US009403075B1

(12) **United States Patent**
Morgan

(10) **Patent No.: US 9,403,075 B1**
(45) **Date of Patent: Aug. 2, 2016**

(54) **METHODS AND APPARATUS FOR TRAINING SYSTEM FOR BALL STRIKING**

(71) Applicant: **Brent Morgan**, Glendale, AZ (US)

(72) Inventor: **Brent Morgan**, Glendale, AZ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/016,477**

(22) Filed: **Feb. 5, 2016**

(51) **Int. Cl.**
A63B 69/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A63B 69/002*** (2013.01); *A63B 2208/0204* (2013.01)

(58) **Field of Classification Search**
CPC A63B 69/002; A63B 2208/0204
USPC 473/419, 422–429, 446, 575
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,862,044 A 6/1932 White
4,576,379 A 3/1986 Juhasz
4,706,964 A 11/1987 Genovese
5,792,014 A * 8/1998 Brown A63B 69/0079 473/430
5,957,789 A * 9/1999 Ainscough A63B 69/0079 473/423
6,099,419 A 8/2000 Incaudo et al.
6,168,539 B1 * 1/2001 Maina A63B 43/007 473/424
7,364,517 B1 4/2008 Johnsen
7,850,535 B2 12/2010 Noble et al.
8,083,618 B2 12/2011 Coscarelli et al.
8,932,155 B2 * 1/2015 Moore A63B 63/083 473/422
9,011,277 B2 4/2015 Schell

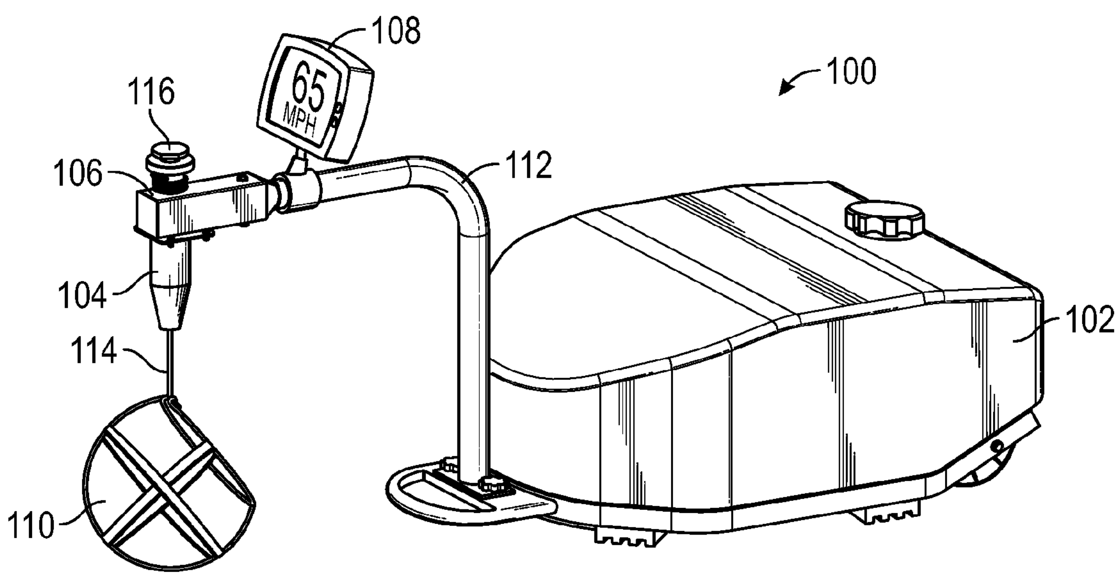
* cited by examiner

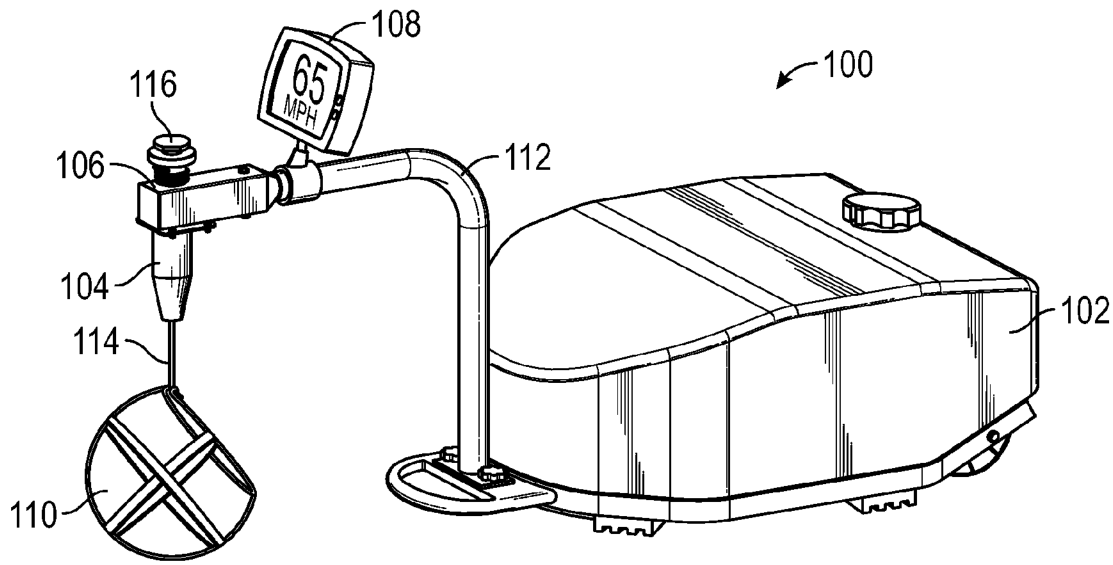
Primary Examiner — Nini Legesse
(74) *Attorney, Agent, or Firm* — The Noblitt Group, PLLC

(57) **ABSTRACT**

A training system according to various aspects of the present technology may comprise a ball retention device coupled to a base and a dampening system coupled to the ball retention device and configured to return a kicked ball to its original resting location with minimal oscillation. The base may be configured to comprise a portable unit that may be selectively weighted to increase stability during use. A force measurement system may be coupled to the dampening system and be configured to measure the kicking force applied to the ball to calculate a speed value for the kicked ball and display the speed value to the user.

