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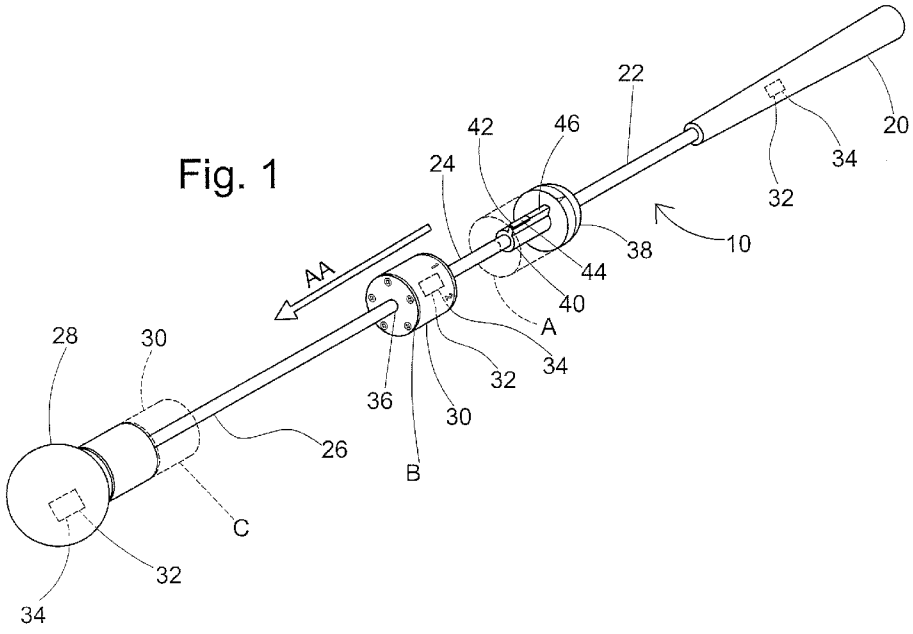
(54) Title: SWING TRAINING DEVICE, METHOD, AND SYSTEM THEREFOR

Fig. 1



(57) Abstract: A swing training device, a swing training method, and a swing training system contain a handle, a shaft attached to the handle, an end cap connected to the shaft and opposite the handle, a slidable weight on the shaft, and optionally a motion sensor. The slidable weight is disposed between the end cap and the handle. The motion sensor is capable of generating motion sensor data.

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
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SWING TRAINING DEVICE, METHOD, AND SYSTEM THEREFOR

SPECIFICATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This PCT application claims the benefit under 35 U.S.C. §119(e) of United States Patent Application Serial No. 62/438,167, filed on December 22, 2016, entitled SWING TRAINING DEVICE, METHOD, AND SYSTEM THEREFOR, the entire disclosure of which is incorporated by reference herein.

FIELD OF THE INVENTION

The present invention relates to the field of sports training devices, methods, and systems, and more specifically arm/shoulder swing-related training devices, methods, and systems.

BACKGROUND

The sport field is rife with various types of training devices, methods, and systems for various parts of the games, such as running, jumping, kicking, etc. to improve speed, strength, distance, etc. as desired. In certain sports such as, for example, baseball, tennis, and golf, where a bat, racquet, pole, and club are respectively used, a player may wish to improve the speed and/or strength of their swing. Accordingly, various devices, methods and systems are provided for training these movements of the shoulders, arms, hips, etc. See, for example US 2011/0305369 A1 to Bentley, et al., entitled "Portable Wireless Mobile Device Motion Capture and Analysis System and Method" published on Dec. 15, 2011; and US 8,425,292 B2 to Lui, et al., entitled "System and Method for Analyzing Postures" published on Apr. 23, 2013.

However, it has been found that many of these systems do not provide sufficient information, are extremely difficult to use and/or expensive such that the average player may not benefit from such devices, methods, and systems. Accordingly, there remains a need for a technically accurate, easily-manufactured, and inexpensive devices, methods, and systems for improving the strength, speed, endurance, and/or accuracy of an athlete or player's swing.

SUMMARY OF THE INVENTION

An embodiment of the present invention relates to a swing training device having a handle, a shaft connected to the handle, an end cap connected to the shaft opposite the handle, a slidable weight on the shaft, and a motion sensor. The slidable weight is disposed between the end cap and the handle. The motion sensor is capable of generating motion sensor data about the motion of the swing training device.

An embodiment of the present invention relates to a swing training method having the steps of providing a swing training device as described herein, positioning the slidable weight away from the end cap, holding the handle, swinging the swing training device such that the slidable weight slides to the end cap, and generating motion sensor data.

In an embodiment of the present invention, a swing training system contains a swing training device as described herein, where the swing training device contains a communication device to communicate motion sensor data. The swing training system has a receiver to receive the motion sensor data, and typically the receiver contains an electronic device. The swing training system contains a software package, where the software package analyses the motion sensor data.

An embodiment of the present invention relates to a swing training device having a handle, a shaft connected to the handle, an end cap opposite the handle, a stopper affixed to the shaft and disposed between the end cap and the handle, and a slidable weight slidably-affixed to the shaft. The slidable weight is removably-attached to the stopper by a force selected from the group consisting of friction, resiliency, or a combination thereof.

An embodiment of the present invention relates to a swing training system having a swing training device as described herein having a motion sensor that collects motion sensor data, a communication device for communicating motion sensor data, a receiver having an electric device to receive motion sensor data, and a software package to analyze the motion sensor data.

An embodiment of the present invention relates to a swing training method having the steps of providing a swing training device or the swing training system as

described herein, positioning the slidable weight away from the end cap, holding the handle, and swinging the swing training device such that the slidable weight slides to the end cap.

Without intending to be limited by theory, it is believed that such an improved swing training device, swing training method and/or swing training system possesses significant advantages over those currently in existence. For example, it is believed that the slidable weight provides a dynamic training experience which may improve one or more swing aspects such as swing speed, swing power, swing accuracy, swing plane, swing posture, swing angle, etc. Furthermore, the slidable weight may be require a minimum centripetal force before it slides towards the end cap, so as to improve swing speed, swing timing, swing posture, etc.

It is also believed that the improved swing training device, swing training method and/or swing training system may provide improved motion sensor data, often very detailed motion sensor data. Such data may allow for various detailed extrapolation and/or analytics which allow the user and/or a receiver to better adjust large and/or minute details of the swing, leading to incremental or even significant gains and/or swing improvement. Furthermore, as a swing typically passes very quickly it is believed that the motion sensor data can better show details which may otherwise be undetectable to the naked eye, or even visional motion capture systems whose tracking may be, for example, blocked and/or occluded during the swinging motion of the user.

Without intending to be limited by theory, it is believed that the improved swing training device, swing training method and/or swing training system may further provide information leading to and/or detailed recommendation for methods for improving the user's swing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a side perspective view of an embodiment of a swing training device of the present invention;

Fig. 2 shows a partial perspective view of an embodiment of a handle and shaft herein;

Fig. 3 shows an exploded-side perspective view of an embodiment of a slidable weight and a stopper;

Fig. 4 shoes an exploded view of an embodiment of an end cap useful herein;

Fig. 5 shows a side-perspective view of an embodiment of a slidable weight and a stopper;

Fig. 6 shows a see-through perspective view of an embodiment of a stopper and a slidable weight;

Fig. 7 shows a side perspective view of an embodiment of a swing training device having an additional weight on the shaft;

Fig. 8 shows a side view of an embodiment of the swing training device having an intermediate section positioned on the shaft between the slidable weight and the stopper;

Fig. 9 shows a schematic diagram of an embodiment of an electronic component useful herein; and

Fig. 10 shows a cut-away side view of an embodiment of a slidable weight and stopper.

The figures herein are for illustrative purposes only and are not necessarily drawn to scale.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Unless otherwise specifically provided, all measurements are made in metric units.

As used herein, the term "inwards" with respect to the shaft indicates a direction that is radially towards the shaft.

As used herein, the term "outwards" with respect to the shaft indicates a direction that is radially away from the shaft.

The present invention relates to a swing training device containing a handle, a shaft connected to the handle, an end cap connected to the shaft opposite the handle, a slidable weight on the shaft, and a motion sensor. The slidable weight is disposed between the end cap and the handle. Furthermore, the motion sensor is capable of generating motion sensor data about the motion of the swing training device, such as

during use.

Without intending to be limited by theory, it is believed that a swing training device comprising a motion sensor therein as well as a slidable weight thereupon may be integrated into a significantly-improved training method and system.

Fig. 1 shows a side perspective view of an embodiment of a swing training device, 10, of the present invention. The swing training device, 10, contains a handle, 20, connected; or removably-connected; on a first end, 22, to a shaft, 24. A second end, 26, is opposite the first end, 22. An end cap, 28, is connected; or removably-connected; opposite the handle, 20, at the second end, 26. A slidable weight, 30, is located on the shaft, 24, and is disposed between the end cap, 28, and the handle, 20. The swing training device in Fig. 1 is intended for training a golf swing, but one skilled in the art understands that the device, system, and method herein may be adapted to other types of swings, and other sports as well.

The swing training device, 10, of Fig. 1 contains a plurality of motion sensors, 32, therein. The motion sensor, 32, senses the motion of the swing training device, 10, and generates motion sensor data about the motion of the swing training device, 10, as it is swung about by the user. In an embodiment of the present invention the swing training device contains a plurality of motion sensors; or from about 1 motion sensor to about 30 motion sensors; or from about 2 motion sensors to about 28 motion sensors; or from about 3 motion sensors to about 15 motion sensors.

In Fig. 1, herein, the swing training device, 10, contains a set, 34, of 3 motion sensors, 32. In an embodiment herein, the swing training device contains at least 1 set of 3 motion sensors. As used herein, a "set of 3 motion sensors" describes 3 motion sensors; or 3 different motion sensors, that are arranged to simultaneously detect motion in the X-axis, the Y-axis, and the Z-axis, respectively. Often the set of 3 motion sensors is manufactured together and sold together as a single unit. In an embodiment herein, the swing training device contains from about 1 set of 3 motion sensors to about 10 sets of 3 motion sensors; or from about 2 sets of 3 motion sensors to about 6 sets of 3 motion sensors; or from about 3 sets of 3 motion sensors to about 4 sets of 3 motion sensors.

In an embodiment herein the motion sensor is selected from the group consisting of an accelerometer, a gyro sensor, a gravity sensor, and a combination thereof; or an accelerometer. The accelerometer useful herein may be a micromachined accelerometer, a piezoelectric accelerometer, a piezoresistive accelerometer, a capacitive accelerometer, an electromechanical servo accelerometer, a potentiometric accelerometer and a combination thereof; or a micro electro-mechanical system (MEMS) accelerometer. In an embodiment herein the motion sensor is a MEMS accelerometer and the set of 3 motion sensors is a set of 3 MEMS accelerometers containing a first MEMS accelerometer set to measure motion in the X-axis, a second MEMS accelerometer set to measure motion in the Y-axis, and a third MEMS accelerometer set to measure motion in the Z-axis.

