handle causes at least a portion of the bearing to rotate relative to the handle. The rotation of the bearing rotates the generator which generates electric energy, at least a portion of which is stored in the battery.

[0004] In yet a further embodiment, a socket is disposed in the first handle. The socket accessible from an outside surface of the handle, and the socket is electrically coupled to battery. In yet another embodiment of the present invention, electrical energy stored in the battery can be accessed via the socket.

[0005] In yet another embodiment of the present invention, a printed circuit board is disposed in the first handle. The electric generator, the battery, and the socket are electrically connected via the printed circuit board.

[0006] The present invention resides in one aspect in a ball. The ball includes a shell that defines a cavity. A generation module is disposed in the cavity and fixed relative to the shell. The generation module has a pendulum and an electric generator. The pendulum is coupled to the electric generator so that the electric generator converts a swinging of the pendulum to electrical energy.

[0007] In some embodiments of the present invention, a battery is electrically coupled to the electric generator and the battery stores electrical energy generated by the electric generator. The ball may further include a socket electrically coupled the battery and accessible from an outside surface of the shell.

[0008] In some embodiments of the present invention, the generation module further includes a rigid housing and the pendulum, the electric generator, and the battery are disposed in the rigid housing. In some embodiments, the pendulum is configured in the rigid housing so that a rotation of the pendulum is restricted about a first axis of rotation. The pendulum extends between a proximal end and distal end. A rotor of the electric generator is coupled to pendulum proximate to the first axis of rotation. The pendulum comprises a bob at or proximate to its distal end.

[0009] In some embodiments of the present invention, the pendulum is supported at the first axis of rotation by a first support and a second support. The first support is laterally displaced from the second support along the first axis of rotation. In yet further embodiments of the present invention, a rod of the pendulum and the bob extend in a plane perpendicular to the first axis of rotation from a point along said first axis of rotation between the first support and the second support. In some embodiments of the present invention, the pendulum is at least 20 grams. In yet further embodiments the pendulum is approximately 30 grams.

[0010] In some embodiments of the present invention, the electric generator is a 6 volt direct current motor and the battery is a 3.7 volt 800 mAh lithium-ion battery.

[0011] In yet further embodiments of the present invention, the shell includes a panel. The panel has a sleeve that extends radially inward from an inner surface of the panel. The generation module is secured inside the sleeve and the panel is secured in the shell. In some embodiments of the present invention the shell comprises ethylene vinyl acetate.

[0012] The present invention resides in other aspects in a soccer ball. The soccer ball includes a shell defining a spheroid having a cavity disposed therein. The shell includes an opening and a panel configured to substantially close the opening. The panel has a sleeve that extends radially inward from an inner surface of the panel. The soccer ball further includes a generation module disposed in the cavity and fixed relative to the shell. The generation module includes a housing. A pendulum, an electric generator, and a battery are disposed in the housing. The pendulum is mechanically coupled to a rotor of the electric generator at or proximate to a first axis of rotation of the pendulum and the electric generator is electrically coupled to the battery. An acceleration of the soccer ball relative to a playing surface causes the pendulum to rotate about the first axis of rotation. The rotation of the

pendulum rotates the rotor of the electric generator. The rotation of the rotor of the electric generator generates electricity, and at least a portion of the generated electricity is stored by the battery.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** is an exploded front view of a ball in accordance with one embodiment of the present invention.

[0014] FIG. **2** is an exploded perspective view of a generation module shown in FIG. **1**.

[0015] FIG. **3** is a partially exploded perspective view of a portion of the generation module shown in FIG. **1**.

[0016] FIG. **4** is a top view of a portion of the generation module shown in FIG. **1**.

[0017] FIG. **5** is a side view of a pendulum shown in FIG. **2**.

[0018] FIG. **6** is a top view of a portion of the generation module shown in FIG. **1**.

[0019] FIG. **7** is a front view of the ball shown in FIG. **1**.

[0020] FIG. **8** is a wiring diagram of a printed circuit board in accordance with one embodiment of the present invention.

[0021] FIG. **9** is an exploded perspective view of a generation module in accordance with one embodiment of the present invention.

[0022] FIG. **10**A is an exploded view of a ball in accordance with one embodiment of the present invention.

[0023] FIG. **10**B is an exploded view of the ball shown in FIG. **10**A.

[0024] FIG. **10**C is a view of the ball shown in FIG. **10**A.