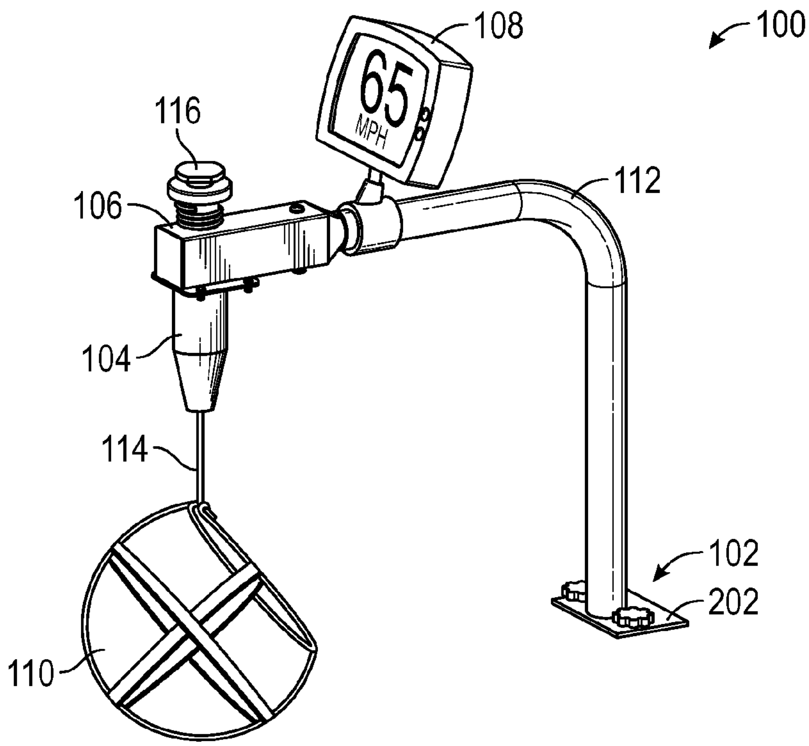
28 Claims, 4 Drawing Sheets





108
100
116
65
MPH
106
112
102
104
114
110

FIG. 1



108
100
116
65
MPH
106
112
104
114
102
202
110

FIG. 2

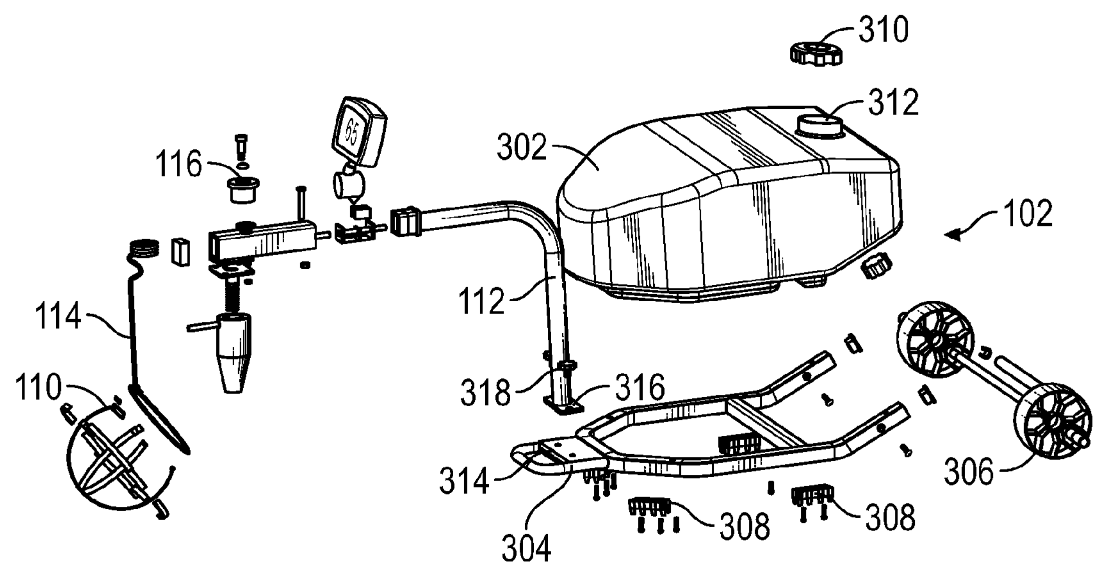

310
312
302
116
102
114
112
110
318
316
314
306
304
308
308

FIG. 3

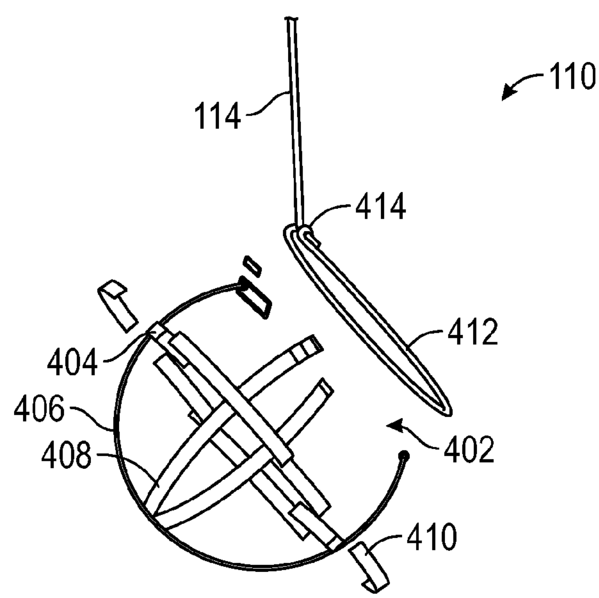

110
114
414
412
404
406
408
402
410

FIG. 4

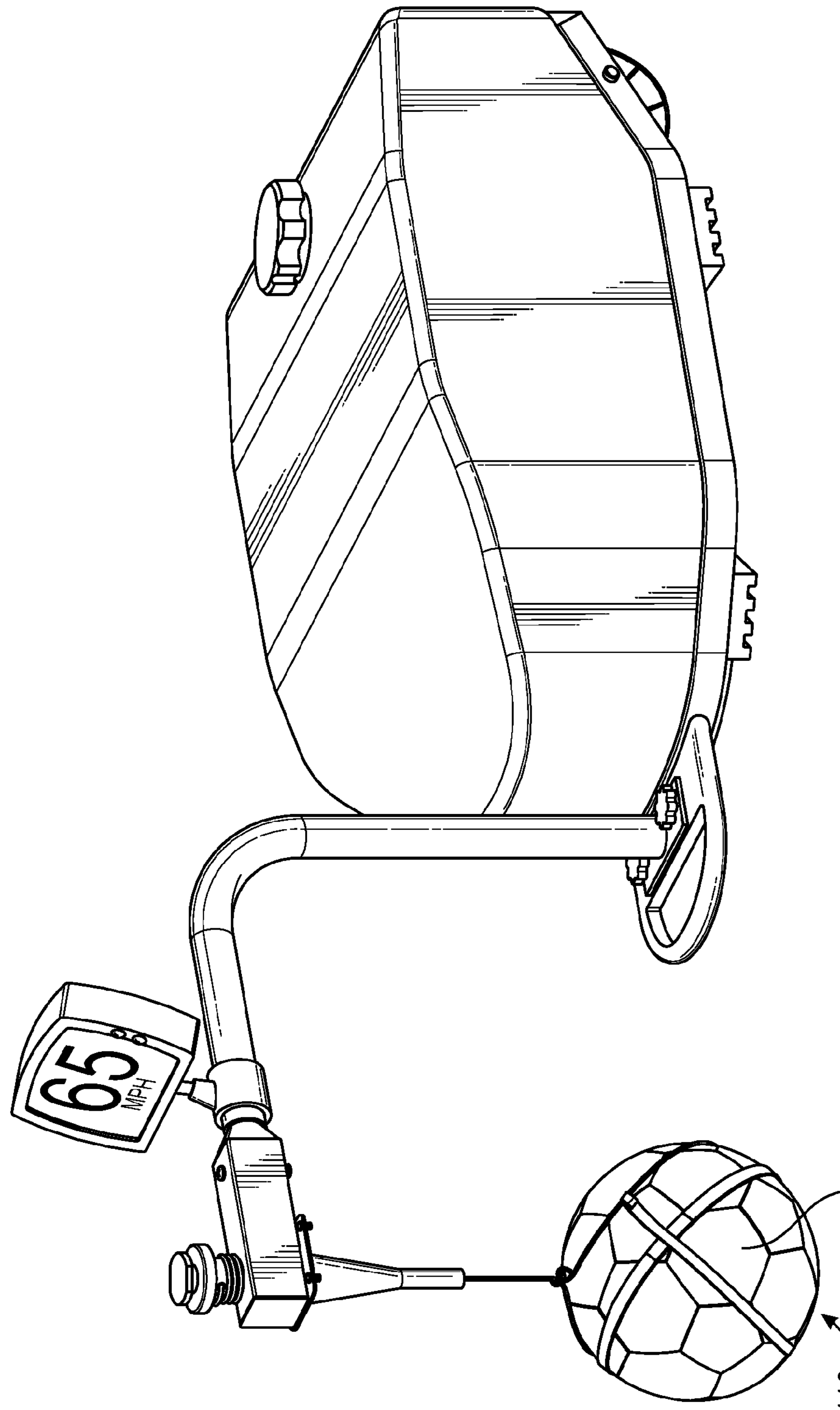


FIG. 5

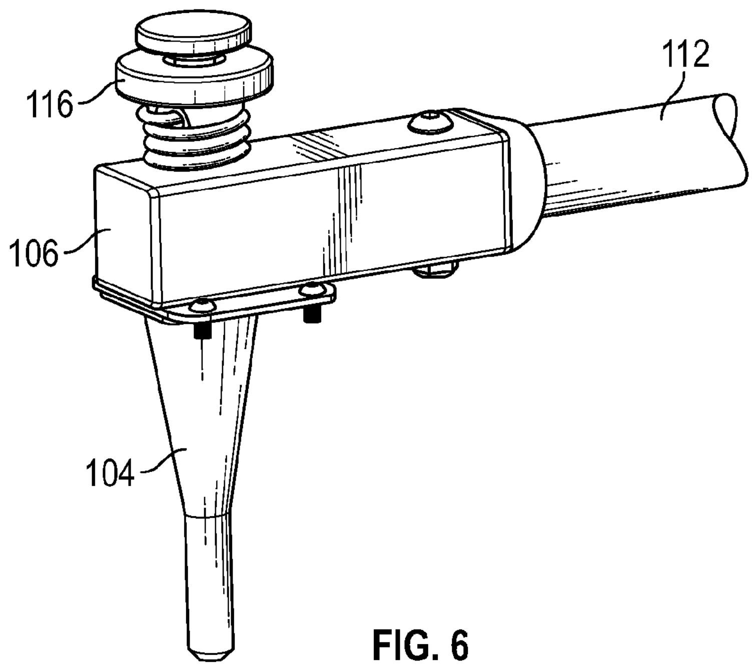

112
116
106
104

FIG. 6

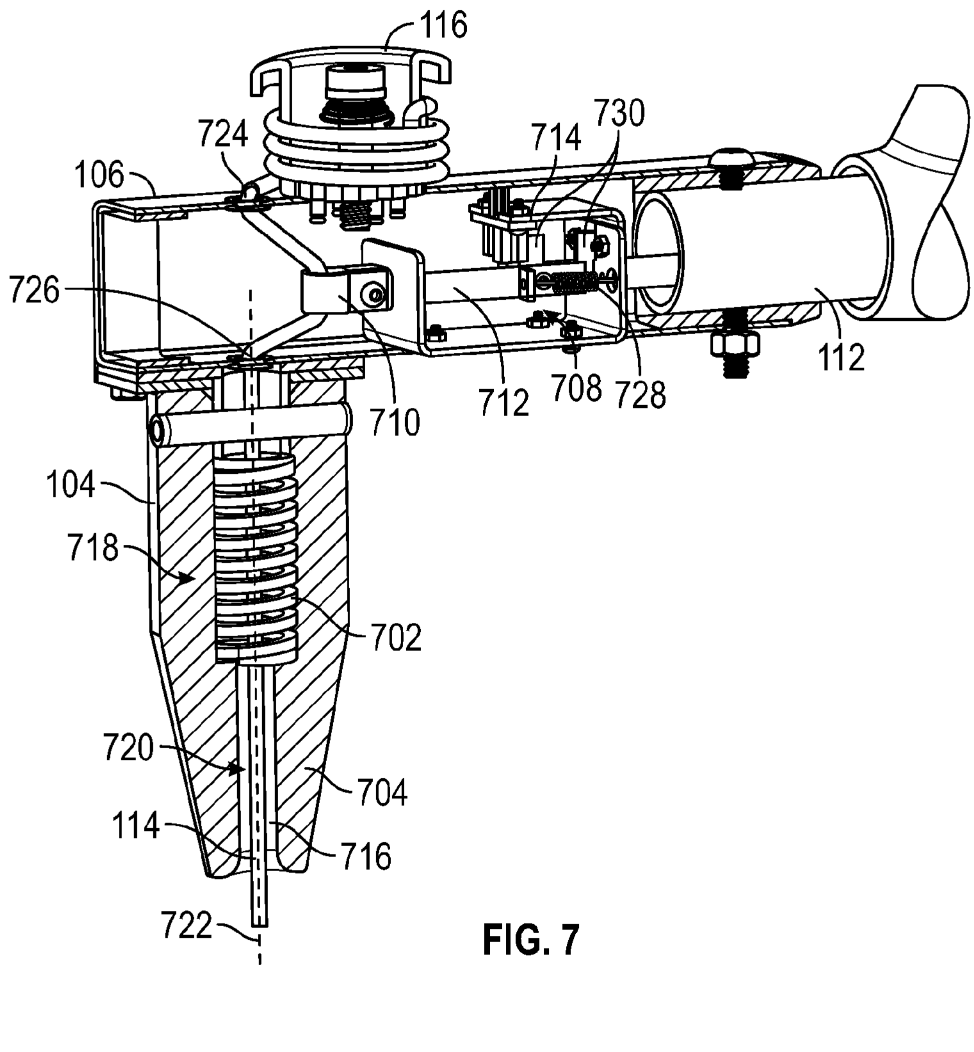

116
724
714
730
106
726
710
712
708
728
112
104
718
702
720
704
114
716
722

FIG. 7

METHODS AND APPARATUS FOR TRAINING SYSTEM FOR BALL STRIKING

BACKGROUND OF THE TECHNOLOGY

Athletic training often requires an athlete to perform repetitive tasks directed towards mastering a movement, increasing skill, and improving performance. In sports that use a ball at least some of the repetitive tasks include striking the ball with a part of the body such as a foot or a piece of equipment such as a bat or a hockey stick. Traditionally this type of practice requires the use of multiple balls in succession otherwise the training becomes inefficient as each time a ball is struck it must be recovered before it can be struck again.

To solve this problem many different solutions have been utilized such as nets to capture balls that have been kicked, hit, or otherwise struck to prevent them from traveling too far from the user. Though an improvement it is still necessary for the user to collect and reset the ball in place before the ball can be struck again. Another solution has been the use of practice balls that are designed to limit their flight through the air after being struck. A drawback of these types of practice balls is that they commonly do not completely simulate the effects of striking a normal ball and as a result provide limited feedback. Yet another solution has been to attach a tether to a normal ball so that ball flight can be limited to the distance of the tether. Although more effective than using a practice ball, a drawback of using a tether with a ball such as a soccer ball is that the ball must still be recovered and placed back into a position so that it may be kicked again. This increases the time between each kick, which decreases the efficiency of the device. Other systems utilize a tether and attempt to automatically reset the ball back into its original position before being kicked or struck. These systems provide somewhat more efficiency but still suffer from drawbacks. For example, in this type of system the ball is returned to its originating location as a result of gravity. The user may still have to wait before striking the ball again due to excessive oscillation of the ball.