In an embodiment herein the motion sensor is located on or in the end cap, on or in the slidable weight, and a combination thereof. Without intending to be limited by theory, it is believed that these portions of the swing training device will typically be subject to greater motion and/or acceleration than, for example, the handle, and therefore the motion sensor will provide better, more accurate, and/or more complete motion sensor data when the motion sensor is located at these positions. In an embodiment herein, the motion sensor is located on or in the handle. Without intending to be limited by theory, it is believed that multiple motion sensors; or multiple sets of 3 motion sensors; may be useful herein, as they may be able to better generate motion sensor data regarding, for example, angular acceleration, torque, flex of the swing training device, plane orientation, and/or other swing characteristics where multiple data points would be useful in accurately describing the swing.

In an embodiment herein, the motion sensor is permanently-attached to, or permanently-embedded within; or permanently embedded within; the swing training device. Without intending to be limited by theory, it is believed that such an arrangement reduces the chance that the motion sensor will become lost and/or broken during use, training, etc.

In Fig. 1, the end cap, 28, contains a set, 34, of 3 motion sensors, 32. The

slidable weight, 30, contains a set, 34, of 3 motion sensors, 32. Also, the handle, 20, contains a set, 34, of 3 motion sensors, 32. In another embodiment herein the shaft contains a motion sensor, 32, and/or a set, 34, of 3 motion sensors, 32.

The handle, 20, and shaft, 24, of the swing training device, 10, is made of typical materials known in the art. For example, the handle may be made of a substance which provides both vibration protection as well as gripability, such as, for example, rubber, foam rubber, neoprene, and a combination thereof. The shaft may be made of, for example, a metal, a polymer, carbon fiber and a combination thereof; or stainless steel, titanium, fiberglass, plastic, carbon fiber and a combination thereof; or steel, titanium, carbon fiber and a combination thereof. Such shaft and handle materials are standard in the art and are typically available from multiple manufacturers and suppliers around the world.

In the embodiment of Fig. 1, the slidable weight, 30, contains a hole, 36, through which the shaft, 24, penetrates, and the hole, 36, extends through the other side of the slidable weight, 24. Thus, the slidable weight, 36, is able to slide up and down along the shaft, 24. A stopper, 38, is optionally permanently affixed to the shaft, 24, generally near the first end, 22. The stopper, 38, serves to stop the slidable weight, 30, from sliding and hitting the user's hands and/or the handle, 20, when the swing training device, 10, is held by the handle, 20, and raised above the user's head as is common, for example, in preparation for a golf swing.

In preparation for use, the slidable weight, 30, may slide onto the stopper end, 40, which is on the stopper, 38, distal from the handle, 20. The slidable weight, 30, typically removably-attaches to the stopper, 38, at, for example, position A. When the swing training device, 10, is then swung by a user, the centripetal force exerted on the slidable weight, 30, causes the slidable weight, 30, to release from the stopper, 38, and slides towards the end cap, 28, in the direction of the arrow, AA. Fig. 1 therefore shows the swing training device, 10, in-use as the slidable weight, 30, is in position B. Assuming that the swing training device, 10, is swung with enough force, the slidable weight, 30, then travels down the shaft, 24, away from the handle, 20, and impacts the end cap, 28, ending up in position C.

In an embodiment herein, the slidable weight creates a sound; or a loud sound; when the slidable weight impacts the end cap. Without intending to be limited by theory, it is believed that such a sound; or loud sound; provides the user with an audible signal which indicates that the swing speed was sufficient to achieve the goal of making the slidable weight impact the end cap. It is also believed that users especially prefer such a sound upon impact, as it provides an affirmation that the user is using the swing training device correctly. Typically, the faster the user swings the swing training device by the handle, the faster the slidable weight travels down the shaft to hit the end cap, and the louder the noise. Upon impact therewith, the slidable weight may then be removably-attached to the end cap.

In an embodiment herein, the slidable weight herein is removably-attached to the stopper by a force such as, for example, friction, magnetism, resiliency (i.e., flexibility or bendability), and a combination thereof; or friction, magnetism, resiliency, and a combination thereof, or friction, resiliency, and a combination thereof.

In Fig. 1, the stopper end, 40, contains a magnetic portion, 42, to which a magnet (see Fig. 3 at 52), located in the slidable weight, 30, magnetically-attaches. In an embodiment herein, the slidable weight, 30, is removably-attached to the stopper, 38, by a force selected form the group consisting of friction, a magnetic force, resiliency, and a combination hereof; or a magnetic force; or friction, resiliency, and a combination thereof. In Fig. 1, where the slidable weight, 28, is removably-attached to the stopper, 38, via a magnetic force, one skilled in the art understands that the magnet (see Fig. 3 at 52) may be located in a magnet position (see Fig. 3 at 53) selected from the slidable weight, the end cap, the stopper, and a combination thereof. Similarly, one skilled in the art understands that the corresponding magnetic portion, 42, may be conversely-located in a magnetic portion location, 44, selected from the slidable weight, the end cap, the stopper, and a combination thereof, as long as the magnet (see Fig. 3 at 52) magnetically-attaches to the magnetic portion, 42. Thus, when the centripetal force of the swing on the slidable weight, 30, overcomes the (attracting) magnetic force between the magnet (see Fig. 3 at 52) and the magnetic portion, 42, the slidable weight, 30, will release from the stopper, 38, and slide towards the end cap,

28.

In Fig. 1, the stopper, 38, further contains a stopper ridge, 46, upon which the magnetic portion, 42, is affixed. In an embodiment herein, the stopper ridge, 46, interacts with the slidable weight, 30, to create friction therebetween and therefore hold the slidable weight in place against the stopper in position A.

Fig. 2 shows a partial perspective view of an embodiment of a handle, 20, and shaft, 24, herein. The handle, 20, and the shaft, 24, are co-axial, in that the handle has a longitudinal handle axis, HA, and the shaft has a shaft axis, SA. In the embodiment of Fig. 2, the handle axis, HA, and the shaft axis, SA, are the same, and thus the handle, 20, and the shaft, 24, are co-axial.

Fig. 3 shows an exploded-side perspective view of an embodiment of a slidable weight, 24, and a stopper, 38. In Fig. 3, it can be seen that the stopper, 38, contains a magnetic portion, 42, provided on the stopper end, 40, at the magnetic portion location, 44. The magnetic portion, 42 and the magnetic portion location, 44, are located on a stopper ridge, 46. A plate, 48, at each end of the slidable weight, 30, is attached into place with screws, 50. A hole, 36, allows the plate, 48, and therefore the slidable weight, 30, to slide along the shaft (see Fig. 1 at 24).

The plate may be made of, for example, a metal, a polymer, carbon fiber and a combination thereof; or stainless steel, titanium, fiberglass, plastic, a fabric, carbon fiber and a combination thereof; or steel, titanium, carbon fiber and a combination thereof. In an embodiment herein, the plate is a magnetic material. In an embodiment herein, the plate is a non-magnetic material. IN an embodiment herein, the fabric is a high-impact fabric, such as, for example, a para-aramid synthetic fiber such as Kevlar® from DuPont.

Fig. 3 also shows that an embodiment of the slidable weight, 24, contains a plurality of magnets, 52, specifically 5 magnets, and more specifically, 5 different sized magnets. In these magnets, the different sizes indicate different magnetic field strengths. In an embodiment herein the swing training device contains from about 1 magnet to about 20 magnets; or from about 2 magnets to about 15 magnets; or from about 3 magnets to about 10 magnets. Without intending to be limited by theory it is

believed that by providing multiple; or different; magnets, it is possible to provide different magnetic attraction forces between the slidable weight and the magnetic portion on, for example, the stopper. Accordingly, the user may then customize the strength of the magnetic attraction to their own liking, for a particular user, or a particular training session. In many cases, the magnetic attraction force is a constant per unit mass for a given type of magnet. Accordingly, in an embodiment herein, the magnets are of different masses and/or sizes; or each magnet has a different mass; or each magnet has a different size. It is further understood that the same or similar-sized magnets may be joined together to form a stronger magnetic field. Accordingly, in an embodiment herein, the magnets are the same size and/or mass. In an embodiment herein, a plurality of magnets are combined to form a stronger magnetic field.

In Fig. 3, each of the magnets, 52, is located at a magnet position, 53, in the slidable weight, 38. In an embodiment herein, the magnet position is in the stopper. In an embodiment herein the magnet is in the slidable weight.

Fig. 4 shoes an exploded view of an embodiment of an end cap, 28, useful herein. The end cap, 28, has a plate, 48, and a plurality of screws, 50, to attach the plate, 48, to the end cap, 28. The plate, 48, also contains a hole, 36, though which the shaft, 24, passes and is connected to the end cap, 28. The end cap may be securely-connected and/or removably-connected to the shaft via any method known in the art, such as a screw, an adhesive, a fastener, etc.

Fig. 5 shows a side-perspective view of an embodiment of a slidable weight, 30, and a stopper, 38, useful herein. The stopper end, 40, contains a hole, 36, into which the shaft (see Fig. 1 at 24), passes. The stopper, 38, and the slidable weight, 30 are both coaxial with the shaft axis, SA. The slidable weight, 30, is removably-attached to the stopper, 38, and a plate, 48, is positioned between the stopper, 38, and the slidable weight, 30. The slidable weight, 30, has a plurality of different sized magnets, 52, 52', 52", 52'", and 52"" affixed therein. It can be seen that the magnet, 52, is in contact with the magnetic portion, 42, which is located at the magnetic portion location, 44, at the stopper end, 40, of the stopper, 38. The stopper ridge, 46, ensures that the magnetic portion, 42, is located directly next to the magnet, 52.

It is also seen that the user may optionally turn the slidable weight, 30, either clockwise or counter-clockwise around the shaft axis, SA, so as to align different magnets, 52', 52", 52'", 52"", with the magnetic portion, 42. As mentioned herein, this allows the user to adjust and thereby customize the strength of the magnet, 52, which is magnetically-attaching to the magnetic portion, 42; this in turn adjusts the strength of the magnetic attraction between the stopper, 38, and the slidable weight, 30, so as to customize the speed at which the swing training device (see Fig. 1 at 10) must be swung to release the slidable weight, 30, from the stopper, 38, so it may slide towards the end cap (See Fig. 1 at 28).

The slidable weight should be heavy enough to change the center of gravity of the swing training device during use, and must also be light enough to allow the user to comfortably use the swing training device. In an embodiment herein, the slidable weight has a mass of from about 0.1 kg to about 5 kg; or from about 0.2 kg to about 4 kg; or from about 0.3 kg to about 3 kg.