[0025] FIG. **11** is an exploded view of an American football.

[0026] FIG. **12** is an exploded view of a handle of a jump rope.

[0027] FIG. **13** is a view of a jump rope in accordance with one embodiment of the present invention, wherein the jump rope is connected to a smart phone for charging the smart phone.

DETAILED DESCRIPTION OF THE INVENTION

[0028] In reference to the FIGS. generally and with specific reference to FIG. **1**, a ball **10** in accordance with one embodiment of the present invention is shown. The ball **10** includes a generally spherical shell **20** that defines a cavity **22**. The ball **10** includes a generation module **50** that harnesses kinetic energy of the ball **10** to generate and store electrical energy. The shell **20** defines an opening **24** for accessing the cavity **22** and includes a panel **30** for substantially closing the opening **24** defined by the shell **20**. The panel **30** includes a cylindrical sleeve **32** that extends radially inward from an inner surface **34** of the panel **30**. During assembly the generation module **50** is secured in the sleeve **32** and the panel **30** is secured in the opening **24** defined by the shell **20** so that the sleeve **32** is disposed in the cavity **22**. A socket **110** is electrically coupled to the generation module **50** and is accessible through an opening (not shown in FIG. **1**) defined by the panel **30**. A cap **38** closes the opening defined by the panel **30** during recreational play with the ball **10** and the socket **110** is accessible from outside the ball when the cap **38** is removed from the opening defined by the panel **30**.

[0029] In the embodiment shown, the shell **20** is generally spherical and has a diameter approximate to that of a standard soccer ball. The present invention, however, is not limited in this regard as the shell **20** may define different shapes. For example, the shell **20** may define a spheroid approximating the dimensions of an American football. Additionally the shell **20** may approximate a baseball, a basketball, or any other type of ball. The shell **20** is made from cross linked ethylene-vinyl acetate (EVA). The EVA is injection molded to form the spherical shape of the shell **20**. In the embodiment shown, the shell **20** is approximately between 10 mm and 12 mm in thickness, although the present invention is not limited in this regard and the thickness of the shell **20** may vary from ball to ball or from location to location within a specific shell. Cross linked EVA and the specified selected thickness were selected to emulate the look and feel of a standard soccer ball without requiring a pressurized bladder disposed in the cavity **22** of the shell **20**.

[0030] In reference to FIG. **2**, an exploded view of the generation module **50** is shown. The generation module **50** includes a housing **60**, a pendulum **80**, an electric generator **90**, a battery **96**, and supporting hardware including one or more brackets and fasteners as discussed in detail below. The housing **60** includes a first section **62** and a second section **64**. The first section **62** and the second section **64** are generally symmetrical and are secured together by one or more fasteners **63** (shown in FIG. **4**) received through one or more holes **66** in the housing **60**. The housing **60** defines a cavity **68** when the first section **62** and the second section **64** are secured together. The inner surfaces of the first section **62** and the second section **64** of the housing **60** are configured to receive and stabilize the pendulum **80**, the electric generator **90**, and the battery **96**. In the embodiment shown, the housing **60** is manufactured by injection molding acrylonitrile butadiene styrene. It should be understood, however, that the present invention is not limited in this regard and, as can be appreciated by a person having ordinary skill in the art, different manufacturing techniques and materials may be employed. Acrylonitrile butadiene styrene was selected for the housing **60** because it secures and protects the internal components of the generation module **50** under high impact conditions experienced during use of the ball **10**.

[0031] In the embodiment shown, the electric generator **90** comprises a 6 volt direct current motor with an 11:1 gear ratio. This gear ratio and motor were selected to optimize generation of electrical energy with a soccer ball. It should be understood that the type and gearing of the electric generator is not limited to this embodiment and a person of ordinary skill in the art familiar with this disclosure would recognize that different gearing and motor combinations may be used with the present invention. The electric generator **90** includes a rotor **92** extending from a surface **91** of the electric generator **90**. Rotation of the rotor **92** operates the electric generator **90** causing it to generate electrical energy. Although a specific electric generator **90** is disclosed herein, the present invention is not limited in this regard and many different types of motors may be employed to convert rotational motion of the pendulum **80** to electrical energy. The electric generator **90** is mounted on pedestal **70** extending from an inner surface **65** of the second section **64** of the housing **60**. A U-shaped bracket **72** is mounted over the electric generator **90** and to the pedestal **70** using a plurality of fasteners **74** (shown in FIG. **4**) to secure the electric generator **90** to the pedestal **70**.