SUMMARY OF THE TECHNOLOGY

A training system according to various aspects of the present technology may comprise a ball retention device coupled to a base and a dampening system coupled to the ball retention device and configured to return a kicked ball to its original resting location with minimal oscillation. The base may be configured to comprise a portable unit that may be selectively weighted to increase stability during use. A force measurement system may be coupled to the dampening system and be configured to measure the kicking force applied to the ball to calculate a speed value for the kicked ball and display the speed value to the user.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present technology may be derived by referring to the detailed description and claims when considered in connection with the following illustrative figures. In the following figures, like reference numbers refer to similar elements and steps throughout the figures.

FIG. **1** representatively illustrates a perspective view of a training device in accordance with an exemplary embodiment of the present technology;

FIG. **2** representatively illustrates a perspective view of an alternative embodiment of the training device in accordance with the present technology;

FIG. **3** representatively illustrates an exploded view of the training device in accordance with an exemplary embodiment of the present technology;

FIG. **4** representatively illustrates a detailed view of a ball retention device in accordance with an exemplary embodiment of the present technology;

FIG. **5** representatively illustrates a ball positioned within the ball retention device of the training device in accordance with an exemplary embodiment of the present technology;

FIG. **6** representatively illustrates a detailed view of a speed sensor and an energy absorber in accordance with an exemplary embodiment of the present technology; and

FIG. **7** representatively illustrates a cross-sectional view of the speed sensor and the energy absorber of FIG. **6** in accordance with an exemplary embodiment of the present technology.

Elements and steps in the figures are illustrated for simplicity and clarity and have not necessarily been rendered according to any particular sequence. For example, steps that may be performed concurrently or in a different order are illustrated in the figures to help to improve understanding of embodiments of the present technology.