Fig. 5 also shows a plurality of indicators, 54, 54', which correspond to different magnets, 52, and therefore different magnetic attraction strengths between the stopper, 38, and the slidable weight, 30. The indicator, 54, may line up with a mark, 55, on the stopper, 38. The mark, 55, therefore indicates to the user which magnet, 52, and therefore what magnetic-attraction strength the swing trainer, 10, is set for. A communication device, 56, is provided on the stopper, 38, which in this case may be an outlet plug. The communication device, 56, may communicate motion sensor data to the user, either directly, or indirectly. In Fig. 5, the communication device, 56, is a display device, 58.

The communication device herein typically allows the swing training device to communicate the motion sensor data, and/or other data to/from a person, an electronic device such as a computer, a phone, a tablet computer, and a combination thereof. The communication device useful herein includes a wireless communication device, a display device, an output plug and a combination thereof. In an embodiment herein, the wireless communication device useful herein includes a near field communication device, a radio frequency identification device, a Wi-Fi™ device, a Bluetooth™

device, a ZigBee™ device, a GPRS device, a 2G device, a 3G device, a 4G device, a LTE device and a combination thereof; or a a radio frequency identification device, a Wi-Fi™ device, a Bluetooth™ device, a ZigBee™ device; or a Wi-Fi™ device, a Bluetooth™ device, a ZigBee™ device. The Wi-Fi™ protocols are known in the art and are based on the IEEE 802.11 standards, typically at a wavelength of 2.4 GHz and/or 5 GHz. Bluetooth™ is a standard previously ratified as IEEE 802.15.1, which is now managed by the Bluetooth Special Interest Group. Bluetooth™ communication devices typically employ a wavelength between 2.4 GHz and 2.4835 GHz. ZigBee™ is an IEEE 802.15.4-based standard, typically communicating at a wavelength of 2.4 GHz, 915 MHz, 868 MHz, and/or 784 MHz. Such wireless standards and protocols are well-known in the wireless communications art. In an embodiment herein, the wireless communication device useful herein includes a security protocol or an encryption protocol to protect the motion sensor data and/or further data. In an embodiment herein the swing training device is an Internet of Things device.

The display device herein typically allows the swing training device to communicate the motion sensor data and/or any other data directly to/from a person. In an embodiment herein, the display device useful herein includes a LED screen, an OLED screen, a touch screen, a liquid crystal display, an electroluminescent display, an electronic ink display, a thin film transistor display and a combination thereof; a LED screen, an electroluminescent display, a touch screen, and a combination thereof.

The type of touch screen useful herein includes a 5-wire resistive screen, a surface capacitive screen, a projected capacitive screen, a surface acoustic wave screen, an infrared screen, and a combination thereof; or a surface capacitive screen, a projected capacitive screen, and a combination thereof. These types of touch screens are well-known in the art.

The output plug useful herein typically allows a physical communication line to be connected to the swing training device so as to transmit the motion sensor data and any other data to/from an electronic device such as a computer, a phone, a tablet computer, and a combination thereof. In an embodiment herein, the output plug includes a USB port, a headphone jack, a lightning port, a 9-pin connector, a 15-pin

connector, a 30-pin connector and a combination thereof; a USB (universal serial bus) port, a lightning port and a combination hereof; and a USB port. The USB port herein may be, for example, a micro-AB plug, a micro-B plug, a standard A plug, a standard B plug, a mini-A plug, a mini-B plug, a reversible micro-B plug, a type C plug, and/or other USB plugs known in the art.

In another embodiment of the present invention, the mass of the slidable weight may be increased or decreased to allow customization of the swing training device for a particular user, or a particular training session. Accordingly, in an embodiment herein, the swing training device, method and/or system contains an additional weight.

In an embodiment herein, the end cap comprises a soft material, especially at the end distal from the handle. Such a soft material, such as a foam rubber, is believed to be an advantage as it may reduce damage and/or improve safety if, for example, the end cap accidentally contacts another surface during use and/or a swing. The soft material may for a substantial portion of the end cap, or may be an outer coating of the end cap, as desired.

Fig. 6 shows a see-through perspective view of an embodiment of a stopper, 38, and a slidable weight, 30, useful herein. The stopper, 38, contains a magnet, 52’’’’’, located at a magnet position, 53. The magnet position, 53, is located in the stopper, 38, and the magnet, 52’’’’’, may be permanently-attached to the stopper, 38. The magnet, 52’’’’’, is magnetically-attracted to the magnet(s), 52, in the slidable weight, 30. In this embodiment, the magnets, 52, stick through the plate, 48, and thereby are able to contact the magnet, 52’’’’’, in the stopper. As previously-noted, the slidable weight, 30, contains optional magnets, 52, 52’, 52”, etc., of varying mass.

In an embodiment herein, the magnet is in a magnet position selected from the stopper, the slidable weight, and a combination thereof. In an embodiment herein, the magnet is permanently- attached to, or permanently-embedded in a magnet position selected from the stopper, the slidable weight, and a combination thereof.

The stopper, 38, is affixed to the shaft, 24, typically permanently-affixed to the shaft, 24. The slidable weight, 30, is slidable along the shaft, 24, away from the

stopper, 38.

Without intending to be limited by theory, it is believed that locating a magnet and/or a magnetic portion in the stopper allows the user to be less concerned about the potential twisting of the slidable weight as it travels back and forth between the stopper and the end cap (see Fig. 1 at 28).

In an embodiment herein a magnet in the stopper is magnetically-attracted to the magnet in the slidable weight. In such an embodiment, the magnetic portion is optional.

Fig. 7 shows a side perspective view of an embodiment of a swing training device, 10, having an additional weight, 60, on the shaft, 24. The additional weight, 60, is removably-attached to the shaft, 24, and also to the slidable weight, 30. As the swing training device, 10, is swung, the additional weight, 60, slides along with the slidable weight, 30, away from the stopper, 38, to impact with the end cap, 28. Typically the additional weight has a mass of from about 0.1 kg to about 5 kg; or from about 0.2 kg to about 4 kg; or from about 0.3 kg to about 3 kg.

Fig. 8 shows a side view of an embodiment of the swing training device, 10, having an intermediate section, 62, positioned on the shaft, 24, between the slidable weight, 30, and the stopper, 38. In this embodiment, the intermediate section, 62, is fixed to the stopper, 38, while the slidable weight, 30, is able to traverse up and down the shaft, 24. The intermediate section, 62, contains a plurality of indicators, 54, thereupon which are related to relative attractive forces, such as magnet strengths. The user aligns the indicator, 54, with the mark, 55, so as to determine the magnetic-attraction strength. In this embodiment, the stopper, 38, contains a communication device, 56, which in this case is a display device, 58, for providing information to the receiver (see Fig. 9 at 80) which in this case is a user. The stopper, 38, also contains 4 buttons, 64, which allow the user to access various functions of the swing training device, 10. For example, the button, 64, may allow the user to toggle the readout of the display screen between, for example, a table, a numeric reading, and a graphic. Alternatively, the button, 64, may be, for example, a power button (see Fig. 9 at 88), a selection button, etc.

In the embodiment of Fig. 8, the intermediate section, 62, further contains an attraction sensor, 66, which detects/senses; or automatically detects/senses; directly or indirectly the strength of the attraction between the intermediate section, 62, and the slidable weight, 30. The attraction sensor may be located in the slidable weight, the stopper, the shaft, and/or other locations, as desired. The attraction sensor may be a magnetic sensor, if the slidable weight, the intermediate section and/or the stopper contains a magnet. One skilled in the art understands that other types of attraction sensors may be employed as well, which include detection based upon an electronic signal, an optical clue, proximity, etc. For example, the indicator may also include an electronic circuit which indicates which indicator is aligned with the mark. Alternatively, an optical clue may indicate to an optical reader which indicator is aligned with the mark, or a near field communication device may indicate which indicator is aligned with the mark.

Fig. 10 shows a cut-away side view of an embodiment of a slidable weight, 30, and a stopper, 38, of the present invention. The slidable weight, 30, in Fig. 10 is a frictive-resilient slidable weight, 100, removably-attached to the stopper, 38, via friction and resiliency caused by a ball bearing, 102; or a plurality of ball bearings; or from about 1 to about 20 ball bearings; or from about 2 to about 10 ball bearings; or from about 2 to about 6 ball bearings, which resiliently-push against the inner edge, 104, of the slidable weight, 30. The inner edge, 104, is formed of a plastic and/or a resin such that it is slightly flexible and/or resilient and is slightly angled inwards (i.e., towards the shaft, 24). This creates the frictive-resilient slidable weight, 100.

When the swing training device, 10, is swung and the centripetal force overcomes the combination of resiliency and friction holding the slidable weight, 30, in place, the inner edge, 104, deforms outward away from the shaft, 24, and away from the ball bearings, 102. This in turn allows the slidable weight, 30, to release and travel in the direction of the arrow, AA.

In Fig. 10 it can be seen that the stopper, 38, is affixed to the shaft; or permanently-affixed to the shaft; or permanently-affixed to a specific location of the shaft, 24, by a pair of pins, 106 and 106'. The pin, 106, at the handle-side of the

stopper, 38, goes through a hole, 108, located in the shaft, 24, and permanently-affixes the stopper, 38, to the shaft, 24, at a specific location. At the other end of the stopper, 38, the pin, 106', also goes through a hole, 108, located in the shaft, 24, so as to permanently-affix the stopper end, 40, to the shaft, 24, at a specific location. Typically the inner circumference of the inner edge, 104, is slightly less than the outer circumference of the ball bearing(s), 102, so as to ensure a tight fit when the inner edge, 104, is pushed over the ball bearing(s), 102, so as to secure the slidable weight, 30, to the stopper, 38.. In Fig. 10, the stopper end, 40, is an inclined ring, 110, having an inclined surface, 111. The inclined surface, 111, helps to deform the inner edge, 104, so that it will fit over the ball bearings, 102, when the slidable weight, 30, is removably-affixed to the stopper, 38. Furthermore, it can be seen that the inner edge, 104, contains an indentation, 112, which in three-dimensions is formed as an indented ring around the inner edge, 104. When at rest like in Fig. 10, the ball bearing(s), 102, are nestled in the indentation, 112.