[0032] The battery **96** is disposed in the cavity **68** of the housing **60** and the battery **96** is in electrically coupled to the electric generator **90**. In the disclosed embodiment, the electric generator **90** and the battery **96** are connected via a printed circuit board **100**. The printed circuit board **100** is secured to a pedestal (not shown in the FIGS) extending from an inner

surface **61** of the first section **62** of the housing **60**. A circuit diagram **200** for the printed circuit board **100** in accordance with one embodiment of the present invention is shown in FIG. **8**. Although a specific circuit diagram **200** for the printed circuit board **100** is shown in FIG. **8**, the present invention is not limited in this regard and many different configurations may be employed. Some embodiments do not include a printed circuit board **100**. In the embodiment shown, the battery **96** comprises a 3.7 volt 800 mAh lithium-ion battery, although many different configurations of batteries may be employed with the present invention. The battery **96** receives and stores at least a portion of the electrical energy generated by the electric generator **90**.

[0033] In specific reference to FIG. **5**, the pendulum **80** includes a rod **88** that extends along a linear axis between a proximal end **81** and a distal end **82**. The pendulum **80** rotates about a first axis of rotation A (shown in FIGS. **4** and **6**) at or proximate to its proximal end **81**. The axis of rotation A of the pendulum **80** is perpendicular to the rod **88**. The pendulum **80** includes a recess (not shown in the figures) proximate to the proximal end **81** for receiving the rotor **92** of the electric generator **90**. The recess is configured so that when the rotor **92** is received therein an axis of rotation of the rotor is coaxial with the first axis of rotation A. The rotor **92** may be secured in the recess of the pendulum **80** by any known method, including by a press-fit, an adhesive, or by a mechanical fastener. A portion of the pendulum **80** proximate to the proximal end **81** and laterally displaced from the recess along the first axis of rotation A of the pendulum **80** terminates in truncated cone **89** (shown in FIGS. **2** and **5**).

[0034] In specific reference to FIGS. **4** and **6**, the pendulum **80** is supported in the housing **60** by a first support and a second support. The first support is the rotor **92** being received in the recess of the pendulum **80** which is coaxial with the first axis of rotation A. The second support is a bearing **76** received in the housing **60**. The truncated cone **89** is received in the bearing **76**. This configuration of supporting the pendulum **80** limits the pendulum to the single axis of rotation A regardless of which direction the ball **10** is rotating during play. The housing **60** is configured so that the pendulum **80** can rotate completely about the first axis of rotation A. The pendulum **70** includes a bob **86** at or proximate to its distal end **82**. In the embodiment shown, the pendulum **80** is die cast from zinc and is approximately 30 grams. The present invention is not limited in this regard as different materials and masses may be readily employed.

[0035] In reference to FIG. **4**, the generation module **60** includes a socket **110** electrically coupled to the battery **96**. The socket **110** extends from a portion of the housing **60** of the generation module **50**. The socket **110** is accessible through the opening defined by the panel **30**. A cap **38** closes the opening **36** defined by the panel **30** during play and the socket **110** is accessible from outside the ball **10** when the cap **38** is removed from the opening defined by the panel **30**.

[0036] The generation module **50** is disposed in the cylindrical sleeve **32** that extends radially inward from the inner surface **34** of the panel **30**. In the disclosed embodiment, the inside of the sleeve **32** has a similar profile as a cross section of the generation module **50** to facilitate disposal of the generation module in the sleeve. The generation module **50** is secured in the sleeve **32** using an adhesive, press-fit, and/or some other known method. In the embodiment shown, the adhesive comprises CA-SI-30 Cyanoacrylate. After the generation module **50** is secured in the sleeve **32** the sleeve is inserted through the opening **24** in the shell **20**. As shown in FIG. **7**, the panel **20** substantially closes the opening **24** in the shell **20**. In the embodiment shown, the panel **30** is shaped as a pentagon to appear as a panel of the ball. In some embodiments of the present invention, the opening **24** and the panel **30** define a tongue and groove arrangement to provide a uniform closing of the opening **24** and to provide a smooth outer surface of the shell **10**, especially at the point of transition between the outer surface of the panel **30** and the outer surface of the shell proximate to the panel **30**. In some embodiments, the panel **30** is secured to an area of the shell proximate to the opening **24** using an adhesive of some other method known in the art. In the embodiment shown, the adhesive comprises CA-SI-30 Cyanoacrylate. This adhesive was selected because it provides good adhesion over time in a ball subject to stresses encountered during recreational use. In further reference to FIG. **7**, a coating of paint may be applied to the outside surface of the shell **20** of the ball **10**.