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The present technology may be described in terms of functional block components and various processing steps. Such functional blocks may be realized by any number of hardware or software components configured to perform the specified functions and achieve the various results. For example, the present technology may employ various sensors, detectors, materials, connectors, and the like, which may carry out a variety of functions. In addition, the present technology may be practiced in conjunction with any number of ball types, and the system described is merely one exemplary application for the technology. Further, the present technology may employ any number of conventional techniques for dissipating energy, sensing movement, collecting data, processing data, and the like.

Methods and apparatus for a training system for ball striking according to various aspects of the present technology may operate in conjunction with any suitable mobile and/or stationary device for positioning a ball in a desired location. Various representative implementations of the present technology may be applied to any system for athletic training or positioning and repositioning a ball such that it can be repetitively struck. Certain representative implementations may include, for example, portable and/or non-portable bases, hands free operation, adjustability, interoperability with multiple types of balls or like sporting devices, and visual feedback of performance.

Referring now to FIGS. **1-3**, a training system **100** according to various aspects of the present technology may comprise a base **102** for positioning the training system **100**, an energy absorber **104** for dissipating energy imparted to a ball by a user, a force measurement system **106**, a display system **108**, and a ball retention device **110**.

The base **102** positions the training system **100** during use to allow a ball or other athletic equipment (not shown) to be kicked or struck by the user. The base **102** may comprise any suitable system or device for at least temporarily positioning the training system **100** during use. In one embodiment, the base **102** may be configured to allow the training system **100** to be portable and remain at least substantially in place during use. For example, referring now to FIG. **3**, the base **102** may comprise a housing **302** having an internal volume that may be selectively filled with a substance such as water or sand to provide additional weight to the base **102**. The internal volume may be accessed by an opening **312** disposed along a surface of the housing **302** and a cover **310** may be used to seal or close off the opening **312**.