In Fig. 10, a second inclined ring, 110', is located in the stopper, 38, surrounding the shaft, 24, and adjacent to and touching the ball bearing, 102, to push the ball bearing, 120, in both the direction of the arrow, AA, as well as outwards from the shaft, 24. The stopper, 38, is hollow and contains an inner surface, 114, within which the inclined ring, 110', is located. The inner surface, 114, also contains a screw thread, 116, which matches up with a concentric screw plug, 118. The stopper, 38, may rotate around the shaft, 24, while being fixed in place by the pin, 106. Accordingly, the screw plug, 118, will then move in the direction of the arrow, AA, or the opposite direction, so as to compress or release a spring, 120, which is already under tension. As the spring is compressed and released, it either exerts more pressure, or less pressure, respectively, on the second inclined ring, 110', which due to the inclined surface, 111, in turn exerts either more or less pressure on the ball bearing(s), 102, so as to move the ball bearing(s), 102, either inward towards the shaft, 24, or outwards away from the shaft, 24.

For example, if the rotating of the stopper, 38, moves the screw plug, 118, towards the end cap (see Fig. 1 at 28) which is in the direction of the arrow, AA, then

the spring, 120, will become more compressed, thereby moving the second inclined ring, 110', towards the ball bearing(s), 102. The ball bearing(s), 102, would then be pushed outwards, away from the shaft, 24, which would increase the force required to cause the inner edge, 104, to deform enough so as to pass over the ball beating, 102, and release the slidable weight, 30, to travel in the direction of the arrow, AA. Upon reaching the end cap (see Fig. 1 at 28), the plate, 48, on the slidable weight, 30, strikes the plate (see Fig. 4 at 48) on the end cap (see Fig. 4 at 28), and causes a loud sound.

Conversely, if the rotation of the stopper, 38, moves the screw plug, 118, away from the end cap (see Fig. 1 at 28), and in the direction opposite to the arrow, AA, then the spring, 120, will become more relaxed, releasing some pressure on the second inclined ring, 110'. This in turn allows the inner edge, 104, to push the ball bearing(s), 102, inwardly, which results in a relatively reduced amount of force required to cause the inner edge, 104, to deform enough so as to pass over the ball beating, 102, and release the slidable weight, 30, to travel in the direction of the arrow, AA. Upon reaching the end cap (see Fig. 1 at 28), the plate, 48, on the slidable weight, 30, strikes the plate (see Fig. 4 at 48) on the end cap (see Fig. 4 at 28), and causes a loud sound.

Accordingly, one skilled in the art understands that in the embodiment of Fig. 10, the rotation of the stopper, 38, allows the user to adjust the amount of force; or centripetal force, needed to overcome the force (in the embodiment of Fig. 10, this force is a combination of friction and resiliency) holding the slidable weight, 30, to the stopper, 38. Once the force is overcome, then the slidable weight, 30, is released from the stopper, 38, and moves in the direction of the arrow, AA.

Accordingly, in an embodiment of the present invention, the force needed to release the slidable weight from the stopper is adjustable; or easily adjustable; or adjustable by hand, or adjustable without the use of tools; or adjustable by the user without taking apart the swing training device, etc. In an embodiment herein, the force needed to release the slidable weight is adjustable in specific increments; or adjustable to about 2 to about 10 increments; or adjustable to about 3 to about 6 increments. In an embodiment herein, the force needed to release the slidable weight is infinitely-adjustable within a certain range and is not specifically-adjustable to only a limited

number of specific increments.

The ball bearing, 102, the second inclined ring, 110', the spring, 120, the screw thread, 116, and screw plug, 118 (i.e., a screw arrangement), etc. therefore are each individually, and combined, a force generator, 122, as defined by the term herein. The force generator creates the force needed to removably-affix the slidable weight, 30, to the stopper, 38.

In an embodiment herein, ball bearing, 102, the second inclined ring, 110', the spring, 120, etc. in Fig. 10 may be replaced with, for example, an O-ring, a washer, and a combination thereof.

Accordingly, in an embodiment herein, the force generator is selected from the group of, for example, a ball bearing, an inclined ring, a spring, a screw arrangement, an O-ring, a washer, and a combination thereof; or a ball bearing, an inclined ring, a spring, a screw arrangement, an O-ring, and a combination thereof; or a ball bearing, an inclined ring, a spring, a screw arrangement, an O-ring, and a combination thereof. In an embodiment herein, the force generator is not a magnet, a magnetic force, a magnetic arrangement, or a magnetic portion.

In an embodiment herein, the force generator is made of a material selected from metal, rubber, plastic, resin, polymer, and a combination thereof; or rubber, metal, plastic, and a combination thereof.

In an embodiment herein, the user presses the button in order to indicate which indicator, magnet, and/or magnetic strength is aligned with the mark.

In an embodiment herein, the intermediate section contains a magnet; or a plurality of magnets; or a plurality of magnets having different magnetic strengths, therein.

In an embodiment herein, the intermediate section contains a magnet or a magnetic portion therein and the slidable weight contains a magnet; or a plurality of magnets; or a plurality of magnets having different magnetic strengths, therein.

In an embodiment herein, the stopper is replaceable in that it may be removed and then replaced with a different stopper. For example, the simple stopper of Fig. 1 may be removed from the shaft and the more complicated stopper of Fig. 8, containing

a more complicated electronic component (see Fig. 9 at 70) may be affixed to the shaft in its place.

Method of Use

One object of the present invention is to allow a user access to detailed data and analytics so as to allow the user to make changes in their swing so as to improve one or more characteristic2 of their swing. This characteristic may be, for example, the speed, velocity, acceleration, swing plane, lag, accuracy, force, angle, timing, posture, grip, balance, face angle, vertical angle, consistency, orientation, grip, snap alignment, release speed, swing efficiency, and a combination thereof; or angular acceleration, speed, swing plane, consistency, orientation, grip, alignment and a combination thereof. By providing such detailed motion sensor data, it is believed that the user will then be able to decide which characteristics of their swing to enhance, change, practice, etc.

In an embodiment of the swing training method useful herein, a swing training device is provided and typically the user positions the slidable weight distal from the end cap; or positions the slidable weight against the stopper; or otherwise removably-affixes the slidable weight to the stopper. The user then holds the handle and swings the swing training device. The centripetal force exerted on the slidable weight then overcomes the force(s) holding the slidable weight against and/or to the stopper, and the slidable weight slides down the shaft to impact the end cap; or a portion of the end cap. Typically when the slidable weight impacts the end cap or a portion thereof, it makes an audible sound; or a loud sound. During this swing, the motion sensor (if present) generates motion sensor data.

The inventors believe that various embodiments of the swing training device herein may be used for any type of action requiring a swinging motion such as, for example, a club swing, a racquet swing, a pole swing and a combination thereof. Typically, the club swing for which the swing training device may be useful is, for example, a baseball swing, a softball swing, a golf swing, a polo swing, an ice hockey swing, an inline hockey swing, a cricket swing, a field hockey swing, a weapon swing, and a combination thereof; or a baseball swing, a softball swing, a cricket swing, a

golf swing, and a combination thereof; or a baseball swing, a softball swing, a golf swing and a combination thereof; or a golf swing. Typically the racquet swing for which the swing training device may be useful is, for example, a tennis swing, a racquetball swing, a squash swing, a ping pong swing, a lacrosse swing, a pickleball swing, a badminton swing, and a combination thereof; or a tennis swing, a squash swing a lacrosse swing and a combination thereof; or a tennis swing. Typically, a pole swing may be, for example a fishing cast, such as a fly fishing cast.

In an embodiment herein, the user may adjust the strength of the force(s) holding the slidable weight to the stopper, for example, the strength of the magnet that is magnetically-attaching to the magnetic portion, the strength of the force generator, the amount of friction, the resilience of the force generator, etc. This may allow, for example, the user to train some times by swinging more slowly and yet still allow the slidable weight to release from the stopper and slide to impact the end cap, and other times to train by requiring a faster swing in order for the slidable weight to release from the stopper and slide to impact the end cap.

In an embodiment herein, the user may adjust the mass of the slidable weight, either by adding additional mass to the slidable weight, by removing mass from the slidable weight, by adding an additional weight, by removing an additional weight, etc.

In an embodiment herein, the receiver analyzes the motion sensor data and/or any further data. Without intending to be limited by theory it is believed that such an analysis of the motion sensor data and/or any further data may provide suggestions and/or training programs designed to improve the swing of the user. Furthermore, the motion sensor data provided by the swing training device may be able to provide insight into minute details of the user's swing, including, for example, twisting, angles, impacts, etc. which the user may then seek to either enhance or reduce.

Swing Training System:

Fig. 9 shows a schematic diagram of an embodiment of an electronic component, 70, of the swing training device, swing training method and/or swing training system herein. In Fig. 9, a control circuit, 72, contains a controller, 74, which is operatively-connected to the motion sensor, 32, the communication device, 56, and

an optional memory unit, 76. The controller, 74, is the electronic brain of the swing training device and typically performs a variety of roles such as, but not limited to: collecting the motion sensor data, collecting any other data, providing a time stamp, providing a date stamp, managing the memory unit, managing the communication device, managing the power source, managing any alerts or error messages, receiving and sending electronic control signals, receiving and sending data, etc. The controller is typically a printed circuit board, a microcontroller, a computer chip and/or a combination thereof. The controller may also contain optional additional electronic features, such as, for example, a timer, a location (e.g., Global Positioning System (GPS)) sensor, a calculator and a combination thereof. Alternatively, if present at all, these additional electronic features may be contained elsewhere in the electronic components, in the electronic device, etc.

In an embodiment herein, the controller automatically turns on one or more electronic components and/or automatically turns off one or more electronic components. The controller may do this based upon a specific condition recognized by the controller, for example receiving motion sensor data, or not receiving motion sensor data. In an embodiment herein, the communication device is a touch screen, and the touching of the touch screen provides a specific condition which is recognized by the controller.

In an embodiment herein, the motion sensor is a high speed motion sensor which may generate, for example, at least 5 readings per second; or from about 5 readings per second to about 10,000 readings per second; or from about 10 readings per second to about 1,000 readings per second. In an embodiment herein, the motion sensor data contains from about 1 data set to about 125,000 data sets; or from about 2 data sets to about 30,000 data sets; or from about 10 data sets to about 15,000 data sets.

As used herein, a "data set" is motion sensor data from multiple motion sensors that is generated simultaneously. For example, a data set may be the set of data taken simultaneously from 3 motion sensors in the X-axis, the Y-axis, and the Z-axis. This data set may also be combined with further data as well. Without intending to be limited by theory, it is believed that given the very small amount of time required by a

single swing, high speed motion sensor data generation is desirable. For example, a baseball swing, a tennis swing, or a golf swing may last, for example, less than about 5 seconds; or less than about 3 seconds, or less than about 1.5 seconds. Accordingly, to generate sufficient data within this short time, a high speed motion sensor may be especially desirable. Alternatively, if the data generation speed is determined by, for example, the controller or another electronic component, then in an embodiment of the invention the controller or another electronic component generates at least 5 readings per second; or from about 5 readings per second to about 10,000 readings per second; or from about 10 readings per second to about 25,000 readings per second.