[0037] After assembly, a distal end of the sleeve **33** extends through the cavity **22** and contacts an opposite wall of the shell **20**. In this manner, the sleeve **32** increases the rigidity of the ball **10**. This is an important aspect in emulating the feel of a standard soccer ball with the ball **10** of the present invention, which unlike standard soccer balls does not include a bladder of pressurized air. It should be understood that the present invention is not limited in this regard, and that the sleeve may not extend to the opposing side of the shell **10**. In yet further embodiments, the sleeve is not included in the design. In some embodiments, foam may be inserted into the cavity **22** of the shell **20** to further enhance structure of the ball **10**.

[0038] During recreational use of the ball **10**, the ball is accelerated relative to a playing surface for a period of time. These accelerations induce rotation of the pendulum **80** about the first axis of rotation A. This rotation is transferred to the rotor **92** by virtue of the connection between the pendulum **80** and the rotor **92**. The rotor **92** rotates the electric generator **50** thereby generating electricity. At least a portion of this electricity is transmitted to and stored in the batty **96**.

[0039] The electrical energy stored in the battery **96** can be accessed through the socket **110**. The cap **38** is first removed and an electric cord compatible with the socket **110** is inserted therein. The electrical energy may be used to power a device that requires electricity for operation. For example, the electrical energy may be used to power a light, a telephone, a radio, etc. In some embodiments of the present invention, the electrical energy stored in the battery **96** can be used by a device included in the ball, for example, one or more lights or a global positioning system. In some of these embodiments, the ball **10** does not include a socket **110**.

[0040] In reference to FIG. **9**, an exploded view of a generation module **250** in accordance with one embodiment of the present invention in shown. The generation module **250** includes a housing **260**, a pendulum **280**, an electric generator **290**, a battery **296**, and supporting hardware including one or more brackets and fasteners as discussed in detail below. The housing **260** includes a first section **262** and a second section **264**. The electric generator **290** is mounted on pedestal **270** extending from an inner surface **265** of the second section **264** of the housing **260**. A U-shaped bracket **272** is mounted over the electric generator **290** and to the pedestal **270** using a plurality of fasteners (not shown in the FIG. **9**) to secure the electric generator **290** to the pedestal **270**. The electric generator **290** includes a rotor **292** extending from a surface **291** of the electric generator **290**.

[0041] The pendulum **280** rotates about a first axis of rotation A at or proximate to a proximal end **281** of the pendulum **280**. The first axis of rotation A of the pendulum **280** is perpendicular to a rod **288** of the pendulum **280**. The pendulum **280** includes a recess (not shown in the figures) proximate to the proximal end **281** for receiving the rotor **292** of the electric generator **290**. The recess is configured so that when the rotor **292** is received therein an axis of rotation of the rotor is coaxial with the first axis of rotation A. The rotor **292** may be secured in the recess of the pendulum **280** by any known method, including by a press-fit, an adhesive, or by a mechanical fastener. The rotor **292** is inserted through an opening **275** in a faceplate **274** of the U-bracket **272** and through a washer **276** before being inserted into the recess of the pendulum **280**. The faceplate **274** and the washer **276** serve to maintain the pendulum **280** rotating about a single axis of rotation, the first axis of rotation A, regardless of the axis(es) of rotation of the ball. The faceplate **274** further inhibits radial forces from being transferred from the pendulum **280** to the electric generator **290** along the rotor **292**.

[0042] In reference to FIGS. **10**A-**10**C, a ball **310** in accordance with on embodiment of the present invention is shown. The ball **310** includes a generally spherical shell **320** that defines a cavity. The ball **310** includes a generation module **360** that harnesses kinetic energy of the ball **310** to generate and store electrical energy. The shell **320** defines a first opening **324** for accessing the cavity and includes a first panel **330** for substantially closing the first opening **324**. The first panel **330** includes a cylindrical sleeve **332** that extends radially inward from an inner surface **334** of the first panel **330**. The shell **320** defines a second opening **344** for accessing the cavity and includes a second panel **350** for substantially closing the second opening **344**. In the embodiment shown, the second opening **344** is substantially opposite the first opening **324** in the shell **320**. The second panel **350** includes a cylindrical sleeve **352** that extends radially inward from an inner surface **354** of the second panel **350**.