The base **102** may further comprise a frame **304**, a set of wheels **306**, and a set of feet **308**. The frame **304** may be configured to couple to the housing **302**, the wheels **306**, and the feet **308**. The frame **304** may comprise any suitable system or device to support the housing **302** and provide a connection point for the wheels **306** and the feet **308**. The frame **304** may be formed integrally with the housing **302** or the frame **304** may be formed as an independent structure configured to be coupled to a lower portion of the housing **302**.

The frame **304** may comprise any suitable material such as plastic, metal, or composite material. For example, in one embodiment, the frame **304** may comprise one or more metal elements such as bar stock, square or round tubing, U-channeling, or the like formed or joined together to form a support structure such as an A-frame. The frame **304** may be further configured to conform to the shape and size of the housing **302**.

The set of wheels **306** help facilitate movement of the training system **100** and may comprise any suitable system for allowing the housing **302** to be moved. In one embodiment, the set of wheels **306** may comprise one or more traditionally shaped wheel elements positioned along the housing **302**. The set of wheels **306** may also comprise a locking element (not shown) configured to prevent the wheels from undesired rotation. For example, two wheels may be positioned along a rear portion of the housing so that a forward end of the housing **302** may be lifted such that the wheels are free to rotate. In an alternative embodiment, the set of wheels **306** may comprise four wheel elements positioned at the rear and front sections of the frame **304** so that the housing **302** may be moved without the need to lift the training system **100** itself. In yet another embodiment, the set of wheels **306** may comprise a single ball shaped element, a set of skids, or any other device that would allow the housing **302** to be rolled or slid along the ground.

The set of feet **308** help keep the training system **100** securely positioned during use. The set of feet **308** may comprise any suitable device for impeding movement of the housing **302**. In a first embodiment, the set of feet **308** may comprise a plurality of cleated members disposed along a bottom surface of the frame **304**. The cleated members may be configured to fit against the ground when the housing **302** is positioned for use. For example, each cleated member may comprise a rubberized surface have one or more protrusions configured to extend downwardly towards the ground. The size and shape of the protrusions may be selected according to any suitable criteria such as the type of surface the training system **100** will be used on or a height of the frame **304** from the ground. In a second embodiment, the set of feet **308** may comprise a plurality of spikes configured to extend downwardly into the ground.

Referring now to FIG. **2**, in an alternative embodiment, the base **102** may be configured to permanent or semi-permanent attachment to a desired location of use. For example, the base **102** may comprise a bracket **202** that is suitably configured to be bolted or otherwise affixed to a ground location. Alternatively, the bracket **202** may comprise an end portion such as a barb or spike that is suitably configured to be inserted into a field surface such as grass, dirt, sand, or the like and secure the training system **100** in place.

Referring now to FIGS. **1-5**, the ball retention device **110** is used to securely couple a ball **502** to the training system **100** during use. The ball retention device **110** may be coupled to the base **102** by an arm **112** that is suitably configured to extend upward and away from the base **102** to position the ball **502** far enough away from the base **102** to allow the user sufficient access to the ball **502**. For example, in one embodiment, the arm **112** may extend upwardly away from the base **102** at an angle of between about thirty and sixty degrees. In an alternative embodiment, the arm **112** may comprise a generally L-shaped member coupled at a forward end portion **314** of the frame **304** such that the ball **502** may be suspended within the ball retention device **110** and yet at least partially rest on the ground a pre-determined distance away from the base **102** such that the user may kick the ball **502** with a normal kicking motion without contacting the base **102**.

The L-Shaped member may extend upward from the frame **304** by any suitable distance and may be determined according to the type of ball **502** that will be used with the training system **100**. For example, the L-Shaped member may extend upwardly from the base a distance of between about twelve inches and about twenty-two inches such that a soccer ball or football may be used with the training system **100**. In a second embodiment, the height of the arm **112** may extend upwardly from the base a distance of between about six inches and about twelve inches such that a golf ball may be used with the training system **100**. Alternatively, the height of the arm **112** may be adjustable to account for varying sizes of balls such as those used for youth sports and regulation adult sized balls. In yet another embodiment, the height of the arm **112** may be set such that the ball retention device **110** is positioned at least a foot above the ground such that a baseball may be properly positioned to allow a user to swing a bat.

The arm **112** may comprise any suitable material such as a metal, plastic, or composite capable of withstanding varying torque forces that result from the ball being kicked or otherwise struck. For example, the arm **112** may comprise an aluminum tube having a flange **316** disposed along a first end to allow the arm **112** to be coupled to the base **102**. The arm **112** may be coupled to the base **102** by any suitable method such as by welding or a fastener. In one embodiment, the flange **316** may comprise attachment apertures that extend there through to receive at least one fastener **318** to couple the flange **316** to the forward end portion **314** of the frame **304**.

The ball retention device **110** receives and suspends the ball **502** from the arm **112**. The ball retention device **110** may comprise any suitable system or device for securely holding the ball **502** before and after being kicked or otherwise struck and set into motion. In one embodiment, and referring now to FIGS. **4** and **5**, the ball retention device **110** may comprise a net-like structure configured to receive a ball **502** within an interior portion **402**. The net-like structure may be tightened after the ball **502** is positioned within the interior portion **402** to at least partially enclose the ball **502**. Alternatively, the net-like structure may be suitably configured to self-tighten around the ball **502**.

The net-like structure may comprise one or more straps **404**, **406**, **408** woven, stitched, or otherwise coupled together to form the interior portion **402**. The straps **404**, **406**, **408** may comprise any suitable material such as a rubber or a webbing made from polypropylene, nylon, polyester, synthetic or natural fibers, Dyneema®, Kevlar®, and the like. For example, in one embodiment, the straps **404**, **406**, **408** may comprise a polyester strip having a width of between about three-eighths of an inch and about three-quarters of an inch and a length of between about three inches and twenty inches.

One or more of the straps **404**, **406**, **408** may be individually or collectively coupled together by an elastic strap section **410** to allow the interior portion **402** to be at least partially adjustable in response to different sized balls. For example, a first strap **404** may comprise alternating sections of a non-elastic strap section and an elastic strap section **410** to allow the first strap **404** to stretch lengthwise and better conform to the shape and size of the ball **502**. A second and third strap **406**, **408** may be similarly constructed such that the entire net-like structure may automatically conform to multiple sizes and/or types of balls.