In an embodiment herein, the location sensor is a GPS unit to help determine the location of where the swing training device is used.

The communication device, 56, provides the motion sensor data, and/or any other further information to a receiver, 80. The further data may include, for example, a time stamp, a date stamp, location data, identification data and a combination thereof. Typically, the identification data useful herein may include, for example, identification of the swing training device, identification of the user, identification of the physical parameters of the swing training device, identification of the location of the motion sensors in the swing training device, identification of the swing training system, identification of the swing training system owner, etc. Without intending to be limited by theory, it is believed that this further data may be useful in analyzing the motion sensor data, so as to calculate, for example, swing characteristics such as, for example, velocity, force, torque, repeatability, swing trends over time, swing improvement over time, correlation with swing characteristics stored in a database, swing plane, accuracy, and a combination thereof.

In Fig. 9, an attraction sensor, 66, is also connected to the controller, 74. As discussed with respect to Fig. 8, the attraction sensor automatically detects/senses directly or indirectly the strength of the attraction; or the magnetic attraction between the slidable weight and, for example, the intermediate section, the stopper, etc.

The receiver, 80, may be, for example, a person, 82, and/or an electronic device, 84, as described herein. Where the receiver is a person, then the person may be

the user of the swing training device, or another person. In such a case, typically the person would simply look at, for example, the display screen of the communication device so as to visually receive the motion sensor data and/or any further data, in some form or another.

In the embodiment of Fig. 9, a power source, 86, is operatively connected to the controller, 74, and may be operatively connected either directly or indirectly to, for example, the communication device, the memory unit, the motion sensor, the location sensor, the control circuit, the attraction sensor, and/or any other electronic component that has a need for power. The power source useful herein is known in the art and may be, for example, a battery, a piezoelectric generator, an induction loop/generator, and a combination hereof; or a battery; or a disposable battery, a rechargeable battery, and a combination thereof.

In the embodiment of Fig. 9, the swing training device also contains an optional power button, 88, which may toggle the power on and off by providing a specific condition that is recognized by the controller.

In an embodiment where the receiver is an electronic device, 84, then the electronic device, 84, may receive the motion sensor data and/or any further data via the communication device, 56, which may be, for example, a cable connected to an output plug, or via a wireless communication device. The electronic device, 84, may further contain a software package, 90, operatively-installed and/or running thereupon. The software package, 90, may, for example, analyze the motion sensor data and/or the further data to provide, for example, one or more recommendations to improve the swing, one or more recommendations on a swing characteristic to maintain or keep the same, one or more recommendations on training programs, exercises, or procedures to improve the swing, etc.

For example, in an embodiment herein, the swing training system herein understands where each motion sensor is located and analyzes the motion sensor data from multiple motion sensors to calculate, extrapolate, and/or display a swing characteristic. In an embodiment of the swing training system herein, the electronic device, the software package, or a combination thereof includes a database of motion

sensor data. The database of motion sensor data may include, for example, motion sensor data generated from a person, generated from a computer model, and a combination thereof. In an embodiment herein, the database may contain motion sensor data generated from a person who is, for example, a recognized expert in the swing being trained, a professional, etc. In an embodiment herein, the database contains motion sensor data generated by, for example, a professional golfer, a professional tennis player, a professional baseball player, a professional hockey player, a professional badminton player, and a combination hereof.

In an embodiment herein, the database is a dynamic database which may add as new data the motion sensor data and/or further data provided by the swing training device.

In an embodiment herein, the electronic device compares the motion sensor data provided by the swing training device, and matches it to the closest motion sensor data in the database.

In an embodiment herein, the electronic device provides the data to the user in a graphic form, a tabular form, a video form, a virtual reality form, an augmented reality form and a combination thereof.

In an embodiment herein the swing training device provides motion sensor data and/or further data in real time to the receiver. In an embodiment herein the motion sensor, the communication device, and the receiver act in real time as the user is swinging the swing training device.

In the embodiments herein, such as in Fig. 9, only a single motion sensor, controller, power source, etc. is indicated, for the sake of brevity and ease of understanding. However, it is understood that multiple similar or identical items and/or individual components may be included in the device, system, and method herein, without departing from the scope and gist of the invention.

All references cited herein are, in relevant part, incorporated herein by reference. However, the citation of any particular reference herein does not constitute an admission as to its availability or appropriateness as prior art hereto.

It should be understood that the above only illustrates and describes examples whereby the present invention may be carried out, and that modifications and/or alterations may be made thereto without departing from the spirit of the invention.

It should also be understood that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment, may also be provided separately, or in any suitable subcombination.

What is Claimed is:

1. A swing training device comprising:

A. a handle, wherein the handle optionally comprises a longitudinal handle axis, wherein the shaft comprises a longitudinal shaft axis, and wherein the longitudinal handle axis is coaxial to the longitudinal shaft axis;

B. a shaft connected to the handle;

C. an end cap connected to the shaft opposite the handle;

D. a slidable weight on the shaft, wherein the slidable weight is disposed between the end cap and the handle; and

E. a motion sensor therein; or an accelerometer, a gyro sensor, a gravity sensor, and a combination thereof, wherein the motion sensor is capable of generating motion sensor data about the motion of the swing training device.

2. The swing training device according to claim 1, wherein the device is intended for training a swing selected from the group consisting of a club swing, a racquet swing, a pole swing, and a combination thereof; or wherein the club swing is selected from the group consisting of a baseball swing, a softball swing, a golf swing, a polo swing, an ice hockey swing, an inline hockey swing, a cricket swing, a field hockey swing, and a combination thereof; or wherein the club swing is selected from the group consisting of a tennis swing, a racquetball swing, a squash swing, a ping pong swing, a lacrosse swing, a pickleball swing, a badminton swing and a combination thereof; or wherein the club swing is a golf swing.

3. The swing training device according to any of the previous claims, comprising from about 1 motion sensor to about 30 motion sensors; or form about 2 motion sensors to about 28 motion sensors; or from about 3 motion sensors to about 15 motion sensors; or comprising a set of 3 motion sensors, and wherein the set of 3 motion sensors are arranged to detect motion in the X-axis, the Y-axis, and the Z-axis when the swing training device is swung.

4. The swing training device according to any one of the previous claims, further

comprising a communication device, wherein the communication device communicates the motion sensor data; or wherein the communication device is selected from a wireless communication device, a display device, an output plug and a combination thereof

5. The swing training device according to Claim 4, wherein the wireless communication device is selected from the group consisting of a near field communication device, a radio frequency identification device, a Wi-Fi™ device, a Bluetooth™ device, a ZigBee™ device, a GPRS device, a 2G device, a 3G device, a 4G device, a LTE device, and a combination thereof.

6. The swing training device according to Claim 4, wherein the display device is selected from the group consisting of a LED screen, an OLED screen, a touch screen, a liquid crystal display, an electroluminescent display, an electronic ink display, a thin film transistor display and a combination thereof.

7. The swing training device according to Claim 4, wherein the output plug is selected from the group consisting of a USB port, a headphone jack, a lightning port, a 9-pin connector, a 15-pin connector, a 30-pin connector and a combination thereof.

8. The swing training device according to any one of the previous claims, further comprising a power source operatively connected to the communication device and the motion sensor.

9. The swing training device according to any one of the previous claims, further comprising a control circuit; optionally wherein the control circuit comprises a memory unit.

10. The swing training device according to any one of the previous claims, further comprising a stopper affixed to the shaft, and wherein the stopper is disposed between the handle and the slidable weight.

11. The swing training device according to any of the previous claims, further comprising a magnet, wherein the magnet is located at a magnet position selected from the group consisting of the slidable weight, the end cap, the stopper, and a combination thereof.

12. The swing training device according to Claim 11, further comprising a magnetic portion, and wherein the magnetic portion is located at a magnetic portion location selected from the group consisting of the slidable weight, the end cap, the stopper, and a combination thereof, and wherein the magnet magnetically-attaches to the magnetic portion, the swing training device optionally comprising from about 1 to about 20 magnets; or from about 2 to about 15 magnets; or from about 3 to about 10 magnets.

13. A swing training method comprising the steps of:

A. providing the swing training device according to any one of the previous claims;

B. positioning the slidable weight distal from the end cap;

C. holding the handle;

D. swinging the swing training device such that the slidable weight slides to the end cap;

E. generating motion sensor data, wherein the motion sensor data optionally comprises from about 1 data set to about 125,000 data sets for each swing, wherein the motion sensor data optionally comprises further information, wherein the further information is selected from the group consisting of a time stamp, a date stamp, location data, identification data, and a combination thereof; and

optionally comprising the steps of:

F. wherein the slidable weight creates a sound when it impacts the end cap; and

G. analyzing the motion sensor data,

wherein the swing training device optionally comprises an additional weight.

14. The swing training method according to Claim 13, further comprising the steps of:

collecting the motion sensor data; and

providing the motion sensor data to a receiver, wherein the receiver is selected from the group consisting of a person, an electronic device,

and a combination thereof,

wherein the electronic device is optionally selected from the group consisting of a computer, a phone, a tablet computer, or a combination thereof.

15. The swing training method according to any one of Claims 13 to 14 when dependent on Claims 12, further comprising the step of:

adjusting the strength of the magnet magnetically-attaching to the magnetic portion.

16. A swing training system comprising:

A. the swing training device to any one of Claims 1-12, wherein the swing training device comprises a communication device to communicate the motion sensor data;

B. a receiver to receive the motion sensor data, wherein the receiver comprises an electronic device, wherein the electronic device is optionally selected from the group consisting of a computer, a phone, a tablet computer, or a combination thereof; and

C. a software package, wherein the software package analyses the motion sensor data, the software package optionally comprising a database of motion sensor data, and wherein the software further provides a recommendation to improve the swing based on the motion sensor data.

17. A swing training device comprising:

A. a handle, wherein the handle optionally comprises a longitudinal handle axis, wherein the shaft comprises a longitudinal shaft axis, and wherein the longitudinal handle axis is coaxial to the longitudinal shaft axis;

B. a shaft connected to the handle;

C. an end cap connected to the shaft opposite the handle;

D. a stopper affixed to the shaft, the stopper disposed between the end cap and the handle; and

E. a slidable weight slidably-affixed to the shaft, wherein the slidable weight is removably-attached to the stopper by a force selected from

the group consisting of friction, resiliency, or a combination thereof, and optionally wherein the amount of force needed to release the slidable weight from the stopper is adjustable; or adjustable in specific increments; or adjustable to about 2 to about 10 increments; or adjustable to about 3 to about 6 increments.

18. The swing training device according to Claim 17, wherein the force is generated by a force generator selected from the group consisting of a ball bearing, an inclined ring, a spring, a screw arrangement, an O-ring, a washer, and a combination thereof.