[0043] During assembly the generation module **360** is secured in one or more of the first sleeve **332** and the second sleeve **353**. The first panel **330** and the second panel **350** are secured in the respective first opening **324** and second opening **344** so that the first sleeve **332** and the second sleeve **352** are disposed in the cavity. In some embodiments, the first sleeve **332** is adapted to receive a distal portion **353** of the second sleeve **352** when the first sleeve **332** and the second sleeve **352** are fully inserted into the shell **320** thereby increasing the rigidity of the assembled ball **310**. In yet other embodiments, a portion of the generation module **360** is received in the first sleeve **332** and a portion of the generation module is received in the second sleeve **352** when the first sleeve and the second sleeve are fully inserted into the shell **320** thereby increasing the rigidity of the assembled ball **310**. One of the first and the second panel **330**, **350** includes an opening for an outlet, however, the present invention is not limited in this regarding as there may be more than one outlet or no outlets.

[0044] In reference to FIG. **11**, an exploded view of an American football **410** in accordance with on embodiment of the present invention is shown. The football **410** includes a shell **420** that defines a cavity. An exterior surface of the shell **420** defines a prolate spheroid. The prolate spheroid is, for example, shaped as an American football or as a rugby football. The shell **420** includes a first portion **422** and a second portion **424**. The first portion **422** defines a first edge **423** and the second portion **424** defines a second edge **425**.

[0045] In the embodiment shown in FIG. **11**, the first edge **423** and the second edge **425** are symmetric such that when the first edge **423** is held adjacent to the second edge **425**, the outer surfaces of the first portion **422** and the second portion **424** define a continuous surface. The first potion **422** and the second portion **424** further define a cavity **427** when the first edge **423** is adjacent to the second edge **425**. In the embodiment shown, the shell **420** is made from polyurethane, however, it should be understood that the present invention is not limited in this regard as many different types of materials made be used to form the shell **420** and the portions thereof **422**, **424**.

[0046] The football **410** includes a generation module **460** that harnesses kinetic energy of the ball **410** to generate and store electrical energy. The energy module **460** is disposed in the cavity defined by the first portion **422** of the shell **420** and by the second portion **424** of the shell. After the generation module **460** is disposed in the cavity, the first shell **422** and the second shell **424** are secured together, for example, by adhesive, hook and loop fasteners, an outer sleeve, stitching or by any other known means to secure such a configuration. The generation module **460** may be similar to that described above in reference to the soccer ball embodiment. One of the first and the second portions **422**, **424** may include an opening for an outlet for accessing electrical energy stored in a battery stored in the generation module **460**, however, the present invention is not limited in this regarding as there may be more than one outlet or no outlets. In some embodiments of the present invention a pendulum inside the generation module **460** is configured such that an axis of a pivot of the pendulum disposed in the generation module is parallel to an axis extending between two poles of the prolate spheroid.

[0047] In reference to FIGS. **12**-**13**, a jump rope handle **500** in accordance with one embodiment of the present invention is shown. The jump rope handle **500** includes a generation module disposed therein. As is commonly known, a jump rope typically has two handles and a length of rope extending there between. It should be understood that the term "rope" is used in this description in the broadest sense as it pertains to jump ropes and it is not intended to limit the present invention to any specific configuration or material. As used herein, the term rope can refer to any type of flexible line, such as cord, rope, twine, elastic, etc., that is capable of connecting two handles together and that enable use of the jump rope in accordance with known methods. During one known method of use, a handle is held in each hand of a user of the jump rope. The user continuously swings the rope over his head and under his legs. During this rotation, the rope rotates about an end of each handle. The inventors have discovered that it is possible to harness and store energy from the rotation of the rope about the axis of the handle.

[0048] In reference to FIG. **12**, the handle **500** extends along an axis between a first end **502** and a second end **504**. In the embodiment shown, the handle **500** comprises a first shell half **506** and a second shell half **508**. Each shell **506**, **508** extends along the axis from the first end **502** to the second end **504**. The shells **506**, **508** are configured to join together along an edge of each shell. To form the handle, the shells **506**, **508** are joined together and are fixed relative to each other, for example, by a snap fit, by a fastener, or by some other means

known in the art. In reference to FIG. **12**, the second shell half **508** includes holes for receiving screws (not shown in FIG. **12**).