At least one end portion of each strap **404**, **406**, **408** may be coupled to a ring **412** configured to provide an opening to the interior portion **402**. The ring **412** may be sufficiently sized to allow the ball **502** to pass through. The ring **412** may also be configured to provide a selectively adjustable sized opening so that various types and sizes of balls may be positioned within the interior portion **402**. For example, the ring **412** may comprise a generally circular shaped spring device having end portions that may be selectively coupled together. In an alternative embodiment, the ring **412** may comprise a strap or cord that may be adjusted or otherwise cinched to allow the ball **502** to be positioned within or removed from the interior portion **402**. In yet a third embodiment, the ring **412** may be formed from a stretchable cord such as a shock cord or elastic cord suitably configured to expand to allow a ball **502** to pass into the interior portion **402** and then shorten to help secure the ball **502** within the interior portion **402**.

The ball retention device **110** may be suspended from the arm **112** by a cord **114**. The cord **114** may comprise any suitable material such as a fabric rope, paracord, tension wire, rigid member, or the like. The cord **114** may also be configured to have abrasion resistance such that durability of the cord **114** is increased. For example, the cord **114** may be configured to be slack when not under tension or the cord **114** may be at least slightly rigid even when in a non-tension state. The cord **114** may also be suitably configured to have reduced elasticity along the length of the cord **114** to reduce a potential for the cord **114** to be stretched lengthwise after the ball **502** is struck and set into motion.

The cord **114** may be coupled between the arm **112** and the ball retention device **110** by any suitable method. For example, referring now to FIGS. **1** and **7**, the cord **114** may be coupled at a first end to a spool **116** positioned proximate the force measurement system **106**. The cord **114** may then be fed through the force measurement system **106** and extend downwardly through the energy absorber **104** before being coupled to the ring **412** on a second end.

In an alternative embodiment, the cord **114** may also comprise the ring **412**. For example, the cord **114** may sized such that an end portion of the second end may be woven through the straps **404**, **406**, **408** and then joined back to a mid-portion of the cord **114** by a knot **414** to form the ring **412**. The coupling between the mid-portion and the knot **414** may allow the end portion to be selectively adjusted to allow the ball retention device **110** to be cinched around the ball **502**.

The energy absorber **104** absorbs the force imparted to the ball **502** and acts to return the ball **502** to its initial resting position. The energy absorber **104** may comprise any system or device capable of dissipating energy and reducing any oscillation of the ball **502** so that the ball **502** may come to rest more rapidly. Referring now to FIGS. **1**, **6**, and **7**, the energy absorber **104** may be positioned between the ball retention device **110** and force measurement system **106**. The energy absorber **104** may be coupled to the force measurement system **106** by any suitable method. For example, the energy absorber **104** may be mechanically attached to an underside of the force measurement system **106**.

In one embodiment, the energy absorber **104** may comprise a compression spring **702** positioned within an energy absorbing housing **704**. The energy absorbing housing **704** limits movement of the cord **114** to reduce oscillation of the ball as it returns to a state of rest after being struck. The energy absorbing housing **704** may comprise any suitable device for dissipating the energy imparted to the ball **502**. For example, in one embodiment, the energy absorbing housing **704** may comprise an elastomeric body suitably configured to resist deflecting under the forces transferred to the cord **114** from the struck ball **502**. The elastomeric body may be at least semi-rigid while maintaining some ability to flex under the applied load resulting from the moving ball. The elastomeric body may be suitably configured to act as a dampening system adapted to minimize oscillation.

The energy absorbing housing **704** may further comprise an interior channel **716** extending between first and second end portions of the energy absorbing housing **704**. The interior channel **716** may be suitably configured to provide a passageway to allow the cord **114** to extend through the interior of the energy absorbing housing **704**. The interior channel **716** may be further configured to receive the compression spring **702**. For example, the interior channel **716** may comprise a first zone **718** having a diameter slightly larger than that of the compression spring **702** and a length sufficient to allow the compression spring **702** to be at least partially enclosed within the first zone **718**.

The interior channel **716** may comprise a second zone **720** having a diameter less than that of the first zone **718** but larger than the diameter of the cord **114**. The diameter of the second zone **720** may be sized such that the cord **114** can pass through without touching an interior wall of the second zone **720** but not so large as to allow the cord **114** to swing through more than about five to fifteen degrees of motion relative to a center line **722** of the interior channel **716**. By limiting the ability of the cord **114** to swing or oscillate within the interior channel **716** the angle through which the ball **502** may oscillate is reduced thereby allowing the ball **502** to come to rest more rapidly.

The compression spring **702** may provide the energy absorbing housing **704** with increased resistance to deflection or compression when subjected to a load. The compression spring **702** may also be configured to increase the damping coefficient of the energy absorbing housing **704** to decrease the amount of time required to return the ball retention device **110** to rest after being struck.

The compression spring **702** may comprise any suitable material such as stainless steel alloys, high carbon steel wire, alloy steel or music wire, nickel base alloy wire, brass, and hard drawn wire selected to provide a desired level of stiffness to the energy absorbing housing **704**. For example, in one embodiment, the compression spring **702** may comprise a stainless steel alloy having an outer diameter of between about three-quarters of an inch and about one and one-half of an inch and a length of between about one inch and about three inches.

The spool **116** may be positioned along a portion of the arm **112** and/or the force measurement system **106**. The spool **116** allows an effective length of the cord **114** to be selectively adjusted to accommodate various sizes of balls. For example, the spool **116** may comprise a rotatable knob coupled to the first end of the cord **114**. By rotating the knob in a first direction the effective length of the cord **114** may be shortened thereby raising the ball retention device **110** from the ground to accommodate a larger sized ball **502**. Conversely, rotating the knob in a second direction may increase the effective length of the cord **114** and lower the ball retention device **110**. In this manner, the ball retention device **110** may be positioned such that any size ball **502** may be properly positioned on or just slightly above ground level.

The force measurement system **106** generates a set of data corresponding to the force applied to the ball **502** when kicked or struck during use. The force measurement system **106** may comprise any suitable system or method for converting a measured force into data pertaining to the ball **502**. Referring now to FIGS. **1**, **3**, and **7**, in one embodiment the force measurement system **106** may be disposed proximate a second end of the arm **112** to engage the cord **114** and the energy absorber **104**. For example, the force measurement system **106** may be coupled to and extend outwardly away from the second end of the arm **112** such that the force measurement system **106** is disposed above the ball **502** during use. In an alternative embodiment, the force measurement system **106** may be integrated within the arm **112** itself and form a single structural element.

In one representative embodiment, the force measurement system **106** may comprise a speed sensing device **708** suitably adapted to calculate a speed value for the ball **502** that corresponds to how hard the ball **502** was kicked or otherwise struck and set into motion. The speed sensing device **708** may be configured to use a displacement of the cord **114** to calculate the speed value. For example, the speed sensing device may comprise a cord guide **710** connected to a tracking bar **712** that is linked to a sensor **714** configured to measure the force imparted to the ball and generate the speed value.