19. The swing training device according to any one of Claims 17-18, wherein the device is intended for training a swing selected from the group consisting of a club swing, a racquet swing, a pole swing, and a combination thereof; or wherein the club swing is selected from the group consisting of a baseball swing, a softball swing, a golf swing, a polo swing, an ice hockey swing, an inline hockey swing, a cricket swing, a field hockey swing and a combination thereof; or wherein the club swing is selected from the group consisting of a tennis swing, a racquetball swing, a squash swing, a ping pong swing, a lacrosse swing, a pickleball swing, a badminton swing and a combination thereof; or wherein the club swing is a golf swing.

20. The swing training device according to any one of Claims 17-19, further comprising a motion sensor therein; or an accelerometer, a gyro sensor, a gravity sensor, and a combination thereof; or from about 1 motion sensor to about 30 motion sensors; or form about 2 motion sensors to about 28 motion sensors; or from about 3 motion sensors to about 15 motion sensors; or comprising a set of 3 motion sensors, and wherein the set of 3 motion sensors are arranged to detect motion in the X-axis, the Y-axis, and the Z-axis when the swing training device is swung, wherein the motion sensor is capable of generating motion sensor data about the motion of the swing training device.

21. The swing training device according to any one of Claims 17-20, further comprising a power source operatively connected to the communication device

and the motion sensor.

22. The swing training device according to any one of Claims 17-21, further comprising a control circuit; optionally wherein the control circuit comprises a memory unit.

23. A swing training system comprising:

A. the swing training device to Claim 20, wherein the swing training device further comprises a communication device to communicate the motion sensor data;

B. a receiver to receive the motion sensor data, wherein the receiver comprises an electronic device, wherein the electronic device is optionally selected from the group consisting of a computer, a phone, a tablet computer, or a combination thereof; and

C. a software package, wherein the software package analyses the motion sensor data, the software package optionally comprising a database of motion sensor data, and wherein the software further provides a recommendation to improve the swing based on the motion sensor data.

24. A swing training method comprising the steps of:

A. providing the swing training device according to any one of Claims 17-22 or the swing training system according to Claim 23;

B. positioning the slidable weight distal from the end cap;

C. holding the handle; and

D. swinging the swing training device such that the slidable weight slides to the end cap; and

optionally comprising the steps of:

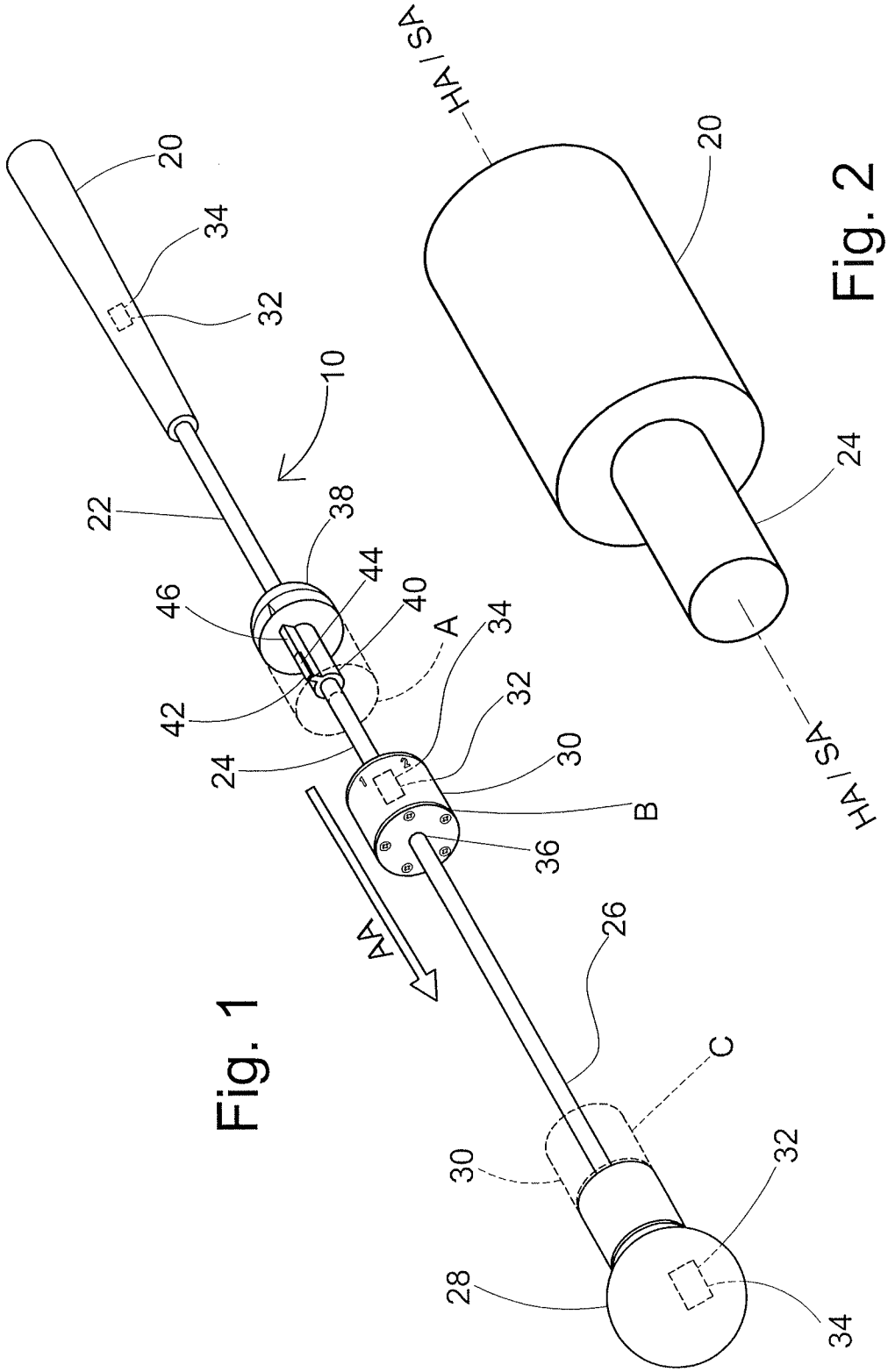
E. generating motion sensor data, wherein the motion sensor data optionally comprises from about 1 data set to about 125,000 data sets for each swing, wherein the motion sensor data optionally comprises further information, wherein the further information is selected from the group consisting of a time stamp, a date stamp, location data,

identification data, and a combination thereof;

F. wherein the slidable weight creates a sound when it impacts the end cap; and

G. analyzing the motion sensor data,

wherein the swing training device optionally comprises an additional weight.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10
22
38
44
46
40
A
34
42
32
24
30
B
36
AA
26
C
30
32
28
34