[0049] The shells **506**, **508** define an interior cavity **520** that extends from the first end **502** to the second end **504** of the handle. In some embodiments of the present invention, the shells **506**, **508** are molded from a plastic, however, any known method of manufacture may be used to form the shells. In reference to FIG. **12**, the outer surface of the handle **510** defines a geometry that is ergonomically shaped for holding the handle during use of the jump rope. It should be understood, however, that the present invention is not limited in this regard.

[0050] A generation module is disposed, at least partially, in the cavity **520**. The generation module includes an electric generator **530**, a battery **540**, and an outlet **550**. The generator **530**, battery **540**, and socket **550** are electrically coupled together via a printed circuit board **560**. In the embodiment shown, the generator **530**, the battery **540**, and the socket **550** are electrically coupled to the printed circuit board **560** via wires (not shown in FIGS). In some embodiments of the present invention all or a portion of the generator **530**, battery **540**, an outlet **550** may directly connected to the circuit board, and, in other embodiments, wires or other forms of electric leads are used.

[0051] A rope **600** (shown in FIG. **13**) is attached to the handle **500** via a bearing **570** proximate to the second end **504** of the handle **500**. The bearing **570** is mechanically coupled to a rotor **532** extending from generator **530**. The shells **506**, **508** are configured to retain the bearing **570** in the second end of the handle **500**. The rope **600** is fixed to the bearing **570** via a slot **572** in the bearing. In some embodiments, a protective shell **574** (shown in FIG. **13**) is enclosed the bearing after the rope **600** is connected. The bearing **570** is retained inside the second end of the handle **500**, such that a portion of the bearing can rotate about the axis of the handle **500** relative to the handle, while a second portion of the bearing **500** remains fixed about the axis and relative to the handle **500**.

[0052] During use of the jump rope, the rope **600** causes a rotation a portion of the bearing **570** relative to handle **500**. The rotating portion of the bearing is connected to the rotor **532**, thereby rotating the rotor **532** and causing the generator to generate electrical energy. The battery **540** receives and stores at least a portion of the electrical energy generated by the electric generator **530**. In the embodiment shown, the electric generator **530** comprises a direct current motor. A gear ratio and motor are selected to optimize generation of electrical energy and the range of rotation expected during use of the jump rope. In some embodiments of the present invention, the bearing **570** further comprises a geared transmission, such that a single rotation of the bearing caused by the rope results in more than one rotation being mechanically transferred to the rotor **532** of the generator **530**.

[0053] In the embodiment shown, the electric generator **530** may be similar to that described above in relation to the soccer ball embodiment. For example, the gear ratio and generator may be selected to optimize generation of electrical energy with a jump rope. It should be understood that the type and gearing of the electric generator is not limited to this embodiment and a person of ordinary skill in the art being familiar with this disclosure would recognize that different gearing and motor combinations may be used with the present invention.

[0054] The battery **540** is disposed in the cavity **520** of the handle **500** and the battery **540** is in electrically coupled to the electric generator **530**. In the disclosed embodiment, the electric generator **530** and the battery **540** are connected via a printed circuit board **560**. The generator **530**, battery **540**, outlet **550**, and printed circuit board **560** are fixed in the cavity **520** relative to the handle **510**. A socket **550** is electrically coupled to the battery **540**, either directly or via the circuit board **570**. The socket **550** is accessible through an opening in the first end **502** of the handle **500**.

[0055] In reference to FIG. **13**, a jump rope **610** in accordance with the present invention is shown. The jump rope **610** includes two handles **500**, each having a generator module disposed therein, and a rope **600** extending therebetween. During recreational use of the jump rope **610**, the rope **600** rotates about the axis of the handle **500**. This rotational energy is transferred to the rotor **532** of the electric generator **530**. The rotor **532** rotates the electric generator **530** thereby generating electricity. At least a portion of this electricity is transmitted to and stored in the battery **540**. The electrical energy stored in the battery **540** can be accessed through the socket **550** disposed in the cavity of the handle **500** proximate to the first end **502** thereof. The circuit board **570** regulates the storage of electricity in the battery **540**. The electrical energy may be used to power or charge a device that requires electricity for operation. For example, the electrical energy may be used to power a light, a telephone, a radio, etc. In other embodiments, the electrical energy may be used to charge a device, such as a smart phone of a flash light. In some embodiments of the present invention, the electrical energy stored in the battery can be used by a device included in the jump rope.