The cord guide **710** may be coupled to the cord **114** such that any movement of the cord **114** will be transferred through the cord guide **710** and sensed by the sensor **714**. Referring now to FIG. **7**, the force measurement system **106** may comprise a pair of openings configured to allow the cord **114** to pass through an interior portion of the force measurement system **106**. For example, a first opening **724** may be positioned along a top surface of the force measurement system **106** proximate the spool **116** to allow the cord to enter into the interior portion of the force measurement system **106**. A second opening **726** may be positioned along a bottom surface of the force measurement system **106** to allow the cord to exit out from the interior portion of the force measurement system **106**. The second opening **726** may be at least partially aligned with the first opening **724** such that the cord **114** might pass through the interior portion of the force measurement system **106** in a substantially linear manner.

The cord guide **710** may positioned within the interior portion of the force measurement system **106** at a predetermined distance from the first and second openings **724**, **726** and be configured to engage the cord. For example, the cord guide **710** may comprise an element configured to wrap around the cord **114** and route the cord **114** through the interior portion of the force measurement system **106** and prevent the cord from passing linearly through the interior portion of the force measurement system **106** when the ball **502** is positioned in the ball retention device **110** and at rest. A spring **728** may be coupled to the cord guide **710** to maintain the resting position of the cord guide **710** to cause the cord **114** to deflect and be placed under slight tension.

When the ball **502** is struck the resulting forces imparted to the ball **502** may be transferred to the cord **114** causing the cord **114** to be pulled downwardly from the force measurement system **106** as the ball **502** moves. The downward movement of the cord **114** will tend to cause the deflection of the cord **114** within the force measurement system **106** and pull the cord guide **710** and the tracking bar **712** towards the first and second openings **724**, **726**. As the tracking bar **712** moves it passes by the sensor **714**.

The sensor **714** is responsive to the movement of the tracking bar **712** and converts that movement into a signal that is used to calculate the speed value. The sensor **714** may comprise any suitable sensing device such as an accelerometer, a switch, or the like for converting mechanical movement into a signal. The sensor **714** may comprise a purely mechanical system, an electro-mechanical system, or a purely electrical device. In one embodiment the sensor **714** may comprise a Hall Effect sensor suitably configured to convert the movement of the tracking bar **712** into an electronic signal that is used to generate the speed value. For example, the tracking bar **712** may comprise a pair of tabs **730** separated by a set distance that are suitably configured to be sensed by the sensor **714** as they each pass by the sensor **714**. The sensor **714** may be configured to record a time between the sensing of the first tab and the second tab and use this value along with the known distance between the tabs to calculate a velocity that corresponds to the velocity that the ball **502** was traveling at after being kicked or struck. In this embodiment, the greater the force applied to the ball **502** the greater the speed at which the tracking bar **712** may pass by the sensor **714** and may indicate a higher speed value for the ball **502**.

Referring again to FIGS. **1** and **2**, the display system **108** may be communicatively linked to the force measurement system **106** and be suitably configured to provide a visual indication of the calculated speed value and/or any other generated data relating to the ball **502**. For example, the display system **108** may comprise a processing unit adapted to receive the signal from the sensor **714** and calculate the associated speed value. The calculated speed value may then be displayed to the user and/or saved in a memory device.

The display system **108** may also be configured to communicate to a wireless communications device such as a smartphone, portable computing device, or the like. The display system **108** may be configured to communicate with the wireless communications device according to any suitable criteria or suitable wireless communication protocol, such as ZigBee (e.g. IEEE 802.15.4), Wi-Fi (e.g. IEEE 802.11), Bluetooth, and the like. For example, the wireless communications device may be configured to receive and track the generated data and/or speed values for the ball.

These and other embodiments for methods of detecting and calculating the speed of a ball may incorporate concepts, embodiments, and configurations as described with respect to embodiments of apparatus for detecting and calculating the speed of a ball as described above. The particular implementations shown and described are illustrative of the technology and its best mode and are not intended to otherwise limit the scope of the present technology in any way. Indeed, for the sake of brevity, conventional manufacturing, connection, preparation, and other functional aspects of the system may not be described in detail. Furthermore, the connecting lines shown in the various figures are intended to represent exemplary functional relationships and/or physical couplings between the various elements. Many alternative or additional functional relationships or physical connections may be present in a practical system.

The technology has been described with reference to specific exemplary embodiments. Various modifications and changes, however, may be made without departing from the scope of the present technology. The description and figures are to be regarded in an illustrative manner, rather than a restrictive one and all such modifications are intended to be included within the scope of the present technology. Accordingly, the scope of the technology should be determined by the generic embodiments described and their legal equivalents rather than by merely the specific examples described above. For example, the steps recited in any method or process embodiment may be executed in any order, unless otherwise expressly specified, and are not limited to the explicit order presented in the specific examples. Additionally, the components and/or elements recited in any apparatus embodiment may be assembled or otherwise operationally configured in a variety of permutations to produce substantially the same result as the present technology and are accordingly not limited to the specific configuration recited in the specific examples.

Benefits, other advantages and solutions to problems have been described above with regard to particular embodiments; however, any benefit, advantage, solution to problems or any element that may cause any particular benefit, advantage or solution to occur or to become more pronounced are not to be construed as critical, required or essential features or components.

As used herein, the terms "comprises", "comprising", or any variation thereof, are intended to reference a non-exclusive inclusion, such that a process, method, article, composition or apparatus that comprises a list of elements does not include only those elements recited, but may also include other elements not expressly listed or inherent to such process, method, article, composition or apparatus. Other combinations and/or modifications of the above-described structures, arrangements, applications, proportions, elements, materials or components used in the practice of the present technology, in addition to those not specifically recited, may be varied or otherwise particularly adapted to specific environments, manufacturing specifications, design parameters or other operating requirements without departing from the general principles of the same.

The present technology has been described above with reference to a preferred embodiment. However, changes and modifications may be made to the preferred embodiment without departing from the scope of the present technology. These and other changes or modifications are intended to be included within the scope of the present technology, as expressed in the following claims.