Fig. 1

HA / SA
20
24
HA / SA

Fig. 2

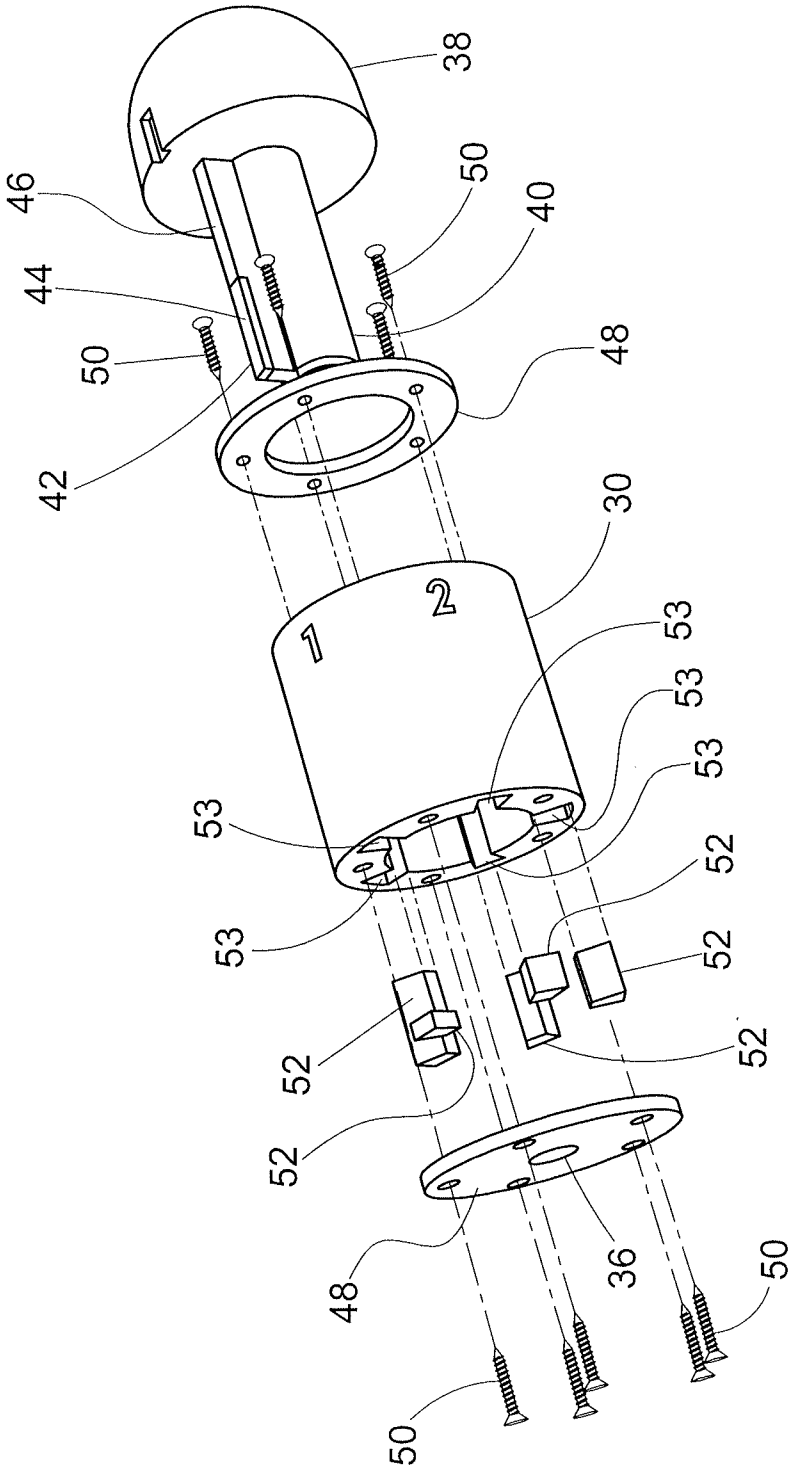


Fig. 3

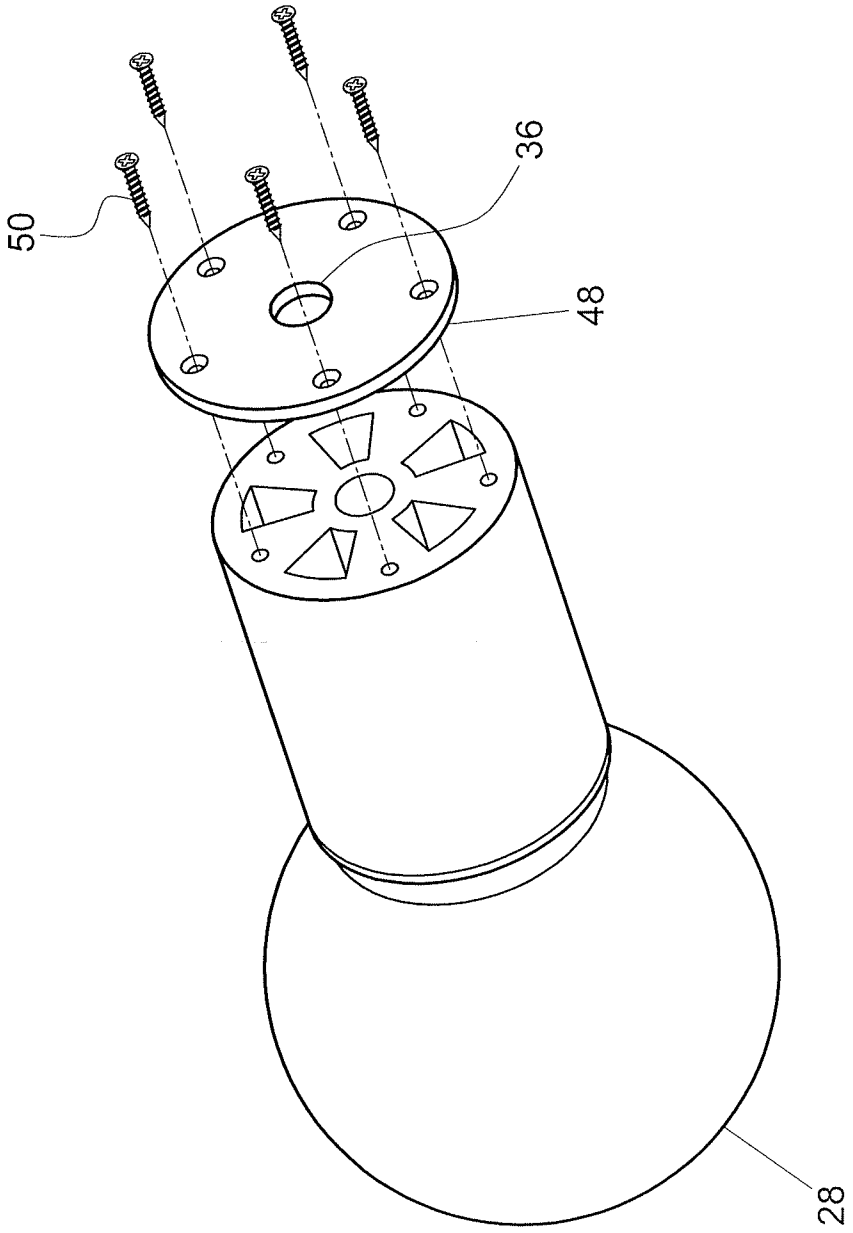


Fig. 4

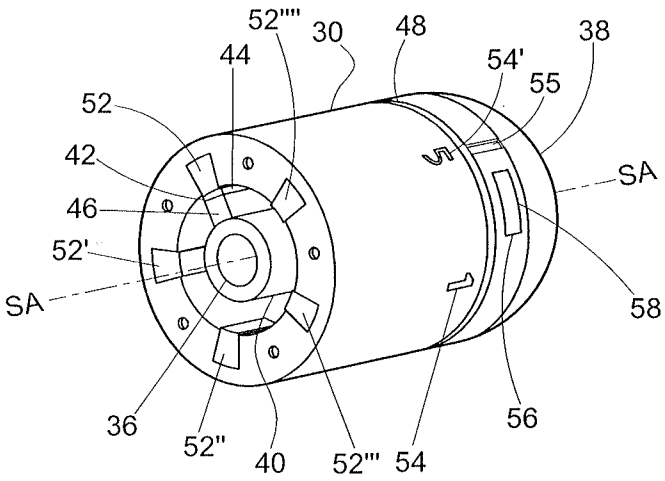
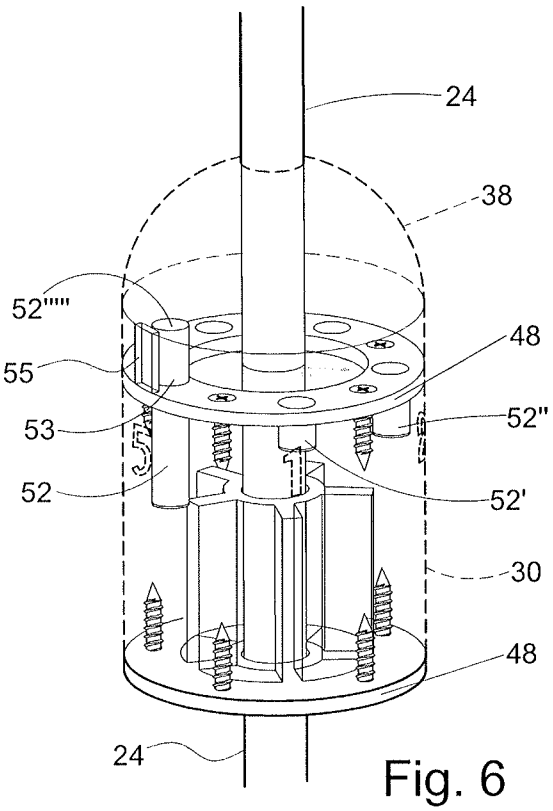

52''''
30
48
38
44
54'
55
52
42
SA
46
52'
SA
58
36
52''
40
52'''
54
56

Fig. 5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38
52''''
48
55
53
52''
52
52'
30
48
24