[0056] In reference to FIG. **13**, and adapter is shown **620**. Each handle includes a generator module and outlet at its first end. The adapter **620** includes two jacks **622** configured to be received in the each outlet **550** of the handles **500** as shown in FIG. **13**. The adapter **620** further includes a USB outlet **624** that is electrically coupled to the two jacks **622**. In the embodiment shown, a smart phone **700** is connected to the USB port via a charging cable **690** charging to the jump rope via the outlets **560** in each handle **500**. Using the configuration shown in the embodiment disclosed in FIGS. **12-13**, it has been found that fifteen minutes of jumping rope can generate and store enough power to provide a 50% charge of a smart phone battery. It should be understood, that although a specific configuration and connector is shown, the present invention is not limited in this regard, and that a person of ordinary skill in the art and familiar with this invention, will understand that other configurations may be employed.

[0057] Although the present invention has been disclosed and described with reference to certain embodiments thereof, it should be noted that other variations and modifications may be made, and it is intended that the following claims cover the variations and modifications within the true scope of the invention.

What is claimed is:

1. A jump rope, comprising:

a first handle;

a second handle;

a rope connected between the first handle and the second handle;

the first handle defining a cavity;

a generation module disposed in the cavity and fixed relative to the handle, the generation module having a bearing, an electric generator, and a battery, a rotor of the

electric generator being mechanically coupled to the bearing and an end of the rope being also coupled to the bearing, the electric generator being electrically coupled to the battery;

wherein a rotation of the rope relative to the handle causes at least a portion of the bearing to rotate relative to the handle;

wherein the rotation of the bearing rotates the rotor of the generator which generates electric energy, at least a portion of which is stored in the battery.

2. The jump rope of claim **1**, further comprising:

a socket disposed in the first handle, the socket accessible from an outside surface of the handle, the socket being electrically coupled to battery.

3. The jump rope of claim **2**, wherein electrical energy stored in the battery can be accessed via the socket.

4. The jump rope of claim **3**, further comprising:

a printed circuit board disposed in the first handle, the electric generator, the battery, and the socket being electrically connected via the printed circuit board.

5. The jump rope of claim **4**, wherein the printed circuit board includes a charge controller circuit that regulates input of generated electric energy into the battery.

6. The jump rope of claim **5**, wherein the printed circuit board regulates access of electric energy via the socket.

7. The jump rope of claim **6**, further comprising:

a generation module disposed in the second handle.

8. The jump rope of claim **6**, further comprising:

a convertor having at least one jack and at least on USB input;

wherein the convertor enables transfer of electric energy stored in the battery to a smart phone.

9. The jump rope of claim **6**, wherein the electric generator comprising a direct current motor.

10. The jump rope of claim **9**, wherein the battery comprises a lithium-ion battery.

11. A ball, comprising:

a shell defining a cavity, an outside surface of the shell defining a prolate spheroid;

a generation module disposed in the cavity and fixed relative to the shell, the generation module having a pendulum and an electric generator, the pendulum being coupled to the electric generator so that electric generator converts a rotation of the pendulum to electrical energy.

12. The ball of claim **11**, further comprising:

a battery electrically coupled the electric generator;

wherein the battery stores electrical energy generated by the electric generator.

13. The ball of claim **12**, further comprising:

a socket accessible from an outside surface of the shell, the socket being electrically coupled to battery.

14. The ball of claim **13**, wherein the generation module further comprises a rigid housing, and the pendulum and the electric generator are disposed in the rigid housing.

15. The ball of claim **14**, wherein the pendulum is configured in the rigid housing so that rotation of the pendulum is restricted to a first axis of rotation.

16. The ball of claim **15**, wherein the pendulum extends between a proximal end and distal end;

wherein a rotor of the electric generator is coupled to the pendulum at or proximate to the first axis of rotation; and

wherein the pendulum comprises a bob at or proximate to its distal end.

17. The ball of claim **16**, wherein the pendulum is supported by a first support and a second support; and

wherein the first support is laterally displaced from the second support along the first axis of rotation.

18. The ball of claim **17**, wherein a rod of the pendulum and the bob of the pendulum extend in a plane extending perpendicular to the first axis of rotation from a point along said first axis of rotation between the first support and the second support.

19. The ball of claim **18**, wherein the pendulum is at least 20 grams.

20. The ball of claim **19**, wherein the pendulum is approximately 30 grams.

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