The invention claimed is:

1. A training device for allowing a user to kick a ball from a ground location, comprising:

a base portion having an attachment arm extending upwardly and away from the base portion from a first end of the attachment arm;

a cord coupled at a first end to a second end of the attachment arm;

a net coupled to a second end of the cord, wherein the net is configured to position the ball at a resting position;

an energy absorber extending downwardly from the second end of the attachment arm and engaging the cord, wherein the energy absorber is configured to:

dampen an oscillation of the cord in response to a kicking force applied to the ball; and

return to the ball to the resting position; and

a force measurement system linked to the energy absorber and coupled to the cord, wherein the force measurement system is configured to measure the kicking force and calculate a set of data corresponding to the force applied to the ball when kicked by the user.

2. A training device according to claim **1**, wherein the base portion comprises a housing.

3. A training device according to claim **2**, wherein the housing comprises:

an internal volume;

an opening configured to provide selective access to the internal volume;

a frame disposed along a lower portion of the housing;

a set of wheels coupled to the frame; and

a set of feet coupled to a bottom surface of the frame.

4. A training device according to claim **1**, wherein the attachment arm comprises a generally L-shaped member.

5. A training device according to claim **1**, wherein the net comprises a net-like structure configured to receive the ball within an interior portion.

6. A training device according to claim **5**, wherein the net-like structure comprises a plurality of straps coupled together to form the interior portion.

7. A training device according to claim **6**, wherein the net-like structure further comprises at least one elastic strap section disposed along a portion of at least one of the plurality of straps.

8. A training device according to claim **6**, wherein the net-like structure further comprises a ring coupled to at least one end portion of at least one of the plurality of straps, wherein the ring comprises an end section of the cord joined back to a mid-section of the cord by a knot configured to allow the end section to be selectively adjusted to allow the net to be cinched around the ball.

9. A training device according to claim **6**, wherein the net-like structure further comprises a ring formed by a stretchable cord configured to expand to allow an opening to the interior portion to be selectively adjusted to allow the ball to be positioned within the interior portion.

10. A training device according to claim **1**, wherein the energy absorber comprises:

an energy absorbing housing comprising an interior channel configured to allow the cord to pass through the energy absorbing housing; and

a compression spring positioned within the interior channel of the energy absorbing housing.

11. A training device according to claim **10**, wherein the energy absorbing housing comprises a dampening system adapted to minimize oscillation.

12. A training device according to claim **10**, wherein the energy absorbing housing comprises an elastomeric body suitably configured to resist deflecting under the forces transferred to the cord from the struck ball.

13. A training device according to claim **10**, wherein the interior channel of the energy absorbing housing comprises:

a first zone configured to receive the compression spring; and

a second zone having a diameter less than that of the first zone but larger than a diameter of the cord.

14. A training device according to claim **1**, further comprising a spool disposed proximate the second end of the attachment arm, wherein the spool is configured to selectively adjust an effective length of the cord.

15. A training device according to claim **1**, wherein the force measurement system comprises a speed sensing device adapted to generate the set of data corresponding to the force applied to the ball.

16. A training device according to claim **15**, wherein the speed sensing device comprises:

a cord guide positioned within an interior portion of the force measurement system and configured to engage the cord;

an encoder connected to the cord guide; and

a sensor responsive to a movement of the encoder and configured to measure the force imparted to the ball and generate the set of data.

17. A training device according to claim 16, wherein the sensor comprises a Hall Effect sensor suitably configured to convert the movement of the encoder into an electronic signal that is used to generate the set of data.

18. A training device according to claim 1, further comprising a display system communicatively linked to the force measurement system and configured to provide a visual indication of the generated set of data.

19. A training device for allowing a user to kick a ball from a ground location, comprising:

a portable base comprising:

a set of wheels disposed along a first end portion of the portable base; and

a set of feet disposed along a bottom surface of the portable base;

a ball retention device coupled to an opposing second end portion of the portable base, wherein the ball retention device comprises:

an attachment arm having a first and second end, wherein the attachment arm extends upwardly and away from the second end portion of the portable base from the first end of the attachment arm;

a cord coupled at a first end to the second end of the attachment arm, wherein the cord is configured to extend downwardly from the second end of the attachment arm towards the ground; and

a net coupled to a second end of the cord, wherein the net:

comprises an interior portion configured to receive the ball; and

is configured to position the ball at a resting position corresponding to the ground location;

an energy absorber extending downwardly from the second end of the attachment arm and engaging the cord, wherein the energy absorber is configured to:

dampen an oscillation of the cord in response to a kicking force applied to the ball; and

return to the ball to the resting position; and

a force measurement system linked to the energy absorber and coupled to the cord, wherein the force measurement system is configured to measure the kicking force and calculate a speed value for the ball corresponding to the kicking force applied to the ball by the user.

20. A training device according to claim 19, wherein the portable base comprises:

an internal volume;

an opening configured to provide selective access to the internal volume; and

a frame disposed along a lower portion of the housing, wherein the frame is configured to couple the set of wheels and the set of feet to the portable base.

21. A training device according to claim 19, wherein the set of feet comprise a plurality of cleated members.

22. A training device according to claim 19, wherein the net comprises:

a plurality of straps coupled together to form the interior portion;

a ring coupled to at least one end portion of at least one of the plurality of straps, wherein the ring comprises an end section of the cord joined back to a mid-section of the cord by a knot configured to allow the end section to be selectively adjusted to allow the net to be cinched around the ball; and

at least one elastic strap section coupled to at least one of the plurality of straps.

23. A training device according to claim 19, wherein the energy absorber comprises:

an energy absorbing housing comprising:

an interior channel configured to allow the cord to pass through energy absorbing housing; and

a dampening system adapted to minimize oscillation; and

a compression spring positioned within an interior channel of the energy absorbing housing.

24. A training device according to claim 23, wherein the energy absorbing housing comprises an elastomeric body suitably configured to provide critical dampening in response to the kicking force transferred to the cord from the kicked ball.

25. A training device according to claim 23, wherein the interior channel of the energy absorbing housing comprises:

a first zone configured to receive the compression spring; and

a second zone having a diameter less than that of the first zone but larger than a diameter of the cord.

26. A training device according to claim 19, wherein the ball retention device further comprises a spool disposed proximate the second end of the attachment arm, wherein the spool is configured to selectively adjust an effective length of the cord.

27. A training device according to claim 19, wherein the force measurement system comprises:

a cord guide positioned within the interior portion of the force measurement system and configured to engage the cord;

an encoder connected to the cord guide; and

a Hall Effect sensor responsive to a movement of the encoder and configured to:

convert the movement of the encoder into an electronic signal;

measure the kicking force imparted to the ball according to the electronic signal; and

generate the speed value based on the measured kicking force.

28. A training device according to claim 19, further comprising a display system communicatively linked to the force measurement system and configured to provide a visual indication of the generated speed value.

* * * * *