Fig. 6

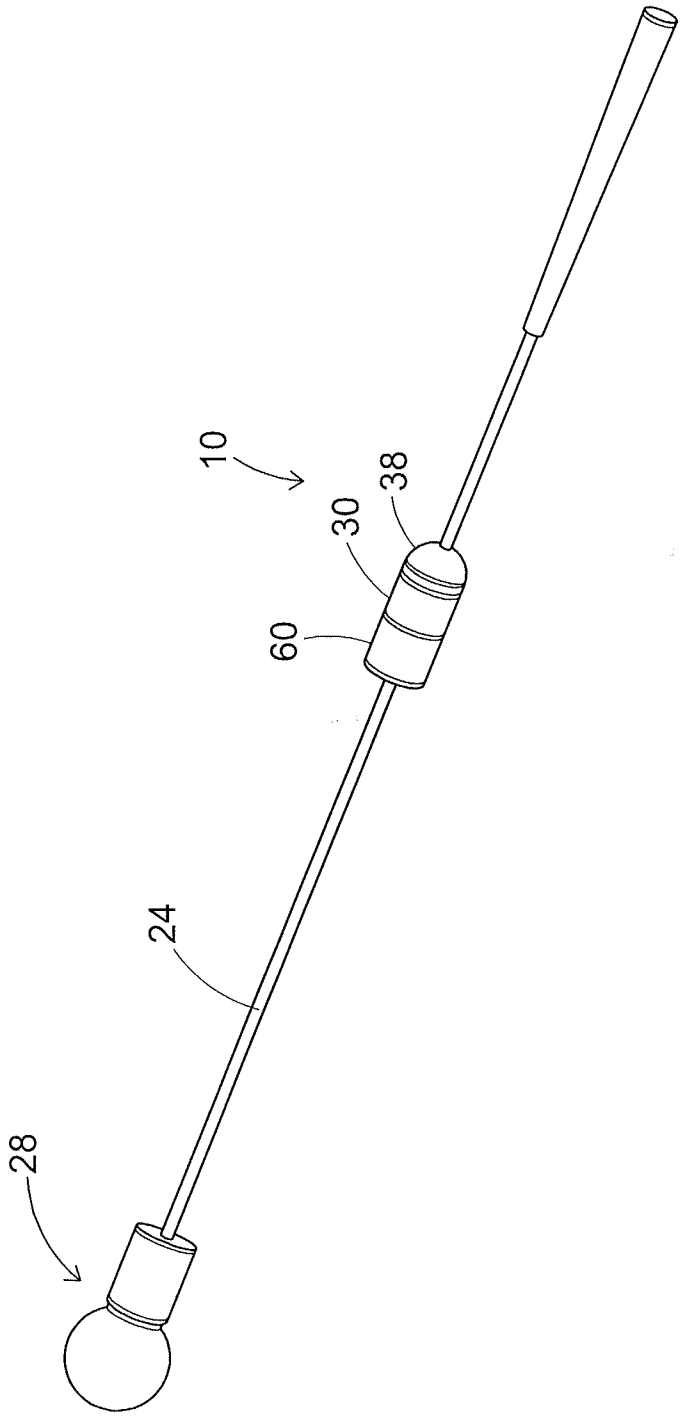


Fig. 7

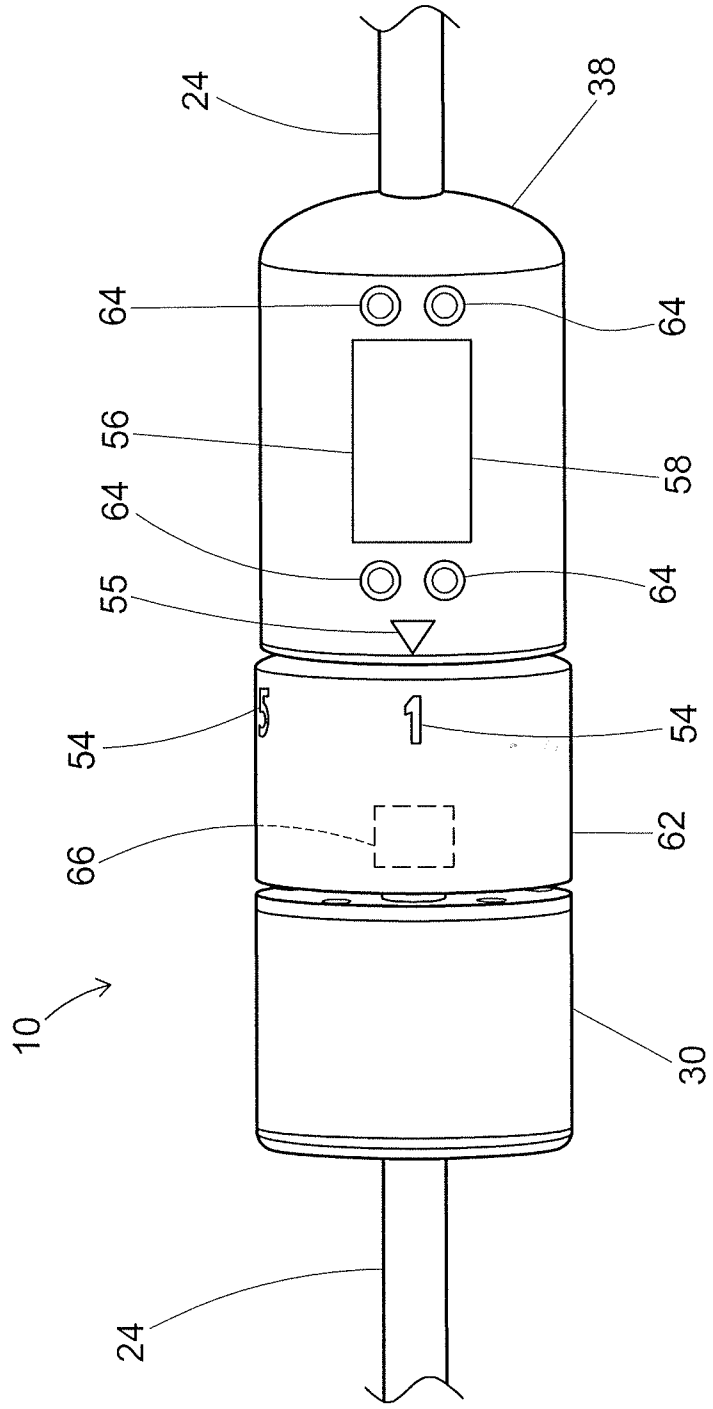
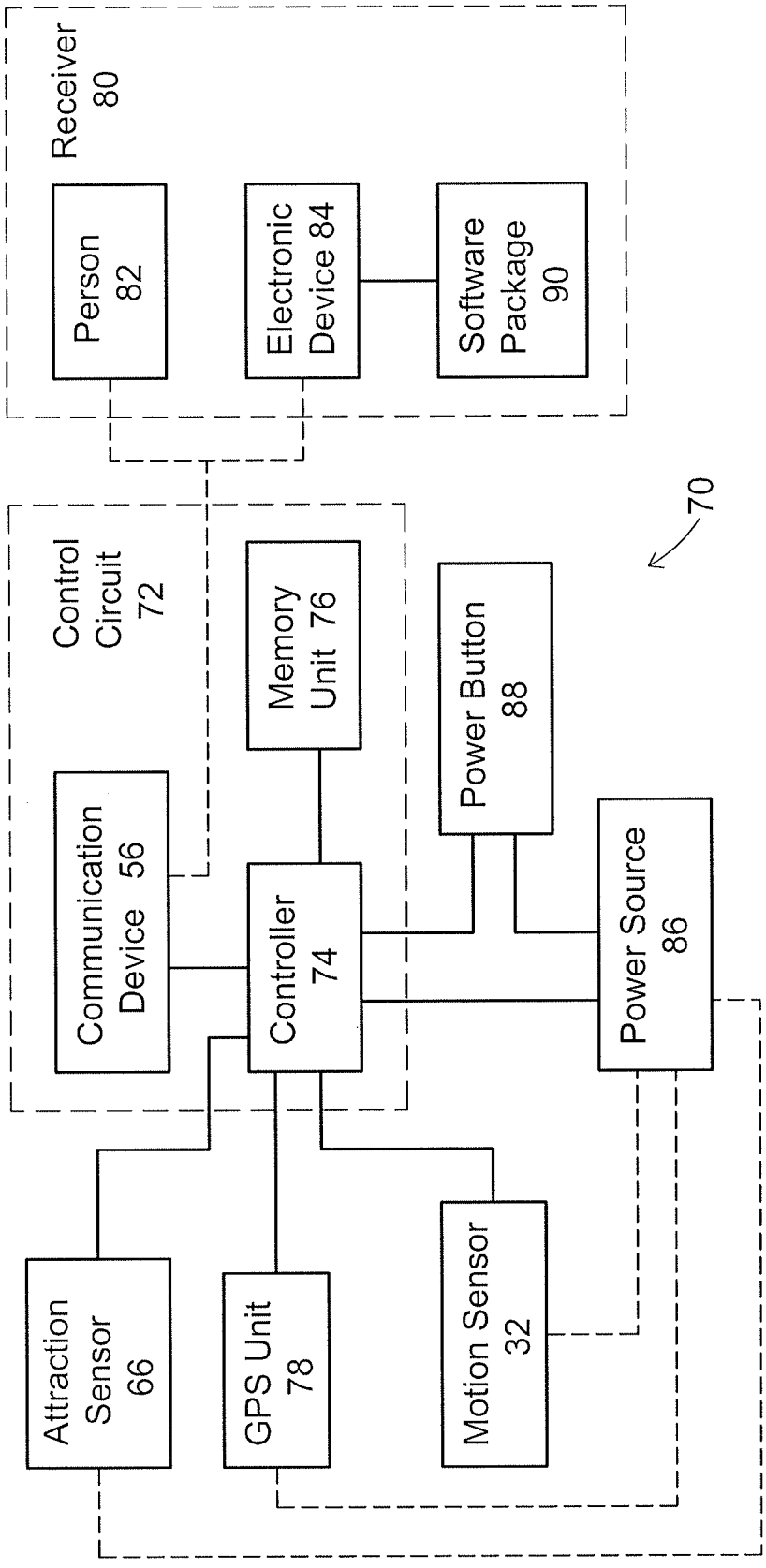


Fig. 8


Receiver 80
Person 82
Electronic Device 84
Software Package 90
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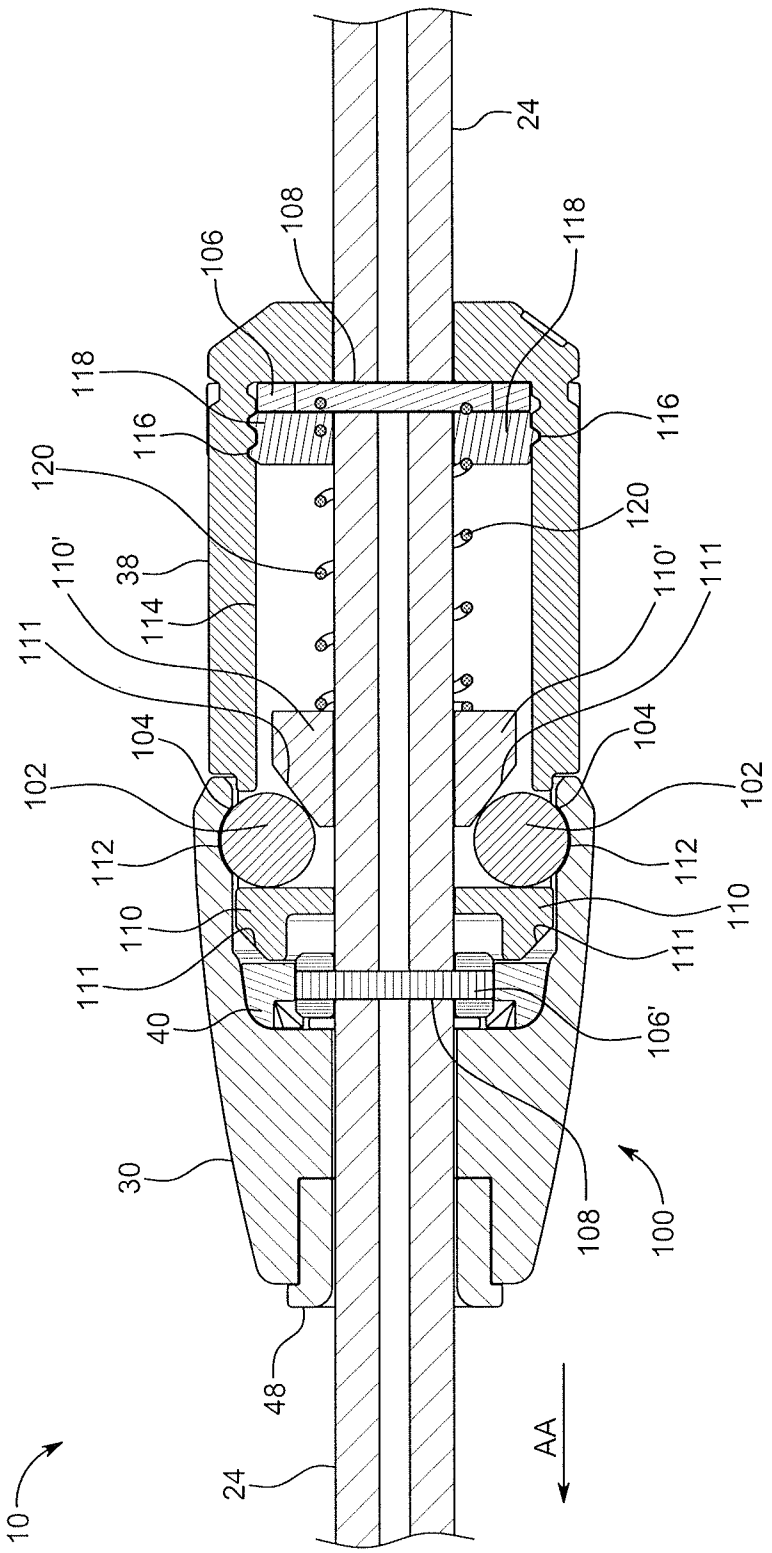
Control Circuit 72
Memory Unit 76
Power Button 88
Communication Device 56
Controller 74
Power Source 86
Attraction Sensor 66
GPS Unit 78
Motion Sensor 32

Fig. 9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104
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106'
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108
100
48
AA
24
10

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/067324

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63B15/00 A63B71/06 A63B102/32 A63B102/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/224381 A1 (RODRIGUEZ JUAN [US]) 13 August 2015 (2015-08-13) paragraph [0033] - paragraph [0063]; figures 1-11	1-24
X	US 2006/223656 A1 (LIBONATI MICHAEL R [US]) 5 October 2006 (2006-10-05) paragraph [0023] - paragraph [0046]; figures 1-6	1-4, 8-10,13, 14,17, 19-22,24
X	US 7 798 910 B2 (SWING KING LLC [US]) 21 September 2010 (2010-09-21) column 4, line 36 - column 9, line 37; figures 1-23	17,19,24

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 March 2018	23/03/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Jekabsons, Armands

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/067324

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007/270214 A1 (BENTLEY MICHAEL D [US]) 22 November 2007 (2007-11-22) paragraph [0086] - paragraph [0156]; figures 1-16 -----	1-24

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2017/067324

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